

# Saipan's Solid Waste Management System

System success is serving as an example to other South Pacific islands.

By Steve Hiney and Ted Hawley

**A**n integrated solid waste management system implemented on the island of Saipan has proven so successful that other neighboring South Pacific islands may follow suit.

Saipan, population 78,252, is part of the U. S. Commonwealth of the Northern Mariana Islands (CNMI), a 15-island archipelago in the south Pacific Ocean, north of Guam and east of the Philippines. The CNMI is under the jurisdiction of the EPA, Region 9. Saipan was the site of the Battle of Saipan in World War II, and the nearby island of Tinian was the launch site for the atomic bombing of Nagasaki and Hiroshima that ended the war. After the war, the Northern Mariana Islands became part of the U. S. Navy Trust Territories, and in 1978 they became a Commonwealth of the United States.

In the early 1990s, the EPA issued a compliance order to the CNMI to close the Puerto Rico Dump (PRD). The

PRD began as a military dump along the shoreline of the Saipan lagoon. It was unsightly, plagued with landfill fires and flies, near main tourist areas, and visible from the main highway.

By the late 1990s, daily soil cover was being placed over the refuse, which helped control the fires and flies, but there was increasing negative publicity from the media and the PRD was a sensitive topic with the local tourism industry. A new landfill was needed. The goal for a new solid waste system was not only to bring Saipan into compliance with federal environmental regulations, but also to utilize state-of-the-art waste reduction and diversion technologies.

## Plan Implementation

Sources, composition, and quantities of waste going to the PRD were evaluated and used to develop 20-year projections. A study revealed that 33 percent of Saipan's solid waste stream was garment waste (Garment manufacturing is

the island's primary industry.) and other easily divertible products.

Because of Saipan's remoteness and the associated difficulties with operations and maintenance, it was vital to develop technologically simple solid waste diversion, recycling, and disposal systems. This eventually included implementation of diversion and recycling programs, a new solid waste transfer station/materials recovery facility—the Lower Base Refuse Transfer Station—and a new RCRA Subtitle D compliant (Resource Conservation and Recovery Act—Subtitle D is the RCRA section that covers municipal solid waste.) municipal solid waste landfill—the Marpi Solid Waste Facility.

## Refuse Transfer Station

The \$4.3-million Lower Base Refuse Transfer Station includes three structures—truck weigh scales and scale house, office/materials recovery facility building, and solid waste transfer building. The facility has on- and off-site access roads and parking; an area for sorting, grinding, and storing green waste (vegetation); and all utilities (water, sewer, power, communications).

The size and layout of the office/material recovery facility and transfer building were determined based on waste generation analyses. The office/material recovery facility is a 10,000-sq ft steel frame building housing 22 employees and warehouse-type space. The transfer facility is an 8,000 sq ft steel frame and cast-in-place concrete building where residential/commercial vehicles can drop off solid waste for loading into rolloff bins for transport to the landfill. A separate site development plan included development of an offsite constructed wetlands area for stormwa-



Landfill liner system is installed on the 12-acre waste management unit.



*Aerial view of the Marpi Solid Waste Facility on the island of Saipan in the South Pacific.*

ter treatment and offsite intersection improvements on a Federal Highway Administration highway.

## Marpi Solid Waste Facility

The \$9.4-million Marpi Solid Waste Facility (MSWF) includes site-support facilities (truck weigh scales and scale house, office building, maintenance building), small-haulers drop-off area, diesel electrical power generation facility, 12-acre lined waste management unit, five-MG leachate storage pond, water and wastewater systems, stormwater control systems, fuel storage systems, and site access roads and parking.

The landfill is used only for disposal of municipal solid waste or other non-hazardous wastes. It is constructed of multiple refuse lifts, each composed of numerous refuse cells. The lifts are sloped to facilitate drainage and to minimize cover material requirements. Daily waste cell placement areas are kept to the smallest area practical for the waste volumes received.

There are numerous environmental safeguards in place. Four groundwater-monitoring wells are tested quarterly and there are stringent load inspection requirements in place—waste designated as prohibited is not accepted. Some safeguards include:

- A daily six-in. soil cover minimizes infiltration of water into the refuse, controls odors, reduces windblown litter, and provides support for trucks or vehicles. Soil cover material is stockpiled adjacent to the landfill.
- The landfill liner system includes a geosynthetic clay liner, a welded 60-mil high-density polyethylene (HDPE) geomembrane, a geocom-

posite drainage layer, and overlying soil operations layers.

- A leachate collection system was installed to facilitate detection, sampling, and removal of any leachate generated to the landfill. It consists of a rock drainage layer with six-in. diameter HDPE lateral pipes. Drainage from the lateral pipes flows into a six-in. diameter HDPE

main pipe and on to the leachate sumps. The leachate is removed by pumps installed in 18-in. diameter HDPE sump riser pipes. The main pipes extend to the surface of the landfill adjacent to the sump riser pipes to allow future service cleanout. The HDPE sump riser pipes and main pipes extend about three ft above the final cover grade.

## Costs and Benefits

Planning, engineering, and construction of the Saipan solid waste management system was funded 80 percent by the U. S. Department of the Interior, Office of Insular Affairs; and 20 percent by the CNMI.

Between January 2004 and June 2004, the MSWF received and managed 19,564 tons of materials. About 12,542

tons have been sent to the landfill, a diversion rate of about 36 percent. Garment waste has been declining dramatically over the past year due to the lifting of quotas and reduction of international trade barriers. It now comprises a much smaller fraction of the waste stream than what was discovered during the initial waste characterizations—1,348 tons or six percent. Other types of diverted materials (tons) were:

- Greenwaste—1,228.57
- Soil—479.91
- Concrete—408.02
- Cardboard—318.4
- White goods—74.33 (refrigerators, stoves, washers, dryers)
- Used tires—64.54 tons
- Glass—28.23
- Office paper—16.36
- Aluminum—12.15
- Old newsprint—1.13
- Plastic bottles—1.10

Self-haul residential users do not have to pay fees unless they exceed a 500-lb limit. The current tipping fee is \$25 per ton; special handling tipping fees are \$35 per ton.

## Education

Programs established to address solid waste are only one part of the broader goal of Saipan's residents and businesses becoming more environmentally responsible. The CNMI Organization



*Initial excavation of the lined waste management unit at the Marpi Solid Waste Facility.*



*The sun sets on Saipan's solid waste disposal problems.*

of Conservation Outreach (COCO) was recently established, comprised of representatives of the CNMI Department of Environmental Quality, CNMI Coast Resources Management, CNMI Director of Fish & Wildlife, CNMI Public School System, and a number of other agencies to provide a coordinated environmental message. Last November, for example, Saipan participated in "America Recycles Day" by conducting a contest in the schools to see which one could collect the most material (aluminum cans).

Other projects have included:

- Purchasing 30 minutes of time on the local TV channel (KCMI) for continuous play of a video produced on solid waste management. CNMI intends to expand the show's content soon to address other environmental issues such as coral reef, non-indigenous species, and non-point pollution issues.
- Quarterly presentations are made to each of the 19 public and ten private schools on Saipan that focus on solid waste and recycling efforts.
- A curriculum is being developed that will eventually be implemented from grades K-12 that will teach students about the environment.
- "Cash for Trash" is an ongoing program that pays residents to clean up and recycle appropriate materials from sites that have been previously used as informal dumps.
- A series of community education events was held to inform the public about solid waste planning issues. Waste prevention and recycling

assessments were conducted to promote sustainable practices at two of Saipan's largest hotels.

- Handouts are provided to all customers as they arrive at the facilities.

- Ads about the solid waste management system are frequently run in CNMI

papers and magazines, some of which include *Island Locator* and *Beach Magazine*.

## The Future

The CNMI has made great strides in addressing solid waste management issues. In fact, other South Pacific islands have expressed an interest in learning

more. CNMI, for instance, recently hosted a training session funded by the U. S. Department of the Interior, Office of Insular Affairs (DOI/OIA), that included attendees from Palau, Federated States of Micronesia, American Samoa, Guam, and Yap. This training was held on Saipan and the attendees included both operators and regulators. The basic concepts of solid waste management were covered. These included development of a reasonable waste generation estimate, environmental compliance, financing systems, and basic day-to-day operations. The solid waste management system was also recognized by the Solid Waste Association of North America (SWANA), which awarded CNMI a Silver Solid Waste Management System Award. **GE**

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