

## **Guam Seaweed Poisoning: Environmental Studies**

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**Abstract**—The site from which the poisonous seaweed was harvested is subjected to warm water and oil discharges from a power plant and, potentially, to sewage from an offshore outfall nearby.

I am privileged and honored to represent the Guam Environmental Protection Agency (GEPA) in this very vital gathering. Our involvement in the toxic seaweed poisoning investigations was requested by the Guam Department of Public Health and Social Services and the University of Guam Marine Laboratory. I would like to describe some aspects of our activities.

We first investigated the site where the suspect seaweed had been harvested. At the time that the seaweed had been collected it was high tide and to avoid fully submerging in the water the ladies who gathered it (the vendor and her sister-in-law), detached the seaweed from the floor of the ocean with their feet and allowed water currents to carry it up within their reach. After rinsing it in seawater the seaweed was placed in large plastic bags to be carried home.

As part of our investigation we also conducted a sanitary survey at the home of the vendor where the seaweed was prepared for sale. We felt this process was an important area for us to investigate. The preparation process involved rinsing the seaweed again in tap water to remove all extraneous algae, sand, shells and pebbles. Water was then brought to a rapid boil and the seaweed was immersed for 1 to 2 minutes or until it took on a distinctive greenish appearance as opposed to its original purplish color. A final rinse was performed in cold running tap water before the seaweed was refrigerated. If the seaweed is collected several days in advance of when it is to be sold, it is stored in a freezer and defrosted just prior to marketing. When the vendor arrives at the market, the seaweed is apportioned out in quantities of approximately 220 g and packed in small plastic bags which are sold for \$1.00 each.

We had been particularly concerned about the possibility that the seaweed may have been contaminated with pesticides. Although properly stored containers of malathion and diazinon were found at the vendor's home, we could find no evidence that cross-contamination may have occurred there or at the market place.

I would also like to describe for the panel the unique combination of environmental factors associated with the Tanguisson Point location. To the southwestern side of Tanguisson Beach is the Tanguisson power plant facility (Fig. 1),



Figure 1. Tanguissan Beach, Guam, source of toxic seaweed, with power plant and Two Lovers Point in background. Photo R. Haddock.

a steam power plant generating about 26.5 megawatts of power. At the site it is easy to observe that there is a problem with nitrogen and sulfur dioxide emissions.

A facility operated by steam turbines needs to be cooled. The mechanism of cooling in this case is to withdraw water from an ocean intake channel and run it through the plant to cool the turbines. Prior to completing the permitting process by the United States EPA, Guam Power Authority (GPA) was allowed to dose the cooling water with chlorine as a descaling method so that their boilers would not become fouled. That provision has since been withdrawn and they are no longer allowed to chlorinate the influent cooling water. However, on one specific occasion the GPA was cited for indiscriminate use of chemicals that were not approved by their permit. In 1983 they used a very toxic chemical, ethylenedinitrotetraacetic acid or EDTA, as a descaling agent and it resulted in a massive fish kill.

When cooling water is drawn into the power plant it comes in contact with the turbines. After it does its job of cooling the turbines, the warm water is forced down into an outlet pipe and discharged through a channel across the reef.

A third environmental factor is the leaching of oil in the Tanguissan area. When the GPA inherited the plant from the United States Navy in 1986, it was discovered that there was a leaking line that went from a buried oil storage tank to the plant. Even though this line was repaired, enough oil had escaped to form

an oil lens, a layer of oil in precarious equilibrium on top of an underlying layer of salt water. There is an estimated 500 to 800 thousand gallons of what GPA calls high sulfur residual fuel in this lens. Every day that passes, this oil leaches out onto the beach area and into the cooling inlet channel. Although attempts are made to control the oil with floating booms and adsorbent pads, it can be observed that oil is drawn into the plant and discharged along with the thermal effluent through the discharge channel and into the ocean.

If one examines the Northwestern side of the beach there is yet another environmental factor that we should be cognizant of: the Northern District Sewage System outfall. After primary treatment, this plant discharges approximately ten million gallons per day of sewage effluent through diffuser pipes in sixty feet of water approximately one-half mile from the seaweed collection site. On occasion GEPA has detected fecal coliform violations of our recreational water quality standards in the beach area. Now, depending on where the currents go, it stands to reason that some of this contamination may affect the area where the seaweed was collected.

While it is not yet known whether the toxin involved in our poisoning incident was synthesized by the seaweed or absorbed in whole or in part from the environment, I think we would be remiss if we do not consider the environmental problems I have mentioned in our deliberations as to just how this incident may have come about. Thank you.