uPOPs Prevention and Chemical Awareness: Elements of a General Awareness Campaign

To Encourage Best Waste Management Practices by the Public, Small to Medium Enterprises, Government Institutions, Schools and Other Stakeholders

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Version 3, September 7, 2011

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Executive Summary

Pacific Island Countries (PICs) are among the most vulnerable states due to limited land availability, fragile ecosystems, limited water resources, increasing population pressures, and limited buffering capacities. Solid and hazardous waste, including unintentional Persistent Organic Pollutants (uPOPs) are a major threat to sustainable development in PICs because of poor waste management practices that have a direct influence over peoples' lives[i].

UPOPs are a variety of Persistent Organic Pollutants (POPs) that are created as a by-product of industry or unintentionally through combustion but have no commercial use, purpose or function. UPOPs remain in the environment for a long time, can travel long distances through air and water, bio-accumulate in the fatty tissue of animals and are among the most toxic cancer causing chemicals known to exist[ii]. The reduction in uPOPs through the improvement of waste management is vital for improving health, livelihoods and the environment in the Pacific Region.

This document forms part of the Training and Awareness component of the Pacific POPs Release Reduction Through Improved Management of Solid and Hazardous Wastes Project. It provides elements of a general awareness campaign to promote best waste management practices by the public, small to medium enterprises, Government institutions, schools and other stakeholders to reduce uPOPs and increase chemical awareness in the areas prioritised by participating PICs. The areas prioritised include: laboratory and agricultural chemicals awareness, composting and alternatives to open burning, waste separation, waste oil management, healthy vehicles and alternative cooking methods. A summary of the awareness campaigns presented in this document, their key elements and the proposed target audiences are represented in table 1 below.

It is intended that PICs use the elements in this document as a starting and reference point to implement their chosen awareness campaigns as part of the Training and Awareness, Chemicals and Waste Oil components of the project (components 2, 3 & 4). The awareness campaigns presented in this document are designed to be integrated into relevant existing PIC Government and NGO awareness programs and strategies that share linkages to encourage an integrated and cross sectoral approach to waste management. This will ensure the broadest possible reach of the program and help to contextualise the campaign messages with other broader issues.

Each awareness campaign area/topic has been organised to provide a coherent structure for implementing institutions and communications/public awareness staff to follow, as well as being flexible enough to allow for geographic and population variations between PICs. Each topic is divided into four key headings to inform and guide implementation institutions, these include an *Overview* of the topic, *Key messages* to be communicated, *Target audience* and *Examples of awareness campaign activities*. An example of a step by step guide on how to create and run an awareness campaign has also been attached to this document for further reference.

Table 1. Summary of awareness campaigns

Target / Topics	Public	Small to Medium Enterprises	Government Institutions	Schools	Other stakeholders
POPS/	-Health and	-Health and	-Health and	-Health and	-Health and

uPOPs	environmental consequences of POPs/uPOPs -Substances that contain POPs/uPOPs	environmental consequences of POPs/uPOPs -Substances that contain POPs/uPOPs	environmental consequences of POPs/uPOPs -Substances that contain POPs/uPOPs	environmental consequences of POPs/uPOPs -Substances that contain POPs/uPOPs	environmental consequences of POPs/uPOPs -Substances that contain POPs/uPOPs
Composting and alternative to open burning	-Environmental and health benefits of composting -How to easily set up a compost pile -Composting as a traditional Pacific Island cultural practice (banana circles) -Harmful health effects of open burning -Benefits of home gardening	-Environmental and health benefits of composting -How to easily set up a compost pile -Harmful health effects of open burning	-Environmental and health benefits of composting -Harmful health effects of open burning	-Environmental and health benefits of composting -How to easily set up a compost pile -Composting as a traditional Pacific Island cultural practice (banana circles) -Harmful health effects of open burning -Benefits of home gardening	
Hospital waste separation			-Source reduction -Waste separation -Waste incineration using BAT		
Municipal waste separation	-Benefits of waste separation -Which materials are recyclable and which aren't -System of collection/drop off -Purchase products that are packaged in recyclable materials.	-Benefits of waste separation -Which materials are recyclable and which aren't -System of collection/drop off -Purchase products that are packaged in recyclable materials.	-Benefits of waste separation	-Benefits of waste separation -Which materials are recyclable and which aren't -System of collection/drop off -Purchase products that are packaged in recyclable materials.	
Waste oil Management	-Environmental and health impacts of dumping oil -Correct storage waste oil and used oil filters -What can and cannot be mixed with waste oil -Dispose of used oil at appropriate drop off points.	-Environmental and health impacts of dumping oil -Correct storage waste oil and used oil filters -What can and cannot be mixed with waste oil -Dispose of used oil at appropriate drop off points.	-Environmental and health impacts of dumping oil -Dispose of used oil at appropriate drop off points.	-Environmental and health impacts of dumping oil	
Healthy vehicles	-Drive smart -Taking care of vehicles -Negative health and environmental impacts of vehicle emissions.				
Alternative cooking methods	-Healthier benefits of cooking with clean cooking fuels -Environmental advantages of clean	-Benefits of cooking with clean cooking fuels -Environmental advantages of clean		-Benefits of Solar cooking -Health benefits in reducing exposure to smoke while cooking	

	cooking fuels over traditional three-stone cooking -Benefits of Solar cooking -Advantages of biomass stoves over traditional three-stone fire -Health benefits in reducing exposure to smoke while cooking	cooking fuels over traditional three-stone cooking			
Agricultural chemicals		-Correct storage practices -Understanding chemical labels -Correct use of PPE			-Correct storage practices -Understanding chemical labels -Correct use of PPE
School laboratory chemicals				-Efficient ordering -Safe use of chemicals -Micro scale chemical use -Correct storage practices -Safe disposal practices	

1. Introduction

Pacific island countries are among the most vulnerable states due to limited land availability, fragile ecosystems, limited water resources, increasing population pressures, and limited buffering capacities. Solid and hazardous waste, including POPs are a major threat to sustainable development in PICs because of poor waste management practices that have a direct influence over peoples' lives[iii]. The improvement of waste management is vital for improving health, livelihoods and the environment in the Pacific Region.

The Training and Awareness component (component 2) of the Pacific POPs Release Reduction Through Improved Management of Solid and Hazardous Wastes Project (Pacific POPs Reduction Project) identifies awareness raising as one of the project outputs. More specifically, to implement broader awareness campaigns to encourage best waste management practices by public, small to medium enterprises, government institutions, schools and other stakeholders.

This document aims to provide the tools needed to create awareness campaigns to inform community attitudes, behaviours and beliefs with the intention of influencing them positively on best waste management practices prioritised under the various project components.

1.1 Purpose

The purpose of this document is to provide elements of a general awareness campaign to reduce uPOPs and increase chemical awareness in the areas prioritised by participating PICs in their National implementation Plans (NIP) and finalised during the Regional Workshop as part of the Project Preparation Grant (PPG) phase (see table 2. Below). Participating countries selected from areas relating to various components of the project that that they saw as priorities for awareness raising or related to

their pilot projects. It is intended that PICs use the elements in this document as a starting and reference point to implement their chosen awareness campaigns.

Table 2. Awareness priorities identified by country

	Cook Is	Fiji	FSM	Kiribati	RMI	Nauru	Niue	Palau	PNG	Samoa	Solomon Is	Tonga	Tuvalu	Vanuatu
Healthy vehicles		X		X										X
School laboratory chemicals		X		X			X	X	X	X	X	X		X
Agricultural chemicals	X			X			X		X	X	X			
Composting	X		X				X					X		
Alternative cooking methods		X		X				X		X	X			
POPS						X								
Hospital waste separation				X				X						
Municipal waste separation			X		X		X							
Waste oil	X	X	X	X	X		X	X		X	X	X		X

1.2 Strategy

The various awareness campaigns in this document are designed to be executed at the national level through PIC Government departments and ministries, using already existing communications and public awareness staff. Where possible, awareness campaigns will be integrated into relevant Government and NGO awareness programs and strategies that share linkages. The incorporation of uPOPs and chemical awareness into other existing awareness programs in health and environment Ministries/Departments will encourage an integrated and cross sectoral approach to waste management. By combining resources it will ensure the broadest possible reach of the program and help to contextualise the campaign messages with other broader issues.

To complement the awareness activities in this document Component 1 of the Pacific POPs Reduction Project aims to mainstream uPOPs prevention through National Solid Waste Management Strategies and the legislative and regulative inputs to governments. This will encourage the longer term facilitation and uptake of awareness activities. With longer term regulatory and legislative frameworks for independent government uptake to compliment awareness campaigns, Small to Medium Enterprises will have greater understanding and incentives for sustained best waste management practices.

Education is the key to long-term success. Children, who will one day be adults, will help determine whether the best waste management practices identified for awareness will become established, stable, and widely practiced in the future. This document encourages awareness raising among children through exercises at school, learning how waste is produced, how much each person generates, where the waste goes, the environmental problems that can develop, and the benefits of limiting disposal needs through prevention and reduction. As well as educating children, these programs often educate their parents, many otherwise reluctant parents may participate if their children enlist their interest.

On the regional level the awareness campaigns will coordinate with SPREP's ongoing public awareness, media and communications programme across the Pacific; and a 6-monthly newsletter will be published by the project to encourage the cross pollination of awareness campaign ideas between PICs.

1.3. Outline

This document outlines general awareness campaigns on areas prioritised by PICs during the project design workshop in Fiji and during in-country consultations (see table 2 above). It is designed to be used by the institutions and organisations that will implement the awareness campaigns as part of the training and awareness component of the project (component 2).

An overview of POPs and uPOPs is provided at the beginning of this document which can be used in conjunction with appropriate awareness campaigns. Each area/topic is structured with four components that will assist with the implementation of these campaigns, they are as follows:

Overview – which provides a background and context to the issue/topic.

Key messages – which first provides a summary of the key information that needs to be communicated, then under sub-heading provides more detail for each message. *Further readings* are also provided for each section of key information which can be utilised to acquire further understanding of the issue or used to gain more information for the awareness campaigns.

Target audience – provides a small list of potential groups within the community that would logically be targeted for the awareness campaign activities. This is a general list only, because of the diverse geographical and population sizes of PICs, implementing institutions are encouraged to either add to or modify their target audiences based on individual country circumstances and scope of awareness campaigns.

Examples awareness campaign activities – provides a short list of suggested activities that relate to the suggested target audiences and key messages. This is also a general list only, because of the diverse geographical and population sizes of PICs, implementing institutions are encouraged to either add to or modify their activities based on individual country circumstances, cultural applicability and scope of awareness campaigns.

It is assumed that Government departments and NGOs implementing these awareness campaigns will use existing communications and public awareness staff that already understand how to create and run an awareness campaign using the information provided. If however, implementation teams require some further guidance, attached to this document is an example of the International Pharmaceutical Students' Federation's toolkit used for a HIV/AIDS awareness campaign. It provides a step by step guide

on how to create and run an awareness campaign which can be adapted using the key information provided in the following chapters.

2. What are POPs?

Overview

Persistent Organic Pollutants (POPs) are a group of chemicals that began to be widely used during the boom in industrial production after World War II. Many of these chemicals proved beneficial in pest and disease control, crop production, and industry however, have had unforeseen negative effects on human health and the environment[iv].

What are POPs used for?

POPs can be divided into two general categories:

1. Intentionally produced chemicals that are currently or were once used in agriculture, disease control, manufacturing, or industrial processes. Examples include PCBs, which have been useful in a variety of industrial applications (e.g., in electrical transformers and large capacitors, as hydraulic and heat exchange fluids, and as additives to paints and lubricants) and DDT, which is still used to control mosquitoes that carry malaria in some parts of the world.

2. Unintentionally produced chemicals that result from some industrial processes and from combustion, for example, municipal and medical waste incineration and open burning of rubbish and garden waste. More is covered on unintentionally produced POPs in the next chapter "What are uPOPS?".

What is being done to eliminate POPs?

The Stockholm Convention on Persistent Organic Pollutants (POPs) is a global treaty to protect human health and the environment from POPs by restricting and/or eliminating their production, use, trade, release and/or storage[v]. Some of the POPs targeted by the Stockholm Convention are already virtually obsolete. The deliberate production and use of most POPs has been banned around the world, with some exemptions made for human health considerations (e.g. DDT for malaria control) and/or in very specific cases where alternative chemicals have not been identified. However, the unintended production and/or the current use of some POPs continue to be an issue of global concern. Even though most POPs have not been manufactured or used for decades, they continue to persist in the environment and thus present an environmental and health risk[vi].

The Stockholm Convention supports signatory countries by:

- Establishing, implementing and strengthening their national capacities to address POPs/contaminated wastes.
- Encouraging the reduction of the total release of unintentional POPs derived from different anthropogenic activities such as incinerators and open burning.
- Establishes a scientific committee consisting of government-designated experts to review new chemicals proposed for addition under the Convention.
- Facilitates the provision of technical and financial assistance for eligible Parties to assist them in implementing the Convention.

- Collects national reports and regional monitoring data to facilitate the evaluation of its implementation as an effective tool to protect human health and the environment from POPs[vii].

What POPs are covered under the Convention?
The first 12 compounds (the dirty dozen) covered under the Convention are Aldrin, Chlordane, DDT, Dieldrin, Endrin, Heptachlor, Hexachlorobenzene, Mirex, Polychlorinated Biphenyls, Polychlorinated dibenzo-pdioxins, Polychlorinated dibenzofurans, and Toxaphene.

New POPs
The 9 new POPs recently added to the Convention are Alpha hexachlorocyclohexane, Beta hexachlorocyclohexane, Chlordecone, Commercial Octabromodiphenyl ether (Hexabromodiphenyl ether and Heptabromodiphenyl ether), Commercial Pentabromodiphenyl ether (Tetrabromodiphenyl ether and Pentabromodiphenyl ether), Hexabromobiphenyl, Lindane, Pentachlorobenzene, Perfluorooctane sulfonic acid (PFOS), its salts and Perfluorooctane sulfonyl fluoride (PFOS-F)[viii].

Key messages

Health and environmental consequences of POPs; Substances that contain POPs.

POP chemicals possess a particular combination of physical and chemical properties such that, once released into the environment, they:

- remain intact for exceptionally long periods of time **(Persistent);**
- become widely distributed throughout the environment as a result of natural processes involving soil, water and, most notably, air;
- accumulate in the fatty tissue of living organisms including humans, and are found at higher concentrations at higher levels in the food chain **(bio-accumulative)**;
- are **toxic** to both humans and wildlife[ix].

Persistent:
POPs are chemicals that last a long time in the environment. Some may resist breakdown for years and even decades while others could potentially break down into other toxic substances.

Semi-volatile:
Due to the chemical characteristics that permit these compounds to occur either in the vapour phase or adsorbed on atmospheric particles, they are able to travel long distances. This resulted in the presence of POPs all over the world, even in regions where they have never been used.[x]

Bio-accumulation and bio-magnification:
Many POPs enter the food chain and bio-accumulate and bio-concentrate in the fatty tissues of humans and wildlife. This means that when POPs are absorbed by an animal or plant which is then eaten by a larger animal, the POPs are simply transferred to the larger animal. Some fish, predatory birds, mammals, and humans are high up the food chain and so absorb the greatest POP concentrations.

Toxic:

- Exposure to POPs can be associated with a wide range of adverse health effects including endocrine disruption, reproductive and immune dysfunction, neurobehavioral disorders, cancer, organ damage and death. The three distinct types of human exposure to POPs are:**High-dose**

acute exposure: typically results from accidental fires or explosions involving electrical capacitors or other PCB-containing equipment, or high dose food contamination.

- **Mid-level chronic** exposure is predominantly due to the occupational exposure, and , in some cases, also due to the proximity of environmental storage sites or high consumption of a POPs-contaminated dietary source, such as fish or other marine animals.
- **Chronic, low-dose** exposure is characteristic for the general population world-wide as a consequence of the existing global background levels of POPs with a variations due to diet, geography, and level of industrial pollution. People are exposed to multiple POPs during their lifetime and most people today carry detectable levels of a number of POPs in their body[xi].

The populations most at risk from contaminants are children and the developing fetus. The unique physiology and developmental/ behavioural characteristics of children increase their vulnerability to exposure. Fetal stage exposure can occur through the placenta when the mother has been exposed toPOPs that have bio-accumulated in her tissue[xii]. Exposure can also occur to babies through breast milk from mothers previously exposed to high levels of POPs.

Further reading
a. Stockholm Convention Factsheet:
http://chm.pops.int/Convention/Media/Factsheets/tabid/527/language/en-US/Default.aspx

b. New POPs:
http://chm.pops.int/Implementation/NewPOPs/The9newPOPs/tabid/672/language/en-GB/Default.aspx

c. Short video explaining POPs
http://www.ipen.org/ipenweb/info.html

d. NGO guide to POPs:
http://www.ipen.org/

e. POPs training tool:
http://chm.pops.int/Portals/0/flash/popswastetrainingtool/eng/index.html

Target audience

Schools, Government institutions, businesses, general public, groups not targeted by previous awareness campaigns on POPs, key messages can be used in other more specific awareness campaigns.

Example awareness campaign activities

- School drawing completion.
- Community information/question/answer sessions.
- Public events to promote awareness such as at church events or markets.
- Radio interviews, newspaper articles and television news stories.

3. What are uPOPs?

Overview

Unintentional Persistent Organic Pollutants (uPOPs) are a variety of POPs that are created as a by-product of industry or unintentionally through combustion but have no commercial use, purpose or function. Like the other POPs[1] they remain in the environment for a long time, can travel long distances through air and water, bio-accumulate in the fatty tissue of animals and are among the most toxic cancer causing chemicals known to exist[xiii].

The uPOPs listed under the Stockholm Convention are:

- Dioxins and Furans - Polychlorinated dibenzo-p-dioxins and Dibenzofurans (PCDD/PCDF)
- HCB - Hexachlorobenzene
- PCBs - Polychlorinated biphenyls

Key messages

Most common sources of uPOPs; Health and environmental consequences of uPOPs

What are the most common sources of uPOPs?

Dioxins, furans and HCBs are unintentionally formed and released from heating processes involving organic matter and chlorine as a result of incomplete burning or chemical reactions. PCBs were historically widely used for many applications, especially as dielectric fluids in transformers, capacitors, and coolants. Although they were deliberately manufactured their release is unintentional so they are also considered uPOPs.

Industrial sources have the potential for comparatively high formation and release of these chemicals to the environment through:

- Waste incinerators, including co-incinerators of municipal, hazardous or medical.
- Cement kilns firing hazardous waste.
- Production of pulp using elemental chlorine or chemicals generating elemental chlorine for bleaching.
- Thermal processes in the metallurgical industry.

Other sources include:

- Open burning of waste, including burning of landfill sites.
- Residential/agricultural burning.
- Fossil fuel-fired boilers.
- Firing installations for wood and other biomass fuels.
- Motor vehicles, particularly those burning leaded gasoline.
- Textile and leather dyeing (with chloranil) and finishing (with alkaline extraction).
- Shredder plants for the treatment of end of life vehicles.
- Smouldering copper cables (When the plastic coating [Polyvinyl chloride plastic] on electrical cables is purposely burnt away to extract the wire from inside, the smoke produced contains a toxic blend of dioxins and furans).
- PVC piping, electrical cable (Polyvinyl chloride plastics) when burnt.

[1] See POPs Overview in previous chapter

- Waste oil refineries[xiv].

Further resources
a. Reducing uPOPs animation:
http://chm.pops.int/Overview/tabid/370/language/en-US/Default.aspx

b. Dioxins and furans factsheet:
http://www.epa.gov/osw/hazard/wastemin/minimize/factshts/dioxfura.pdf

Target audience

Schools, Government institutions, businesses, general public, groups not targeted by previous awareness campaigns on POPs, key messages can be used in other more specific awareness campaigns

Example awareness campaign activities

- School drawing completion.
- Community information/question/answer sessions.
- Public events to promote awareness such as at church events or markets.
- Radio interviews, newspaper articles and television news stories.

4. uPOP Prevention

The prevention of uPOPs must be approached differently to POPs prevention because the sources of uPOPs are varied and many people may not be aware that they are actually causing uPOPs to be released into the environment. Awareness campaigns that endeavour to prevent uPOPs must ultimately seek to inform focussed groups within the community of the practices that cause uPOPs and provide alternatives and/or incentives to change these practices and behaviours.

Of the areas of uPOPs prevention prioritised by PICs the majority are related to the reduction or elimination of combustion in its many forms, including: Alternatives to open burning – reusing waste organic material; Waste separation - to reduce or prevent burning of waste; Alternative cooking methods - to reduce long term exposure to harmful smoke when cooking; Healthy vehicles - to reduce the toxic emissions from vehicles; and Waste oil management – to eliminate the dumping or spillage of used engine oil and control its safe disposal.

4.1 Composting - an alternative to open burning

Overview

Open Burning is the burning of any material in an open fire or an outdoor container when specifically designed equipment is not used to control the combustion or air pollution from the fire. Open burning is typically an activity a person participates in to remove unwanted rubbish or organic vegetation such as leaves, grass and branches.

The burning of leaves and brush, other vegetation and general rubbish results in smoke being produced. Some of the components in smoke can contain uPOPs, which when exposed to over a long period of time can cause cancer and other illnesses (see chapter 3. What are uPOPs?). Smoke can also cause other adverse health effects such as respiratory irritation of the airways, coughing or difficulty breathing, decreased lung function and aggravated chronic bronchitis. People who can be especially sensitive to the adverse effects of smoke are small children, pregnant women, older adults and people with asthma or other respiratory ailments[xv].

Pollutants released from the smoke of burning waste are transported through the air either short or long distances, and are then deposited onto land or into water. Some of these pollutants such as uPOPs[2] and mercury, persist for long periods of time in the environment and have a tendency to bio-accumulate, which means they build up in predators at the top of the food web. Bioaccumulation of pollutants occurs directly through the inhalation of toxins in smoke as well as indirectly through the consumption of contaminated water and food. In wildlife, the range of effects associated with these pollutants includes cancer, deformed offspring, reproductive failure, immune diseases and subtle neurobehavioral effects. Humans can be exposed indirectly just like wildlife, especially through the consumption of contaminated food[xvi].

Incineration is still necessary in some circumstances in Pacific Island Countries because of the limited land availability to dispose of hazardous wastes. For example, chemical and bio hazardous waste from hospitals can be often disposed of through controlled high temperature incineration rather than burying it in the ground where there is a risk of health problems occurring later. There are alternatives however, to most of the open burning that currently takes place in Pacific Island Countries, such as the burning of garden waste in backyards and rubbish at waste dumps because most organic rubbish can be recycled into compost. Where there are limited alternatives to activities such as medical waste incineration, reducing the amount of unnecessary waste that is burnt through waste separation can also achieve reductions in uPOPs production.

What is composting?

Composting is nature's way of recycling and is the method of breaking down organic waste material (from plants and animals) such as leaves, yard trimmings, grass clippings and manure as well as fruit and vegetable scraps. Microorganisms break down this material into compost, a crumbly, dark-coloured, soil-like, nutrient-rich earthy-smelling product that can be used in your garden to enrich plant growth and performance.

Key messages

Environmental and health benefits of composting; How to easily set up a compost pile; Harmful effects of toxic smoke caused by open burning; Health benefits of gardening.

Benefits of composting

Composting offers many benefits, not only will it improve the quality of gardens, save money on fertilizers and by not burning garden waste, improve public health, but composting efforts will help reduce the amounts of garbage going to the landfill.

[2] See What are uPOPs? Chapter above

As populations and consumption increases, so does the amount of waste, creating one of the Pacific's biggest environmental problems – waste management. About half of what is thrown into the garbage bin is food and garden vegetation, and these materials can be used to make compost to benefit gardens[xvii]. Even garden waste, such as fallen leaves and grass clippings, can be added to home composting units and leaves can be used directly on gardens as mulch.

Compost is natural, inexpensive and is good for the environment and by turning food scraps and garden vegetation into compost you can:

- **Improve soil quality and garden vitality** – improving soil fertility, soil structure and aeration (the ability of air to circulate), increases the ability of the soil to absorb and retain nutrients, moderate soil temperature, reduce erosion, and suppress weed growth and plant.

- **Conserve water** – Compost improves water-holding capacity reducing the frequency needed to water in the dry season.

- **Recycle valuable nutrients and reduce the use of artificial fertilizers** - which saves money and protects the environment by eliminating pollution run-off into the ground water.

- **Prevent uPOPs and greenhouse gas emissions** - when organic waste is burnt it creates dioxins and furans (see chapter 3. What are uPOPs?) and it increases the amount of carbon dioxide in the air, which contributes to the global warming problem. Even if waste isn't burnt, it can still pose a problem because when organic matter starts to decay in landfills it can create methane as a by-product, which is another problem linked to global warming.

- **Reduce the amount of organic waste going to landfills** – which in the long run saves money.

Did you know?

- More than 50% of the waste we throw away in the Pacific is organic, meaning that it can decompose[xviii].
- When leaves are composted along with grass clippings the resulting compost can also serve as an organic fertilizer.

How can I set up a compost pile?

Composting is easy. You can set up a compost pile in a corner of your yard with very few supplies. Making compost is a lot like cooking a meal: you take some basic ingredients, add water, mix well and let it cook over a given period of time.

Composting requires four basic ingredients:

Browns (dead leaves, branches, twigs)
Greens (grass clippings, vegetable waste, fruit scraps, and coffee grounds)
Water (to make sure the compost doesn't dry out)
Air (to help the compost breakdown faster)

Having the right amount of greens, browns, water and air is important for compost development. Ideally, your compost pile should have an equal amount of browns to greens and alternate layers of

organic materials of different-size particles. The brown materials provide carbon for your compost and the green materials provide nitrogen, the water provides moisture to help breakdown the organic matter while giving the pile air by turning the pile once a week will inhibit odor-causing bacteria and to speed up the composting process.

Basic backyard composting pile approach[xix]:

1. Select a dry, shady spot near a water source for your compost pile or bin.
2. Add your brown and green materials as you collect them, making sure larger pieces are chopped or shredded. Ideally your pile should be around 1m square - big enough to work and small enough to turn.
3. Moisten dry materials as they are added.
4. Once your compost pile is established, mix grass clippings and green waste into the pile and bury fruit and vegetable waste under 10 inches of compost material.
5. Optional: Cover top of compost with a tarp to keep it moist (or to shelter it from the rain in the wet season).
6. Keeping the pile moist and turning it every few weeks will help speed up the natural decomposition process. In dry weather, sprinkle water on the pile, but don't let it get too soggy.
7. When the material at the bottom is dark and rich in colour, your compost is ready to use (this is usually occurs in two months to four months).

Above is the simplest method, but using a compost bin will help keep your compost pile neat and tidy and help your pile retain heat and moisture. Compost bins can be easily homemade out of wood, old tires, wire mesh, scrap wooden pallets, old garbage bins, bricks or anything you have lying around that will make a barrier around your pile.

What to add to your compost heap[xx]

- Vegetable and fruit scraps
- Dried leaves and twigs
- Tea leaves and tea bags
- Coffee grounds
- Fish bones and seaweed
- Egg shells (crushed)
- Old newspapers
- Grass cuttings
- Sawdust (not from treated timber)
- Animal manure (not dogs or cats)

What <u>NOT</u> to add to your compost heap

- Meat and dairy products
- Diseased plants
- Metals, plastic, glass
- Magazines
- Large branches
- Weeds that have seeds or underground stems
- Bread or cake (may attract mice)
- Bones

• Sawdust from treated timber (e.g. treated pine)

Further reading
a. Easy composting guide factsheet:
http://www.environment.nsw.gov.au/households/EasyCompost.htm

b. Introduction to composting:
http://www.composting101.com/

c. Create your own compost pile:
http://www.epa.gov/epawaste/conserve/rrr/composting/by_compost.htm

d. Composting guide:
http://www.pittwater.nsw.gov.au/__data/assets/pdf_file/0004/28093/CompostingBrochure_for_web.pdf

Are banana circles considered composting?
Yes, the banana circle is a simple composting method used in the Pacific where a number of banana trees are planted in a circle around a hole lined with cardboard and organic waste is placed in the hole. It has evolved as a suitable method for disposing of organic waste and growing bananas at the same time because bananas grow well in a circle and bear fruit on the outside of the circle.

Banana circles are versatile because they can accept a wide range of wastes including cardboard, paper, kitchen scraps, house sweepings, yard waste (leaves, twigs, etc.), and grey water (water from kitchens). This helps to keep organics out of the landfill, and also provides food for the family by producing bountiful bananas. The Banana Circle method is particularly useful and advantageous in low-lying atolls, where food crops are difficult to grow because of poor soil quality[xxi]. The same technique can be used with other fruit crops such as pawpaw.

Further reading
Building a banana circle:
http://permaculture.org.au/2008/06/23/build-a-banana-circle/
&
http://www.permup.com/banana.html

Benefits of home gardening

- Home gardening saves money through producing your own vegetables, fruits, and flowers for very little or no cost.
- The food from home gardening is healthier than the food in the stores and super markets because no chemicals are used.
- Household diets are improved with the introduction of home grown organic food that is harvested straight from the backyard.
- Gardening is good for both your physical and mental health, providing good physical activity, relaxation and stress relief.
- Quality time for the family is enhanced by spending time sitting or chatting in the garden.

- Family members form good eating habits and are more aware of nature and varieties of herbs, plants, and flowers.
- Home gardening lowers the consumption and production of chemical fertilizers. It also gives a much-needed boost to chemical-free plants and vegetables.
- Home gardens are good for the environment increasing carbon sequestration and reducing food transport.

Target audience

Schools, households/communities, restaurants, local councils, gardeners and farmers,

Example awareness campaign activities

- Demonstration compost piles at schools which can be monitored and different materials tested for their 'compostability'.
- Set up communal compost piles in communities.
- Local Councils can lead by example by using composting principles when maintaining public land and parks.
- Organic gardening competitions.
- Community information/question/answer sessions.
- Public events to promote awareness such as at church events or markets.
- Radio interviews, newspaper articles and television news stories.
- Public demonstrations on the construction of compost piles.
- Integration into other waste management programs.

4.2 Waste separation

Waste occurs when materials are not, or cannot be recycled safely back into the environment or into the marketplace. If waste is not managed well, it can result in long-term harmful consequences for people, nature and the economy. As we all generate waste, we all have a responsibility to minimize the waste in our communities, but in order to reduce waste that goes to landfills and into incinerators for disposal it is important to realise that not all waste is the same. Encouraging and teaching people to separate the re-useable and harmful wastes can be an effective way to improve the management of wastes and reduce its negative impacts.

4.2.1 Hospital waste separation

Overview

Health-care waste management is a very important part of managing a health-care facility because if it is not done correctly it can be more costly, be harmful to the environment and pose a health threat to the patients, employees working in the hospital and also the community surrounding the hospital.

Potential dangers of Medical waste:

- Infectious waste can cause diseases like Hepatitis A & B, AIDS, Typhoid, Boils, etc.

- When waste containing plastics and organic matter are burnt at low temperatures causing smoke, dioxins (uPOPs) are produced which can cause cancer.
- Flies also sit on the uncovered piles of rotting garbage. This promotes mechanical transmissions of potentially fatal diseases like Diarrhoea, Dysentery, Typhoid, Hepatitis and Cholera.
- Medical staff can be exposed to health risks if sharps and bio-hazardous wastes are not disposed of correctly.

Before any clear improvement can be made in medical waste management, consistent and scientifically based definitions must be established as to what is meant by medical waste and its components, and what the goals are. Plans and policies should be laid down for this purpose. Then the waste should be segregated. Imposing segregation practices within hospitals to separate biological and chemical hazardous waste will result in a clean solid waste stream. If proper segregation is achieved through training, clear standards, and tough enforcement, then resources can be turned to the management of the small portion of the waste stream needing special treatment[xxii].

Key messages

Source reduction; Waste separation; Waste incineration using BAT

Effective health-care waste management has many components that all contribute to minimizing costs and reducing health risks, these include:

Source reduction

Purchasing practices are key to waste minimization, a procurement strategy for materials coming into the hospital (inventory control) can have a large impact on the amount of waste generated, this is particularly true for materials that have a use by date.

Further resources

a. Reducing PVC in hospitals:
http://www.noharm.org/lib/downloads/pvc/Reducing_PVC_in_Hosp.pdf

b. Mercury free guidelines:
http://www.noharm.org/lib/downloads/mercury/Making_Med_Mercury_Free_HCWH.pdf

c. Purchasing and inventory control:
https://secure.jdeducation.com/JDCourseMaterial/FundPurch.pdf

Separation

Separating different types (categories) of waste at the point of generation allows special attention to be given to the relatively small quantities of infectious and hazardous waste, reducing the risks and cost of waste management through incineration.

Further resources

a. Waste segregation guidelines:
http://www.noharm.org/lib/downloads/waste/Guidelines_Waste_Segregation.pdf

b. Medical waste symbols and colours:

http://toolboxes.flexiblelearning.net.au/demosites/series7/704/toolbox_704/shared/resources/manual/waste_management.htm

Medical waste incineration

Parties to the Stockholm Convention are required to use the best available technologies (BAT) for Medical Waste Incinerators

due to their potential to emit uPOPs from the incineration of materials containing organic compounds (human tissue, blood, plastics, wood, paper etc.). Incineration should occur at temperatures higher than 850 °C with sufficient turbulence and excess oxygen that lead to non-toxic end products[xxiii]. Side reactions leading to toxic by-products however inevitably occur, especially when incinerating waste containing halogens and PCDD/Fs precursors, materials such as PVC plastics and mercury from broken thermometers. Only highly controlled incinerators with air pollution control equipment and operational practice specifically designed to minimize dioxin formation and release could be considered the best available technology[xxiv].

For the reasons outlined above, incineration should only be practised for the hazardous types of waste (e.g. sharps, pharmaceuticals and bio-hazardous wastes) that would otherwise cause potential health and environmental risks if disposed of in a landfill or dumpsite. Because most waste types still contain materials that can cause dioxin and furan formation it is advantageous to minimize as much as possible the amount of medical waste that is incinerated

Further Resources

a. WHO best practices for incineration:
http://www.who.int/water_sanitation_health/medicalwaste/en/smincinerators3.pdf

b. Reducing PVC in hospitals:
http://www.noharm.org/lib/downloads/pvc/Reducing_PVC_in_Hosp.pdf

Target audience

Orderlies, Nurses, Incinerator Operators, Health Inspectors and Procurement Staff

Example awareness campaign activities

- Creation of a hospital "Green Team" comprised of administrators, orderlies, nurses, incinerator operator and others who are responsible for waste handling. This group can then strategize about courses of action for the hospital with input from all responsible sectors.
- Information and reminder signs posted around the work place and where waste is disposed of
- Teaching nursing and housekeeping staff the proper way to segregate waste, small errors at this stage can create lot of subsequent problems.
- Refresher training of waste disposal dangers and responsibilities every 6 to 12 months to keep the issues current and inform new staff.
- Information/training sessions with the introduction of colored bins and personal protective equipment.

Further resources

a. Good list of resources:
http://www.noharm.org/all_regions/issues/waste/

b. Recommendations for reducing waste:
http://www.ban.org/Library/11reco~1.pdf

c. HCWM training guidelines:
www.hjulmandweb.dk/HCRW-CD/Written%20Papers/A%20Swart.doc

d. Green team explained:
http://www.deq.idaho.gov/multimedia_assistance/hospitals/green_team_fs.pdf

4.2.2 Municipal waste separation

Overview

Most of the waste we produce is not really 'waste' at all, but can be reused or recycled. Waste can also mean 'wasted money' because aluminium, metal, paper and some plastics can be recycled to create new items. Most of the rubbish in the Pacific is buried in landfills or placed in open dump sites and these dumps take up lots of space, which is a problem for smaller island states; are expensive to build; and in some cases, are the precious habitats of birds, plants and animals. By separating materials that can be re-used, and in some cases make money from the waste stream, not only saves space at the local landfill/dump site but it can actually help subsidize the management of non-recyclable waste.

Key messages

Importance of waste separation; which materials are recyclable and which aren't; system of collection/drop off; Purchase products that are packaged with recyclable materials.

The importance of waste separation

- It reduces waste going to landfill/dump, which reduces the space required for landfills, decreases the environmental impact and a makes a more beautiful place to live.
- It saves money and some waste can actually be worth money.
- Causes a reduction in the amount of waste burnt at dumpsites, thereby reducing uPOPs.

Further reading
Recycling:
http://www.bvsde.paho.org/bvsars/i/fulltext/decision/decision.pdf - Chapter 6
&
http://www.sprep.org/att/publication/000496_WasteKitBookLR.pdf - Chapter 1

The requirements regarding acceptable materials and contaminants

Not all materials are recyclable so information is required to inform the public what they can put in the recycling bin and which ones they can't.

Plastics - Both PET and HDPE plastics (identification codes 1 and 2) have recyclable markets and should be collected. The identification code numbers (see table 3 below) can usually be found on the bottom of bottles and packaging.

- PET is most common as soft drink and water bottles.
- HDPE are most common bottles for bleach, washing liquid, shampoo and similar including milk when in plastic bottles.

Plastics with the same resin code are in the same *family* of plastics but they have different chemical properties. The manufacturing processes used to create the different shapes results in containers with incompatible properties. It is ***very*** important for staff working at the processing station to sort plastics into identification codes but also into separate manufacturing process piles within the same identification code. For example, bottles and juice/milk containers are made through a process called blow-moulding and should be separated as such. Other plastic containers, such as margarine tubs although displaying the same identification number, are made through a process called injection-moulding. When plastic resins produced by different processes are mixed together, the resulting product is not usable for either application in the future[xxv].

Important Blow-mouldered PET plastics should be separated from injection-mouldered plastics.

Identification code numbers 3 – 7 should also be separated into individual groups by the processing station staff, although markets for these plastics are less available they can may be become available or be able to be used for other products in the future if they are neatly separated from other *plastic families.*

Table. 3 Plastic identification codes[xxvi]

TYPE OF PLASTIC		PROPERTIES Incl. Specific Gravity	APPLICATIONS: Virgin Grades	APPLICATIONS: Recycled grades MAJOR USE / minor use
1 PETE	Polyethylene Terephthalate **PET**	Clear, tough, solvent resistant. Used for rigids, sheets and fibres. Softens: 85 C SG = 1.38	Carbonated soft drink bottles, fruit juice bottles, pillow and sleeping bag filling, textile fibres	**BEVERAGE BOTTLES** Clothing, geo-textiles, bottles for detergents etc., laminated sheets, clear packaging film, carpet fibres
2 HDPE	High Density Polyethylene **HDPE**	Hard to semi-flexible, waxy surface, opaque. Softens: 135° C SG = 0.96	Crinkly shopping bags, freezer bags, milk bottles, bleach bottles, buckets, rigid agricultural pipe, milk crates	**FILM, BLOW MOULDED CONTAINERS** Agricultural pipes, pallets, bins for compost and kerbside collections, extruded sheet, crates, garden edging, household bags, oil containers, pallets
3 V	Unplasticised Polyvinyl Chloride **UPVC**	Hard rigid, can be clear, can be solvent welded Softens: 70 - 100° C SG = 1.40	Electrical conduit, plumbing pipes and fittings, blister packs, clear cordial and fruit juice bottles	**PIPE, FLOORING** Pipe and hose fittings, garden hose, electrical conduit, shoes, road cone bases, drainage pipes, electrical conduit and ducting, detergent bottles
	Plasticised Polyvinyl Chloride **PPVC**	Flexible, clear, elastic, can be solvent welded Softens: 70 - 100° C SG = 1.35	Garden hose, shoe soles, cable sheathing, blood bags and tubing, watch straps, rain wear	
4 LDPE	Low Density Polyethylene **LDPE** Linear: **LLDPE**	Soft, flexible, waxy surface translucent, withstands solvents Softens: 115° C SG = 0.92	Garbage bags, squeeze bottles, black irrigation tube, silage and mulch films, garbage bins	**FILMS: BUILDERS, CONCRETE LINING and BAGS** Agricultural pipe, nursery & other films
5 PP	Polypropylene **PP**	Hard, flexible, translucent (can be transparent). Wide property range for many applications, good chemical resistance. Softens: 165° C SG = 0.90	Film, carpet fibre, appliances, automotive, toys, housewares, crates, pails, bottles, caps and closures, furniture, rigid packaging	**CRATES, BOXES, PLANT POTS** Compost bins, garden edging, irrigation fittings, building panels
6 PS	Polystyrene **PS**	Clear, glassy, rigid, brittle, opaque semitough, melts at 95°C. Affected by fats and solvents. Softens: 90° C SG = 1.06	Refrigerator bins & crispers, stationery accessories, coat hangers, medical disposables. Meat & poultry trays, yoghurt & dairy containers, vending cups	**INDUSTRIAL PACKAGING, COAT HANGERS, CONCRETE REINFORCING CHAIRS** Moulded products, coat hangers, office accessories, spools, rulers, video cases and printer cartridges
	Expanded Polystyrene **EPS**	Foamed, light weight, energy absorbing, heat insulating Softens: 90° C SG = 0. 90 – 0.93	Drinking cups, meat trays, clamshells, panel insulation, produce boxes, protective packaging for fragile items	**SYNTHETIC TIMBER** Picture frame mouldings, under slab void pods for buildings
7 OTHER	**OTHER** : Includes all other resins and multi materials (laminates) acrylonitrile butadiene styrene (ABS), acrylic, nylon, polyurethane (PU), polycarbonates (PC) and phenolics		Automotive, aircraft and boating, furniture, electrical and medical parts	**AGRICULTURAL PIPING** Furniture fittings, wheels and castors. Fence posts, pallets, outdoor furniture and marine structures.

Glass – for recycling in PICs will be mostly from bottles and jars although other forms of glass such as windows can be *Downcycled.* Downcycling is a term given to materials that are recycled into lesser products different from their original use, such as window glass being crushed and used as a form of aggregate substitute.

Before glass bottles are sent for recycling they must be sorted into different colours, and need to have very low levels of contaminants to avoid shipment rejection. Encouraging households to ensure that the contents of glass containers are empty and cleaned prior to putting in the recycling bin is a good way to mitigate this.

Aluminium cans – are the easiest and most profitable recyclable material. They need to be crushed to reduce their volume before they are shipped.

Tin cans - Tin cans are easy to recycle, and must be crushed prior to shipping to increase the shipping volume per container. Cans should be cleaned and their labels stripped off before they are exported, encouraging households to ensure that tins are clean prior to putting in the recycling bin is a good way to mitigate this. Another method is leaving cans for a week or two in the open before crushing and letting the ants do the cleaning[xxvii]. **Important-** ensure that ants do not go into the shipping container with the cans!

Further reading
a. Fact sheet example:
http://www.greensboro-nc.gov/NR/rdonlyres/EED2C6B0-15C6-4E54-95F4-86F89F6641E9/0/RecyclingItems.pdf

b. Plastics:
http://www.greensboro-nc.gov/departments/fieldops/recycling/plastic.htm

c. General
http://www.sprep.org/att/publication/000496_WasteKitBookLR.pdf, p.8-24

Explanation of the collection/drop-off system

The collection or drop off system must be clearly communicated to the public and businesses so there is no confusion about what is expected from them and what they can expect from recycling activities. One example would be to arrange for recyclable material pick up on the same day as the week as regular rubbish collection, this will help create a routine and pattern to people habits, which assists to 'normalize' recycling activities.

The purchasing of recyclable products/product with recyclable packaging

To ensure there is a reduction of non-recyclable materials in the waste stream, businesses and the public should be encouraged to purchase products that use recyclable packaging. By understanding the information on the packaging consumers can make informed purchasing choices. This should include instructions on recycling logos and classification codes of plastics as well as other recyclable products.

Further resources
a. Recycling overview:
http://www.sprep.org/att/publication/000496_WasteKitBookLR.pdf - chapter 1

b. School activities:
http://www.deq.state.or.us/lq/pubs/docs/sw/curriculum/RRPart0405.pdf - excellent and extensive list of fun and promotional activities for school children

c. Recyclable logos and classification codes used on plastics:
http://en.wikipedia.org/wiki/Resin_identification_code
&
http://en.wikipedia.org/wiki/Plastic_recycling

Target audience
Households, communities, small to medium businesses, government offices and schools

Example awareness campaign activities
- One to one household/business awareness raising to ensure information is understood and questions can be answered.
- Leaflet/factsheet distribution.
- Community information/question/answer sessions – this is useful to gather political and social support for the program.
- Public events to promote awareness such as sporting events.
- Radio interviews, newspaper articles and television news stories.
- School activities (for a list of excellent school activities see *further reading* above).

4.3 Waste oil management

Oil is very useful to us, it keeps our cars, lawnmowers, and many other machines functioning, but once oil is used and becomes waste, it can be very hazardous to human health and the environment and must be discarded properly. The waste oil component of this project aims to set up a system for countries that currently do not have a used oil disposal system. Used oil will be collected and stored centrally in each country making it economically viable to be sent to Fiji where it will be burnt at high temperatures in steel production. Recycling used oil is the best way of handling waste oil because it turns waste oil that would either be burnt or dumped into a useable resource, this helps protect the environment and conserves the use of valuable natural resources.

4.3.1 Vehicles repairs shops

Overview
Because vehicle repair shops regularly change engine fluids they are responsible for the correct disposal of waste oil. By correctly capturing, storing and disposing of used oil, repair shops become a crucial part of the oil recycling process by offering a centralized point of collection and storage. Depending on the country's disposal system, this oil is then either dropped off at a government approved storage location or picked up by the government and taken to an approved storage location to await shipment. By following the guidelines below, vehicle repair shops can ensure that waste oil is received, stored and disposed on in the most environmentally way possible.

Key messages
Environmental and health impacts of dumping oil; storing waste oil and used oil filters; what can and cannot be mixed with waste oil; Dispose of used oil at appropriate drop off points.

Environmental and health impacts of dumping oil
Oil is a pollutant: it takes only one litre of oil to contaminate one million litres of water, and a single automotive oil change produces four to five litres of used oil. In water, oil is a visible pollutant, floating as a scum on the surface. This oil scum can stop sunlight and oxygen from getting into the water, affecting fish and water plants. It can kill the fish and other animals that breathe from the water's surface[xxviii].

Used oils such as engine oil, hydraulic fluid, brake fluid and transmission fluid pick up a variety of contaminants during their use that pose significant risks to human health and the environment.
The contaminants in used oil tend to build up in soils where they can then be absorbed by plants, animals, fish and shellfish, harming the health of these organisms. People can also be affected by eating these plants or animals.

Waste oil can contain heavy metals such as cadmium, chromium and lead, and may also contain arsenic and dioxins. Humans can be exposed to some or all of these chemicals by drinking water and eating food contaminated with used oil, by coming into contact with contaminated soil, and by breathing in contaminated dust[xxix].

Unregulated, low temperature burning of used oil can create airborne pollutants that can get into people's lungs. The health effects from exposure to some of these chemicals are very serious, as they can be quickly absorbed through the skin, lungs and intestines, and can accumulate to high levels in people's bodies.

- Short-term exposure to used oil can lead to irritation of the skin, eyes and respiratory system, and potentially gastro-intestinal upsets.
- Long-term exposure can cause damage to the liver, brain, immune system, reproductive system and can cause cancer.

If used oil is disposed of inappropriately, either through being dumped in landfills or stored incorrectly in garages, it can pollute land, waterways, underground reservoirs and the marine environment. To ensure public health and protect the environment, used oil needs to recovered and recycled as much as possible[xxx]. Recycling used oil ensures any contaminants are properly disposed of.

Further reading
a. Motor oil overview:
http://www.eco-usa.net/toxics/chemicals/motor_oil.shtml

b. Used motor oil factsheet:
http://www.environment.gov.au/settlements/waste/oilrecycling/publications/pubs/fs-why-recycle.pdf

c. Health and environmental impacts factsheet:
http://www.ruralresidentialliving.com.au/waste_management/resource_downloads/Used%20oil%20-%20health%20and%20environmental%20impacts.pdf

Storing Waste Oil Correctly

- Do not pour any oil wastes into a storm drain, septic tank, dry well, or on the ground.
- Store waste oil in sturdy, leak-proof metal containers.
- Keep containers closed unless you are adding or removing used oil.
- Place containers on a surface made from any nonporous material (such as concrete) that waste oil cannot pass through. The surface should have no cracks or gaps.
- Store waste oil away from drains or ignition sources.

Oil Filters

When removing oil filters, the engine should be warm and the filter should be placed with its gasket side down in a drain pan. If the filter has an anti-drain valve, the dome end of the filter should be punctured with a screwdriver or similar device so that oil can flow freely. Used oil filters contain reusable scrap metal, which steel producers can use as scrap feed. Used oil filters should be taken to scrap metal dealers or authorised drop off points that have proper storage facilities.

Mixing Waste Oil

It's OK to mix the following fluids with waste oil:

- Hydraulic fluid
- Power steering fluid
- Transmission fluid
- Brake fluid

Do **NOT** mix any of these fluids with waste oil:

- Gasoline
- Antifreeze
- Cleaning Solvents
- Other Hazardous Wastes
- Water[xxxi]

Further Reading
Auto repair shop waste oil regulations (USA):
http://www.newmoa.org/publications/auto/VToil.pdf

Target audience

Vehicle repair shops and medium sized businesses that operate large machinery and/or conduct in-house vehicle maintenance.

Example awareness campaign activities

- One to one business awareness raising to ensure information is understood and questions can be answered.
- Leaflet/factsheet distribution.
- Signage created and handed out to businesses to place around the working environment.
- Media attention to raise general awareness amongst the community – this can encourage businesses to "do the right thing" if the community is aware of what is expected of them.
- Integrate with other relevant environmental campaigns.
- Community awards for repair shops that perform well – this gives free publicity to businesses and the general public.

4.3.2 Do it yourself vehicle owners

Overview

Vehicle owners that change their own oil also need to dispose of waste oil in the most appropriate way that does not impact negatively on the environment or human health. Householders should not re-use used oil for any purpose - there is no appropriate household use of used oil[xxxii].

Key messages

Environmental and health impacts of dumping oil; storing waste oil and used oil filters; what can and cannot be mixed with waste oil; Dispose of used oil at appropriate drop off points.

When changing vehicle oil, 'do it yourself' vehicle owners should follow the same guidelines as vehicle repair workshops. Centralized collection points should be appointed and vehicle owners made aware of these locations. Collection points can either range from designated vehicle repair shops to government approved storage locations. By pouring used oil back into an empty oil container and taking it to a designated facility, vehicle owners are helping to conserve a valuable resource and protecting the environment[xxxiii].

Further reading
Used oil factsheet example:
http://www.derm.qld.gov.au/register/p01566aa.pdf

Target audience

All vehicle owners

Example awareness campaign activities

- Radio interviews, newspaper articles and television news stories to promote the benefits of correct oil disposal and dangers of incorrect oil disposal.
- Signage on busy roads.
- Signage/Information at engine oil retailers.

4.4 Healthy vehicles

Overview

Cars and trucks travel by using internal combustion engines that burn gasoline or other fossil fuels. The process of burning petrol or diesel fuel to power cars and trucks contributes to air pollution by releasing a variety of emissions into the atmosphere. Emissions that are released directly into the atmosphere from the tailpipes of cars and trucks are the primary source of vehicular pollution.

How we drive and how we take care of our vehicles affects fuel economy and pollution emissions. Improving the health of cars and trucks can make a difference in the effort to reduce uPOPs (see chapter 3 what are uPOPs?) and pollution.

Key messages

Drive smart; Take good care of your vehicle; Negative health and environmental impacts of vehicle emissions.

Drive smart

- Be aware of your speed - obeying highway speed limits can save fuel, as well as prevent pollution.
- Avoid rapid accelerations and braking, which burn more fuel.
- When you aren't in traffic, turn off the engine rather than idle for more than 30 seconds.
- Remove excess weight from your trunk, and if you have a removable roof rack and aren't using it, take it off.
- Use your vehicle less wherever possible by combining activities or even walking instead.

Take care of your vehicle

- Simple vehicle maintenance—such as regular oil changes, air-filter changes, and spark plug replacements—can lengthen the life of your car as well as improve fuel economy and minimize emissions.
- Keep your tires properly inflated - Low tire pressure means lower fuel economy.
- During start-up, a car's engine burns extra fuel. However, letting an engine idle for more than a minute burns more fuel than turning off the engine and restarting it.
- Replace your air filter regularly. A clogged air filter can reduce fuel economy significantly.

Further reading
US EPA vehicle emissions awareness campaign:
http://www.epa.gov/smartway/consumer/vehiclepsa.htm

The following are the major pollutants associated with motor vehicles[xxxiv]:

- **Ozone (O_3).** The primary ingredient in urban smog, ozone is created when hydrocarbons and nitrogen oxides (NO_x)—both of which are chemicals released by automobile fuel combustion—react with sunlight. Though beneficial in the upper atmosphere, at the ground level ozone can irritate the respiratory system, causing coughing, choking, and reduced lung capacity.
- **Particulate matter (PM).** These particles of soot, metals, and pollen give smog its murky colour. Among vehicular pollution, fine particles (those less than one-tenth the diameter of a human hair) pose the most serious threat to human health by penetrating deep into lungs. In addition to direct emissions of fine particles, automobiles release nitrogen oxides, hydrocarbons, and sulphur dioxide, which generate additional fine particles as secondary pollution.
- **Nitrogen oxides (NO_x).** These vehicular pollutants can cause lung irritation and weaken the body's defences against respiratory infections such as pneumonia and influenza. In addition, they assist in the formation of ozone and particulate matter. In many cities, NO_x pollution accounts for one-third of the fine particulate pollution in the air.
- **Carbon monoxide (CO).** This odourless, colourless gas is formed by the combustion of fossil fuels such as gasoline. Cars and trucks are the source of nearly two-thirds of this pollutant. When inhaled, CO blocks the transport of oxygen to the brain, heart, and other vital organs in the human body. Newborn children and people with chronic illnesses are especially susceptible to the effects of CO.
- **Sulphur dioxide (SO_2).** Motor vehicles create this pollutant by burning sulphur-containing fuels, especially diesel. It can react in the atmosphere to form fine particles and can pose a health risk to young children and asthmatics.

These chemical compounds, which are emitted by cars, trucks, refineries, petrol pumps, and related sources, have been linked to birth defects, cancer, and other serious illnesses.

Further reading
Auto emission, health and the environment:
http://www.maine.gov/dep/air/lev4me/effects.htm
&
http://www.nutramed.com/environment/cars.htm

Target audience
All vehicle owners

Example awareness campaign activities
- Radio interviews, newspaper articles and television news stories to promote the benefits of correct vehicle maintenance.
- Signage on busy roads and intersections.
- Signage/Information at repair shops and vehicle registration departments.
- Police crackdown on smoky vehicles.

4.5 Alternative cooking methods

The traditional use of the 3 stone fires for cooking can produce dangerous levels of smoke if exposed over a long period of time, particularly if food is cooked indoors. This is caused by the high moisture content of biomass resources and the low efficiency of the combustion process which can cause the formation of dioxins and furans[xxxv].

The World Health Organization estimates that the household air pollution from the use of biomass in inefficient stoves causes more than 1.45 million premature deaths most of these occurring in women and children[xxxvi]. According to the National Implementation Plans of PICs, uncontrolled combustion processes account for a significant portion of uPOP releases. The shift away from the use of biomass or the improved efficiency of biomass stoves is seen as a way to curb the health and environmental impacts of cooking.

4.5.1 Efficient biomass stoves

Overview
For many households, switching away from traditional biomass is not feasible in the short term because of the costs for cleaner cooking fuels such as LPG, so improving the way biomass is used for cooking through improved stoves is an important way of reducing fuel use and the harmful effects of smoke. Efficient biomass stoves are more efficient than regular wood stoves because, due to their design, they can produce more heat from less fuel, they create less ash waste, and need far less ventilation to run properly

Key messages

Health benefits for women using biomass stoves over traditional three-stone fire; Energy efficiency; reduction in toxic smoke exposure while cooking; Environmental benefits.

Benefits of Efficient Biomass Stoves

- Greater efficiency than the traditional three-stone fire for cooking which is only about 10 to 15 per cent efficient because most of the heat generated is lost.
- Energy-efficient stoves can greatly improve the combustion of fuels so that they emit very little smoke and pollution.
- Reduces the time spend to collect wood.
- Relieves local pressure on wood resources and encourages biodiversity.

Improved stoves are based on the principle of enclosing the combustion area to increase the core temperature and thereby achieve more complete combustion with potential reductions of up to 50%in fuel wood requirements for cooking[xxxvii]. There are many variations of efficient biomass stove, but the information provided in *Further resources* below only covers the Rocket Stove design as it is easy to make requiring only bricks (no mortar). Other biomass stoves, although reportedly as efficient require the manufacture of metal or ceramic components.

Important note

According to a World Bank technical paper[xxxviii], biomass stove programs have been most effective where householders pay relatively high prices for wood fuels; in such cases, the improved stoves can pay for themselves in fuel savings very rapidly, even though they are usually more expensive to produce and buy than traditional stoves. Open fire might also be difficult to discourage because they serve many functions including: lighting, heating, drying, providing a communal gathering point, repelling insects and others. It is important to keep in mind during the awareness campaign that when one or more of these needs are not met but are valued more than the promised fuel and time savings public buy in becomes more difficult.

Further resources

a. Useful website:
http://www.journeytoforever.org/at_woodfire.html - vert good list of publications on stoves and dangers of cooking with biomass

b. How to make a 16 brick rocket stove:
http://www.hedon.info/IncreasingFuelEfficiencyAndReducingHarmfulEmissionsInTraditionalCookingStove - short instructional video

c. How to build a rocket stove:
http://www.youtube.com/watch?v=hABYAHLgrck&feature=related - short instructional video

Target audience

Remote/rural communities/households as well as urban households where wood is in short supply and communities that are not able to afford the LPG option. Women and children in particular should be targeted as they spend the most time around fires and suffer more adverse health effects because of it. NGO's that work with women would be ideal to implement an awareness campaign because they

already have the networks, complimentary programs and an understanding of the broader issues that shape women's participation in the community.

Example awareness campaign activities

- Community information/question/answer sessions – this is useful to gather political and social support for the issue.
- Public events to promote awareness such as sporting events (these can be women only or mixed).
- Radio interviews, newspaper articles and television news stories.
- School classroom information awareness sessions, drawing competitions.
- Cooking competitions between fuel efficient stoves and the 3 stone method.
- Public demonstrations on the construction and use of fuel efficient stoves.

4.5.2 Solar cooking

Overview

What is a solar cooker?

It is a device that allows you to cook food using the sun's energy as fuel with only very simple materials and it's healthy and environmentally friendly because there is no burning or smoke.

Because it is easy to construct using tin foil, cardboard and a little glue anyone can make one. All a solar cooker needs is an outdoor spot that is sunny for several hours and protected from strong wind, and where food will be safe.

Key messages

Benefits of Solar cooking; Flexibility of food that can be cooked in a solar cooker; The easy and cost efficient way to make a solar cooker.

Benefits of solar cooking

- Foods cook unattended while you do other things.
- Solar cooking takes about twice as long as regular cooking, however slow cooking retains flavour, moisture and nutrients, and makes meats tender.
- Sunshine is free and saves precious fuel for evenings and cloudy days.
- With no burning or smoke it is good for your health and the environment. Cooking with traditional fuels such as wood and gas pollutes the air and contributes to global warming.
- Pots are easy to clean. Food doesn't stick on the inside and there's no soot on the outside.
- Most solar cookers cook at 82-121ºC, ideal for retaining nutrients, moisture and flavour and not burning foods.
- Your kitchen stays cool on hot, sunny days.
- Solar cookers complement traditional cooking methods, which are still used at night and during inclement weather.

What can I cook with a solar cooker?

Solar cookers can be used to cook vegetables, fruits, meats, grains, legumes and most other foods. You can even bake breads and desserts![3] Simple solar cookers however **cannot** stir-fry or cook flat breads that require high temperatures.

How can I make a solar cooker?

Model 1: Panel Cooker (Cookit)
The CooKit is a simple, portable solar cooker. It can be made in one to two hours and can cook one large pot of food for about six people. For simple and easy to follow instructions see *further reading* - Solar Cookers p 12-13.

Model 2: Box Cooker
The box cooker is for larger families and takes one day to make, plus overnight drying. It cooks two to three pots of food. If rocks or bricks are heated alongside the pots, the box cooker will maintain heat for a couple of hours after sunset with the lid closed. For simple and easy to follow instructions see *further reading* - Solar Cookers p 18-23.

Solar Cooker Tips

- Foods cook fastest between 10 a.m. and 2 p.m., when the sun's energy is most intense.
- Thin, black, metal pots with lids work best.
- The amount, volume and height of food in the pot influence cooking speed. Small quantities of food, and food cut into small pieces, cook fastest.
- You can cook almost anything in your solar cooker, including vegetables, meats, grains and legumes. You can even bake breads and desserts!
- Solar cookers cannot stir-fry or cook flat breads that require high temperatures.

The Solar Cookit booklet, which can be easily downloaded[4], includes solar cooking concepts, solar cooker construction plans and directions for use, recipes, student activities and examples of non-cooking uses of solar cookers including solar water pasteurization.

Target audience

Children, remote/rural communities/households as well as urban households where wood is in short supply. In particular women from poorer communities that are not able to afford the rocket stove, LPG option or to buy wood.

Example awareness campaign activities

- Community information/question/answer sessions – this is useful to gather political and social support for the issue.
- Public demonstrations on the construction and use of solar cookers.
- Public events to promote awareness such as sporting or church events (these can be women only or mixed).
- Radio interviews, newspaper articles and television news stories.
- School classroom information awareness sessions on the dangers of smoke inhalation.
- Cooking competitions between solar cookers and the 3 stone method.

[3] For a great variety of recipes see the Solar Cookers International, *Solar Cookers – How to make Use and Enjoy*, http://solarcooking.org/plans/Plans.pdf, p. 31-38
[4] See further reading

Further reading
Solar cooker:
http://solarcooking.org/plans/Plans.pdf - detailed instructions, recipes and excellent general overview

4.5.3 Clean cooking fuels

Clean cooking fuels significantly reduce the smoke associated with traditional biomass cooking because as the name suggests, when burned they emit much smaller amounts of pollution. This is particularly beneficial to women's health as it is traditionally women who cook in poorly ventilated kitchens.

4.5.3.1 Liquefied Petroleum Gas (LPG)

Overview

The most widely available clean cooking fuel in the Pacific is liquefied petroleum gas (LPG) which is stored and transported as liquid. It can be purchased by refilling dedicated LPG bottles from outlets that sell LPG. It contains little of the contaminants that are found in the more traditional liquid fuels. Sulphur, vanadium and sodium are virtually non-existent making LPG a very clean burning fuel. This also allows LPG to be used in direct firing applications such as in the baking and ceramics industries.

Key messages

Health benefits for women who cook with LPG; Environmental advantages of LPG over traditional three-stone cooking.

Benefits of cooking with LPG

- LPG provides a 'clean' burn with almost complete combustion of the fuel so that there are only low pollutant emissions and very low particulate or other hydrocarbon emissions[xxxix].
- Provides a visible flame that's easily controlled to get just the right level of heat.
- Lights straight away with little effort.
- Doesn't leave any residue or taint food.
- It is portable, so useful for people who live and work in remote locations.

What are the advantages over the traditional 3 stone cooking method?

- 3 stone cooking method is an inefficient energy carrier and the heat is difficult to control.
- 3 stone cooking method produces unhealthy smoke.
- Current rate of biomass extraction is not sustainable for forests.
- Saves time wasted collecting wood.

Further reading
Global clean fuel initiative:
http://www.iiiee.lu.se/publication.nsf/c05cf70b5a5648c8c1256b4a004a5a9f/6848cd20ca737308c1256f1f00423ac2/$FILE/Goldemberg%20et%20al.pdf

Target audience

Urban households and small businesses such as restaurants that use wood as a fuel to cook, and businesses that can supply and sell LPG.

Although LPG gas is an excellent energy solution for reducing negative environmental and health effects during cooking it is often too expensive and difficult to access for rural and poorer communities. Clean cooking fuels are prohibitively expensive for many households, and the high price of compatible stoves further discourages their use[xl]. Urban populations are more suitable to be targeted for any awareness campaign as they will be in more of a position to afford the transition LPG and have better access to the infrastructure required to refill empty gas bottles.

Example awareness campaign activities

- Community information/question/answer sessions – this is useful to gather political and social support for the issue
- Public events to promote awareness such as sporting or church events
- Radio interviews, newspaper articles and television news stories
- School classroom information awareness sessions on the dangers of smoke inhalation
- Cooking competitions between gas stoves and the 3 stone method
- Signage in retail outlets that sell gas
- One on one information/question/answer sessions with restaurants and other businesses that burn biomass.

4.5.3.2 Biogas (methane)

Overview

Biogas (or methane) is generated by the breaking down (bio-degradation) of organic substances in the absence of oxygen. By properly treating this waste, useful renewable energy, in the form of methane, as well as organic fertilizer can be obtained and effectively turn waste into several resources[xli]. Biogas is a unique energy technology because it offers multifunctional and simultaneous benefits in public health, agricultural productivity, environmental sustainability and economic development.

Methane can be used as a clean cooking fuel that is produced by small-scale biogas digesters that break down recycled organic waste from dead plant and animal material, animal dung, and kitchen waste. Food wastes provide equal or higher amounts of biogas per kg of waste than manure however because it is generally less soluble in water than manure it must be cut into smaller pieces before being fed into the digester. This extra step can have a large influence on the outcome of the productivity of the biogas generated.

Small-scale biogas digesters are applicable to small farms that have a steady supply of animal manure, small communities that capture and process human faeces or by small businesses that produce a lot of organic waste such as vegetable markets.

Biogas digesters are currently being used in the Pacific, but only in a very limited capacity. See the pilot project in the village of Falelauniu in Samoa in *further reading* below for an example of how a Samoan community is benefitting from biogas.

There are many varieties of biogas digesters available that range considerably in price. The cheapest is the polythene plastic tubular variety used extensively in Vietnam, Cambodia and Tanzania among other countries (see further reading below for construction examples). This design is ideal for pilot projects because it introduces biogas digester technology with relatively small capital outlay and provides a cost effective gauging of how well the community embraces it.

On the other end of the spectrum small-scale biogas digesters can be built with bricks, mortar and cement, be dug deep into the ground and have toilets constructed and methane gas lamps attached to them (see further reading below for examples). These systems have been proven to be quite effective but require much larger capital outlays. Methane gas lamps also significantly reduce the amount of methane that can be used for cooking.

Factors affecting biogas yield:

- The quantity and nature of organic matter
- The temperature (optimal 20-40 degrees)
- PH value of substrate
- The flow and dilution of material

Key messages

Health benefits for women who cook; Environmental and economic advantages of cooking with biogas over traditional three-stone cooking.

Health benefits of cooking with methane

- Methane provides a 'clean' burn with almost complete combustion and no smoke.
- Doesn't leave any residue or taint food.
- Improved hygiene and health conditions in the household compound (eliminating raw and untreated animal and human faeces) this reduces the smell, flies and parasites around the house.
- When replacing wood as a fuel it eliminates smoke from poorly ventilated kitchens.

Environmental and economic benefits of biogas digesters

- Supplies clean inexpensive renewable energy fuel.
- Reduction in CO2 emissions and deforestation pressure by substituting fossil fuel with biogas.
- Long-term improvement in the financial situation of households by reducing fuel and chemical fertilizer expenses.
- Improved of soil fertility and reduction of soil degradation by the use of the bio digester's digested effluent as organic fertilizer.
- Reduce workload of women and children for fuel gathering.
- Requires only organic inputs, so useful for people who live in remote locations.
- Biogas digesters are low-tech and easily replicated.

What are the disadvantages of the traditional 3 stone cooking method?

- 3 stone cooking method is an inefficient energy carrier and the heat is difficult to control.
- 3 stone cooking method produces unhealthy smoke.
- Time wasted collecting wood.

Socio-cultural constraints to using methane as a clean cooking fuel

Social constraints and psychological prejudice to the use of human waste materials is very common among most cultures, particularly in urban settings. Using biogas digester demonstrations are an excellent way to help overcome negative stigma attached to human waste because if constructed correctly, biogas digesters are quite clean, odourless and have numerous economic, health and

environmental benefits. Focussing on these numerous benefits is the best way to positively change the way people think about it (See further reading below).

Further reading
a. Biogas pilot project in Samoa:
http://www.pcdf.org.fj/files/Rakaka%20Jan%202011%20LR.pdf
&
http://www.unescap.org/EPOC/pdf/Examples-of-Green-Growth-in-the-Pacific.pdf

b. Tubular plastic biogas digester, a how to construct and install guide:
www.fao.org/ag/aga/agap/frg/Recycle/biodig/**manual**.htm

c. VACVINA biogas model (cement and brick construction materials):
http://www.ease-web.org/wp-content/uploads/2009/08/BIOGAS-MANUAL.pdf

d. Community based sanitation approach:
http://unapcaem.org/Activities%20Files/A01/BIOGAS%20and%20DEWATS,%20a%20perfect%20match.pdf

e. Socio-cultural aspects of biogas projects:
www.**gtz**.de/de/dokumente/en-**biogas**-volume1.pdf, *p.35*

Target audience
Communities with no centralised waste water treatment facilities, small farms with a regular supply of manure, small businesses such as vegetable markets with a regular supply of organic waste, remote communities, women's groups/NGOs

Example awareness campaign activities
- Community information/question/answer sessions – this is useful to gather political and social support.
- Radio interviews, newspaper articles and television news stories.
- School classroom information awareness sessions on the dangers of smoke inhalation.
- Cooking competitions between biogas stoves and the 3 stone method.
- One-on-one information/question/answer sessions with businesses that produce significant amounts of organic waste.

5. Chemical Awareness

The elements of the chemical awareness campaign are to be used in conjunction with the chemicals component of the project (component 3). The specific areas/elements were prioritised by some PICs in the consultation process that took place at the workshop in Fiji and during country consultation visits. These elements include: Agriculture - to prevent accidents on farms through exposure to chemicals and School laboratory – to reduce educational chemical waste

5.1 Agriculture

Overview

Chemicals are used on farms for a variety of purposes and the safe management of these chemicals requires access to information and responsible action otherwise farmers can be subjected to serious risks by exposure to some of the most dangerous chemicals available. Agricultural chemicals can be highly poisonous having the potential to inflict molecular-level damage on humans, harm the immune system and establish a predisposition for cancer, diabetes and Parkinson's disease[xlii].

Key messages

Correct chemical storage, Understanding chemical labels and correct use of PPE.

Chemicals Storage

Chemical should be stored:

- In a location away from people, livestock, water, flammable materials and above flood level to prevent contamination.
- In a structurally sound building/shed with an impermeable floor and protection from the elements.
- On shelves away from direct sunlight with incompatible chemicals, such as insecticide, herbicides and fungicides, arranged separately (place powder or granular products above liquid products on shelving).
- In a secure location that can be locked to prevent children and others from entering.
- With appropriate signage at entry point such as 'NO SMOKING', 'PESTICIDE STORE' etc. or visual warnings for illiterate farm workers and children.

Further reading

a. Detailed chemical storage facility guidelines:
http://www.dpiw.tas.gov.au/inter.nsf/WebPages/TTAR-62Q5Y2?open

b. Safe management of farm chemicals:
http://www.safework.sa.gov.au/contentPages/docs/empFarmChemicals.pdf

Understanding chemical labels

- Understanding chemical labels helps you to gain knowledge about the effects of the hazardous substances that you are using, and the methods of using them safely[xliii]. This can be difficult for illiterate farmers or farm workers so instructions on the recognition of signal words and symbols for 'DANGER', 'WARNING' and 'CAUTION' are important to recognize how potentially dangerous the product is to humans.
- Agricultural chemicals should only be de-canted into their original containers, de-canting into other containers should never occur as warning labels are lost in the process.
- Purchasing of de-canted chemicals should also be discouraged unless they are in their original containers.
- Whenever possible, empty pesticide containers should be returned to the distributor or taken to an approved collection scheme. If no facilities exist for the return or safe disposal of empty pesticide containers and unwanted or unusable pesticides, end users and local authorities should lobby pesticide distributors and agricultural advisers to establish schemes. The aim

should be to remove potentially hazardous waste pesticides and empty containers from users and pass them on to competent authorities who have the resources to deal with them safely[xliv].

Further reading
a. Understanding pesticide labels:
http://www.ipm.iastate.edu/ipm/hortnews/1994/1-12-1994/undpest.html - useful website

b. Impacts of pesticide use in developing countries:
http://collections.infocollections.org/ukedu/ru/d/Jid22ie/4.3.html - good general information

c. Management of small Quantities and Obsolete Pesticides: - guidelines
http://www.fao.org/docrep/X1531E/X1531e04.htm

Personal protective equipment (PPE)
Personal protective equipment (PPE) is special clothing used to protect farmers and workers from injury or illness and is required under most Occupational Health and Safety regulations. The advised PPE is always specified on the chemical's label or Chemical Data Sheet.

Examples of PPE include: Overalls or long clothing to prevent superficial exposure; waterproof pants, coat, gumboots (Closed-toed shoes should be worn at all times where chemicals are stored or used, perforated shoes, sandals or cloth sneakers should not be worn), PVC apron, hat and rubber gloves to provide all over body protection from spills, leakage and spray; respirator to protect against vapours and gases; goggles and face shield to protect eyes and face.

PPE is a last resort protection system, it does not reduce or eliminate the hazard, and it protects only the wearer, not others.

- Illiterate farmers and farm workers should understand the visual representations (symbols) of PPE required for handling pesticides.
- Farmers employing farm workers must ensure that all employees have access to and are using the appropriate PPE.
- Persons using PPE must be aware of and trained in its correct use.
- PPE equipment needs to fit the user properly, be clean and be regularly maintained.

Further reading
a. PPE guidelines:
http://www.safety.uwa.edu.au/policies/personal_protective_equipment_guidelines - detailed descriptions

b. OH&S and PPE:
http://new.dpi.vic.gov.au/agriculture/about-agriculture/legislation-regulation/legal-booklets/occupational-health-and-safety

c. PPE symbols:
http://www.safetyoffice.uwaterloo.ca/whmis/ppe_symbols.html - good visual guide to the different symbols

Target audience
Farmers, farm workers, illiterate farmers, illiterate farm workers and pesticide distributers.

Example awareness campaign activities
- Posters distributed to farms with illiterate workers visually outlining the dangers of agricultural chemicals and how to mitigate these dangers.
- Information/demonstration sessions for farmers and farm workers.
- Larger farms and chemical companies should be encouraged to provide training to employees.
- Promotion of organic farming practices.
- Promotion of the national implementation of the FAO Code of conduct and guidelines on the distribution and use of pesticides[xlv].
- Promotion of national OH&S guidelines.

5.2 School laboratory

Overview
School laboratories have potential dangers for human health and the environment, yet with careful planning and awareness, most dangers can be avoided. It is essential for all involved in the science instruction program to develop a positive approach to a safe and healthful environment in the laboratory. Safety and the enforcement of safety regulations in the science classroom and laboratory are the responsibility of the principal, teacher, and student—each assuming his/her share.

Key messages
The key areas to focus on to reduce waste and prevent accidents in the laboratory are: Efficient chemical ordering; Correct use as necessary of harmful chemicals; Correct storage practices; Safe disposal practices.

Ordering
By simply asking the following questions when ordering chemicals is the most effective way to reduce chemical waste:
- Can a safer, less hazardous chemical can be used instead?
- Will the chemical or its end product require disposal as a hazardous waste?
- Can smaller amounts of a chemical (micro experiments) be used to conduct the same experiment?
- Are the ordering quantities consistent with the rate of use?
- Order only what will be used within a year or less.

Further reading
School Chemistry Laboratory Safety Guide:
http://www.cpsc.gov/cpscpub/pubs/niosh2007107.pdf - p.13 & 14

Use
To minimize the toxicity and the amount of chemical waste that is generated and to reduce costs several things can be done:
- Purchase chemicals in the smallest quantity needed.

- Use safer chemical substitutes/alternatives such as chemicals that have been determined to be less harmful or toxic (Table 1 contains examples).
- Use micro scale experiments (Chemical experiments using smaller quantities of chemicals)
- Recycle chemicals by performing cyclic experiments where one product of a reaction becomes the starting material of the following experiment.
- Consider detoxification or waste neutralization steps.
- Use interactive teaching software and demonstration videos in lieu of experiments that generate large amounts of chemical waste.
- Perform classroom demonstrations instead of individual student experiments.
- Use pre-weighed or premeasured chemical packets that reduce bulk chemical disposal problems (no excess chemicals remain)[xlvi].

Further reading
Green chemistry overview:
www.epa.gov/greenchemistry/

Storage
There are correct ways of storing chemicals that might be hazardous or dangerous to people and the environment. The following are some general rules for correct chemical storage:

- The storage area should be a closable cabinet; or shelving secured to the wall or floor in a room that can be locked.
- Organize chemicals first by COMPATIBILITY—not alphabetic succession.
- Segregate chemicals into separate groupings – Acids, nitric acid, toxic, volatile/odoriferous, flammable, organics, non-organics and water sensitive.

Further reading
a. Chemical storage guide:
http://naples.cc.sunysb.edu/Admin/HRSForms.nsf/pub/EHSD0261/$File/EHSD0261.pdf - good list of compatible and incompatible chemicals

b. School Chemistry Laboratory Safety Guide:
http://www.cpsc.gov/cpscpub/pubs/niosh2007107.pdf - Detailed guidelines and storage do's and don'ts, p.18-23

Disposal
All laboratories that use chemicals inevitably produce chemical waste that must be properly disposed of. However hazardous chemical waste is waste that presents a danger to human health and/or the environment and can be defined as having one or more of the following characteristics: Corrosiveness, ignitability, reactivity and toxicity. Chemicals having any of these properties must not be poured down the drain; they must be stored until they can be disposed of properly.

General principles for storing chemical waste:

- Store all waste in containers that are in good condition and are compatible with their contents.
- Clearly and permanently label each container as to its contents and label as hazardous waste.
- Store waste in a designated area away from normal laboratory operations and to prevent unauthorized access.
- Store waste bottles away from sinks and floor drains.

- Do not completely fill waste bottles; leave several inches of space at the top of each waste container.
- Cap all waste bottles.

Target audience

School principals, chemistry teachers, students

Example awareness campaign activities

- Create laboratory safety booklet to be used by staff and students.
- Post information and reminder signs around the laboratory.
- Incorporation of guidelines into school policy.
- Information/awareness session conducted by teacher at the beginning of the year.

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