

CHAPTER 39

MANAGING OUR SOLID WASTES

39. 1. SOLID WASTE CYCLES

In a natural setting the landscape is not littered with huge mounds of leaves, fallen trees, bones, or other solid matter from dead plants and animals.

The material from living things is **reused** and **recycled** over and over again. Nature incorporates the chemicals and elements from one organism's wastes into the tissues of another. Occasionally, however, chemical elements are locked inside glaciers or geological deposits for long periods of time. Changing weather patterns and geological processes eventually cause some of these deposits to be returned to the ecosystem. here, they are once again rapidly recycled and reused. Nature's efficient *solid waste cycle* prevents waste material from accumulating.

In contrast to the natural cycle, the solid waste cycle is very different and inefficient in our present day modern societies. A banana grown on a farm in Ecuador is shipped 9,000 miles to Saipan to be eaten. The skin is not left out to be consumed by scavengers or to break down naturally, but is temporarily stored in a garbage pail. Then it is trucked to the dump and buried.

The dump is too polluted to support the normal community of organisms that would result in the break down of the skin and the reuse of the nutrients. Similarly, the bodily wastes of the person who ate the banana are ultimately transported to a wastewater treatment plant, and then discarded into the ocean.

Because the valuable chemicals in the banana's waste products have been transported away from his trees, the farmer in Ecuador must now use money to purchase manufactured fertilizers to support next year's banana crop. Our example given here describes a **dead-end waste**. This is a waste that does not return valuable nutrients and chemical elements back to the ecosystem.

A good example of the dead-end use of raw materials in industry is the manufacturing of synthetic rubber. **Coke** (no, not the soft drink) is a natural material produced from coal. Manufacturers use it as a raw material to make the gas **acetylene**. Acetylene is then used to make synthetic rubber. The rubber, in the form of old tires and other things, eventually accumulates in a location such as a gar-



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bage dump. It does not return to the mine as coal, or to the earth as a carbon source for life processes.

Many of our new synthetic materials, especially plastics and corrosion-resistant coatings for metals, were developed to be resistant to chemical break-down so that they would not deteriorate during their useful lifetimes.

Unfortunately, this resistance remains long after the products are discarded. The movement of materials through industrial processes, unlike the movement through life processes, generates an ever-increasing quantity of waste. Most of this is in the form of solid matter.

This does not mean that all manufactured products eventually become dead-end wastes, but most do. Look at our ever-growing piles of trash as evidence for this. Manufacturers use some industrial waste products as raw materials for other manufacturing. Others, soap for example, can be used as food for living organisms such as bacteria.

We call materials that can be consumed by living organisms **biodegradable**. However, the fact that a product is biodegradable does not mean that it is harmless to the ecosystem. Petroleum products, for example, are eventually broken down by bacteria, but the process is very slow. Fuels and oils dumped at sea, or through aquifers, seep onto a shoreline and may disrupt this ecosystem long before bacteria can consume the petroleum products.

Plastics, another petroleum product, exist for decades before bacteria and sunlight will break them down. In the meantime they are a serious threat to animals, and are ugly as **litter**.

In this chapter, we will discuss the sources and quantities of solid wastes here in the Marianas. We will also look at the different types of solid wastes and the problems involved in their disposal.

We encourage you, as a student of island ecology, to think about the natural systems we discussed in previous units, and to compare them with the solid waste cycles of our current modern society.

39. 2. SOURCES AND QUANTITIES

The most noteworthy characteristic of our solid waste is its variety. Household garbage pails contain food scraps, newspapers and other discarded papers, glass, and cans. Household trash also includes broken toys, old appliances, tires, wood, lawn trimmings, and worn out furniture. The other items are too numerous to mention.

The total quantities of solid wastes are large and increasing here in the CNMI. In 1994, municipal solid wastes, which includes both household and commercial wastes, averaged almost six pounds per person per day.

In other words, our waste disposal system must take care of about 125 tons—250,000 pounds—of garbage every day. During that year, 95 million pounds of trash accumulated. This is a lot of trash!



The most noteworthy characteristic of our solid waste is its variety.



Many materials were developed so that they would not deteriorate during their useful lifetimes. Unfortunately, this resistance remains long after the products are discarded.

Per person, people in the CNMI produce about as much trash as people in the mainland United States, the largest producers of trash in the world. Compared to the CNMI, the average person in Sydney, Australia, produces less than two pounds per person per day, and the average person in India produces only about half a pound.

Our modern material lifestyle and our tourism/garment manufacturing economy are the joint causes of most of our trash. Packaging materials comprise a high proportion of what we throw away even though these materials are expensive to produce.

More than half of what we pay to buy our soft drinks and beer (those over 21 years old only please) is for the bottles and cans. Nearly half the cost of many other items is for their packaging as well. This does not prevent people from buying these products. However, packaging wastes are only part of the problem. Even if there was no wasteful and expensive packaging, we still throw away an enormous amount of trash.

Processing raw materials such as metals, fossil fuels, or agricultural products—from which to manufacture appliances, airplanes, shoes, soda cans, and automobiles—always generates solid wastes.

Look around the room you are reading in. Note the number of manufactured items. A series of industrial processes produced each object. Solid wastes were produced at each step along the way.

Although at the time of this chapter's writing, the CNMI did not have significant manufacturing industries, people still buy products that produced industrial waste elsewhere. Even the products themselves eventually become waste here. Our one major manufacturing industry — garment production — has caused serious environmental problems from both the burning of scraps and the clogging of our sewers.

39. 3. THE NATURE OF OUR SOLID WASTE PROBLEM

Dealing with our solid wastes presents many problems. The ineffective disposal of trash around the CNMI creates litter. Blowing trash from the dump pollutes marine waters. Trash piles attract flies and rats and promote bacterial growth and disease. As the CNMI runs out of places to dump trash, a disposal problem is created. Finally, the accumulation of cans and other recyclable materials wastes precious non-renewable resources.

Litter is a particularly difficult issue to resolve. Notably a small percentage of the population is responsible for a large proportion of our litter problem. Moreover, there appears to be no solution. Anti-litter campaigns are ineffective. Laws that create stiff fines are difficult to enforce.

One significant step would be to limit packaging waste. This could be done by requiring the use of degradable packaging materials, or reducing the overall volume of packaging material.

Another solution would be to promote more island cleanups. This means that many people who do not litter would be routinely cleaning up after those who do. This is not a pleasant thought, but what else can one do about a neighbor's litter?



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On Saipan the solid waste problem begins with quantity. Almost all solid waste that is discarded is [Ed. Note: (was)] deposited in the Puerto Rico dump. Even though some efforts have been made to operate the dump more like a sanitary landfill, the present open dump system is the most primitive of disposal methods. Waste is hauled to the site, spread on the ground, and compacted by large machinery. Organic matter rots or is consumed by rats and insects.

Occasionally the accumulation catches fire (this may have been deliberate or spontaneous) reducing the total volume, but sending very toxic compounds airborne. Sometimes soil cover is provided, but not regularly and not in amounts sufficient enough to cover the trash. (See our Air Pollution chapter).

Recently, cover material for this dump has, in fact, become excessive, resulting in the new Mt. Puerto Rico. The newly found cover material comes from Saipan's port dredging project. This has reduced the occurrence of fires.

Of course, the organic decay and the burning are recycling operations of a sort. However, there are serious problems with the open dump. The biological community there differs from those that have evolved in natural ecosystems.

The dump is a potential source of disease, especially diseases that are carried by flies and rats. When the fires are uncontrolled, the smoke is a very hazardous pollutant. Rainfall that enters the dump washes pollutants into the ground water and out to the ocean. Dumps of course are also ugly and smelly.



Occasionally the accumulation of solid waste at the Puerto Rico Dump caught fire (this may have been deliberate or spontaneous) reducing the total volume, but sending very toxic compounds airborne.

[Editor's update note: As of 2003, Saipan has implemented a comprehensive Integrated Solid Waste Management Plan (ISWMP). The ISWMP includes all necessary elements to address Saipan's solid wastes over the next twenty to fifty years. This was accomplished through a tremendous cooperative effort by the CNMI's government agencies, the U.S. Federal authorities, and the private sector.]

39. 4. COMPOSITION OF SAIPAN'S WASTE STREAM

The major components of Saipan's mixed solid waste stream are metals, plastics, paper, yard wastes, food, rubber, and textiles. As mentioned earlier, in comparison with the US mainland, solid waste quantities per person on Saipan are generally similar.

Saipan's waste stream is higher than average in plastics, glass, aluminum cans, and textiles. Aluminum, plastic, and glass waste can be attributed to the high consumption of imported beverages by both our local population and our tourists.

Compared to the US mainland, Saipan's waste has a little less paper, yard wastes, food, and rubber. The paper waste in the Marianas is primarily the corrugated type found in packaging. Newspaper is found in relatively small quantities. The quantities of yard and food wastes are low because of fewer highly cultivated lawns and our practice of feeding food scraps to animals.

39. 5. HAZARDOUS WASTES

39. 5. 1. What Makes a Waste “Hazardous”?

When discussing solid waste, it is necessary to talk about hazardous waste, too. Hazardous wastes come in all shapes and forms. They may be liquids, solids, or sludges.

A **hazardous waste** is a waste that may cause a serious illness or death; one that poses a substantial threat to human health or to the environment.

Hazardous wastes are a product of our highly industrialized and technical society. Even here on islands far out in the Pacific Ocean, we have hazardous wastes because we buy and use products from industrial countries.

Hazardous wastes come from industries, hospitals, laboratories, and from the materials and products we use in our daily lives. Some of these hazardous wastes are junk cars, fuel, paper, plastics, clothing, rubber, paint, pesticides, and medicines.

Whatever their form, however, proper management and disposal of hazardous wastes are essential to protect our islands’ beauty and our natural resources.

Hazardous wastes may also be the by-products of manufacturing processes, or simply be commercial products—such as household cleaning fluids or battery acids—that have been discarded.

Hazardous waste has four basic characteristics: **ignitability**, **corrosivity**, **reactivity**, and **toxicity**.

Ignitability means that a waste can catch fire and burn when handled. Fires are dangerous because of heat and smoke, but the smoke from fires can also spread harmful particles and gases.

Corrosivity means that the waste can corrode, eat away, materials and live tissues. This is especially dangerous when the waste corrodes the container it is stored in. Sometimes, the waste corrodes the container very slowly and leaks are not found until many years later.

A hazardous waste is called reactive if it is explosive. A reactive waste tends to react violently with some other substance, such as air or water, or in some cases, spontaneously with itself.

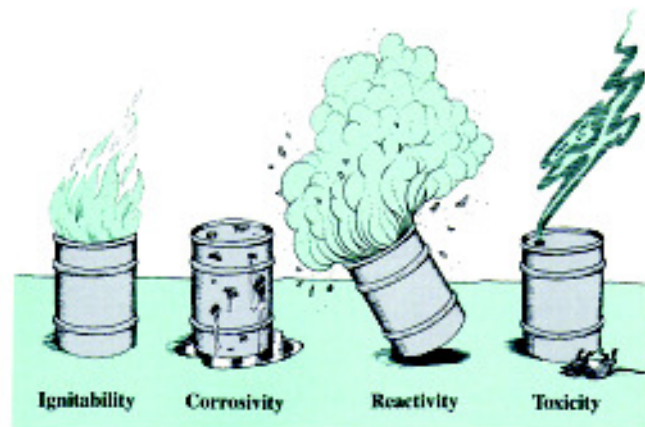
A toxic hazardous waste is one that is a threat to human health and to other living things in the environment because it may cause disease or death.

39. 5. 2. Significant Hazardous Wastes in the CNMI

The CNMI produces very little hazardous waste itself. Our hazardous waste arrives here in the form of manufactured products which we use every day. The most significant, that is dangerous, of these are fuels and oils, heavy metals, solvents, paints, acids and bases, pesticides, and munitions.



Improper disposal of hazardous waste endangers our environment. Proper management and disposal are essential to protect our islands’ beauty and our natural resources.



A waste is hazardous if it exhibits any of these four basic characteristics: ignitability, corrosivity, reactivity, and toxicity.

Metals occur in such products as paints, cleaners, oils, batteries, and pigments and dyes. Solvents are used for cleaning and maintaining industrial equipment, and often concentrate metals as they are being used.

Many solvents are organic solvents, with very complex chemical structures. These often have serious effects on human health, especially the respiratory and nervous systems.

Acids and bases often occur in cleaners. Drain cleaners are usually almost pure sodium hydroxide, a base that is a powerful corrosive agent. Pesticides are used extensively in the CNMI by gardeners, farmers, and hotel groundskeepers. Once these are applied, they last a very long time in the environment.

Eventually rain washes them into our groundwater and ocean water. Munitions are leftover from the war period. These are often the most dangerous of all wastes in the CNMI, but they are generally buried in remote areas and are only occasionally encountered. They need to be disposed of by specially trained people when they are found.

Fuel is stored on-island in large quantities, and there is always a risk of a spill, fire, or explosion. Waste oil is extremely hazardous to our environment and it continues to accumulate in barrels and tanks. Many thousands of gallons of waste oil are now stored on Saipan, Tinian, and Rota.

39. 5. 3. How are Hazardous Wastes Disposed Of?

At this time, most of the hazardous wastes in the CNMI are simply part of the general waste stream. Some are disposed of in our three main dumps (Saipan, Tinian, and Luta).

There have been some attempts to contain waste oil and to separate old batteries from the waste stream, but so far these have been minor efforts.

Some of our hazardous waste does not make it to the dump. It is simply thrown out into the jungle, alongside the road, or on a remote corner of private property. To deal properly with our wastes, and especially our hazardous wastes, we need an overall waste management program.

39. 6. INTEGRATED WASTE MANAGEMENT (IWM)

As a small island, it is difficult to dispose of trash in such a limited land area. In many respects, we are a throw-away society similar to industrialized nations, so our trash production is increasing. Our current form of disposal into an uncontrolled dump can not continue indefinitely.

An **integrated waste management (IWM)** solution uses several types of disposal methods at the same time. The major methods are to reduce, recycle, incinerate, and to use landfill techniques. Using a variety of methods has many advantages.

Landfill requirements are minimized, resources are recovered, often at a profit, and the risks to the environment are reduced.



Division of Environmental Quality staff must be called in to deal with issues such as leaking chlorine containers. Special clothing, equipment, and training are necessary to handle these chemicals.



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39. 6. 1. Source Reduction

The first component of an IWM is **reduction**. Reduction is the best way to deal with waste; that is, to not have to deal with it at all. This is the idea behind source reduction: if we eliminate some of the waste that enters the CNMI before it gets here, we will have less to throw away.

This sounds easy at first; however, it is the most difficult task in solid waste management. Our trash piles are growing larger and larger, so it is easy for us to see that we have not made any headway in reducing trash at its source. We are a people that enjoys buying things. When we buy things, we end up with things to throw away.

How many times a day do we stop and buy juice, water, or a snack, each of which comes in its own little container? Maybe there are five of us together and each of us buys juice in a single-serving container. As a result, we have five little containers to throw away when we finish drinking.

Packaging waste decreases as the container size increases. If we shared one large container of juice amongst the five of us, there would only be one container to throw away. A larger container, yes, but not as large a volume of packaging as the five smaller ones put together. We also get more juice since less of our money is spent on containers.

Perhaps we could use that large container for something else, too. Instead of buying bottled water each time we go out, we could bring water from home in the reusable bottle and eliminate a piece of packaging waste altogether.

Think about the types of products you buy, how often you buy them, and how they are packaged. Look at the contents of your trash can. How could we alter some of our buying habits so that we create less trash?

39. 6. 2. Recycling

Recycling is the next component of a well-planned IWM program. Recycling, like source reduction, reduces the amount of waste that needs to be buried or burned.

Reducing trash volume may reduce disposal costs and add years of life to existing landfills. In addition, recycling puts valuable materials to better use, cuts down on litter, and conserves natural resources.

Adding recycling to a waste management program is challenging, especially when we have gotten used to constantly throwing things away. Recycling programs come in many shapes and sizes. The type of program we choose should be based on our island's needs and on what materials can best be recycled.

The easiest items for recycling in the Marianas are metals, plastics, and papers. Our waste stream is already high in aluminum and plastic. These materials have good market value if they can be efficiently collected, separated, and transported to an industrialized country.

RECYCLE



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Once these items are mixed in with the normal waste stream, however, they are difficult and expensive to separate from the rest of the trash. The same is true for paper waste.

These resources have an economic value that is recognized in countries that have a lot of manufacturing. If we can collect our recyclable materials and get them to a recycling center, they can be sold for profit.

Individuals who take part in a recycling program should not expect a monetary gain from their efforts however. Separating our trash into batches of recyclable materials at home is good for our islands. It reduces litter and saves landfill space. Recycling helps our economy by fighting inflation.

For example, even though we may not get much money (if any) for separating our aluminum at home and taking it to a recycler, a strong recycling program will reduce the cost of producing new beverage containers. This reduction in cost will eventually be passed on to us. We receive it in the form of lower prices for products that are packaged in aluminum.

Students should understand that the advantages from recycling will not be realized overnight. Years of work lie ahead before results will be visible on a large scale. However, we need to start now. Perhaps our children or grandchildren will benefit from our efforts. Somebody has to start sometime or nothing positive will get done.

39. 6. 3. Incineration

A third element in an IWM is the **incineration** of trash. Incineration is the controlled burning of trash in a mechanical device. The machine is usually called an incinerator, or sometimes a furnace.

Burning trash in an open pile, in a barrel, or a fire pit is not incineration because the combustion rates and temperatures are not controlled.

One of the best things about incineration is that it can reduce the original volume of trash by nearly 90 percent. Some of the new incinerators are designed to operate at very high temperatures which results in less air pollution. This method of disposal also makes it possible to produce electricity using trash as the fuel source.

Even in the best incinerators, air pollution must be controlled through the use of expensive, high technology equipment. Producing electricity from trash also requires expensive equipment.

In an IWM system, the type and the volume of trash to be incinerated and the type of pollution generated must be carefully considered.

39. 6. 4. Landfilling

The final element in an IWM is controlled landfilling. Ultimately, something must be done with the trash that cannot be burned or recycled. Ash from the incinerator must be disposed of as well. The



Aluminum recycling is one of the most efficient forms of recycling. Individuals, organizations and schools can all make money by recycling aluminum.

only option we have in our islands is to bury it in a landfill since disposing of it in the water is an unacceptable solution.

Land disposal should be done in a **sanitary landfill**. This is different from an open dump where trash is piled in the open. A sanitary landfill is an operation where the waste is compacted by machinery as it is hauled in to the landfill site. This minimizes the bulk volume of space used and extends the life of the landfill. It is then covered with an adequate layer of soil (or other cover material) at the end of each day.

The soil layer keeps insects and rats out of the trash. Consequently, they can not breed and thrive. This prevents a situation where disease hazards from **vermin**, which carry diseases harmful to people, can arise.

Still there are some very serious concerns with landfilling on small tropical islands. To begin with, there is not a lot of land available. The main use for our land should be for homes and farms. In addition, the amount of soil needed daily to cover the trash is often great.

Topsoil on oceanic islands is usually very thin, and must be conserved for planting crops and maintaining habitats for wild animals. When topsoil is disturbed, erosion becomes a problem that can result in the destruction of our land and reef. Crushed limestone can be used, but mining and crushing operations are very expensive.

Furthermore, the high amount of rainfall in the tropics results in water percolating through the landfill, where it picks up pollutants and transports them to our groundwater and lagoon waters. Water percolating through the landfill can be collected and treated, but this process is expensive, and not totally effective.

Because of these concerns about landfills, the use of this part of the IWM system should be minimized as much as possible. Even properly constructed landfills have negative environmental impacts.

In the end, impacts are going to happen. How much we minimize them is up to each of our own daily actions. Every day, each one of us helps decide how many negative impacts on our island's ecosystem will occur from our solid waste use and disposal actions. How many are we willing to accept?

39. 7. WASTE MANAGEMENT IN THE YEARS AHEAD

Our modern island lifestyle creates trash. A lot of it! As our trash piles up around us, with all its related bad effects, we do not have anywhere to go.

Each island's population continues to increase, and each new person is another trash producer. If we do not wish to be surrounded by pollution on our islands, or crowded off our land by our own growing piles of trash, we need to take some steps in managing our solid wastes.



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...it is then covered with an adequate layer of soil at the end of each day.



The most difficult part of managing our solid wastes in the future will be changing our lifestyle so that the amount of trash we produce is more manageable.

As we have discussed in this chapter, garbage has many problems associated with it. These problems, like the trash itself, never go away. Unless we go back to the completely natural subsistence lifestyle of our ancestors, there will always be some pollution from our waste.

One way we can mitigate pollution is by learning how our lifestyles produce trash. Engage your entire class in a project charting daily activities. Record what your family buys, reuses, recycles, and throws away. Keep an hourly log for seven days, recording and charting your data. Compare your data with others in your class and prepare and present a report illustrating the lifestyle trends of the class. Encourage your instructor and your principal to keep and share class records from previous school years.

If we choose to make a serious effort in dealing with all of our trash, then this trash may impact our island's ecology less. The patterns we follow will be modeled by our children, just as we have modeled our behavior after that of our parents.

Solid waste management is most effective in an integrated program. Several different techniques are each used to their best advantage this way. Each component is less costly if the quantity and the hazards of the trash are decreased. This can be accomplished best through reduction and recycling programs.

The most difficult part of managing our solid wastes in the future will be thoughtfully changing our lifestyle so that the amount of trash we produce is more manageable.