REGIONAL SEAS

UNITED NATIONS ENVIRONMENT PROGRAMME

Hazardous waste storage and disposal in the South Pacific

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PREFACE

Twelve years ago the United Nations Conference on the Human Environment (Stockholm, 5-16 June 1972) adopted the Action Plan for the Human Environment, including the General Principles for Assessment and Control of Marine Pollution. In the light of the results of the Stockholm Conference, the United Nations General Assembly decided to establish the United Nations Environment Programme (UNEP) to "serve as a focal point for environmental action and co-ordination within the United Nations system" (General Assembly resolution 2997(XXVII) of 15 December 1972). The organizations of the United Nations system were invited "to adopt the measures that may be required to undertake concerted and co-ordinated programmes with regard to international environmental problems", and the "intergovernmental and non-governmental organizations that have an interest in the field of the environment" were also invited "to lend their full support and collaboration to the United Nations with a view to achieving the largest possible degree of co-operation and co-ordination". Subsequently, the Governing Council of UNEP chose "Oceans" as one of the priority areas in which it would focus efforts to fulfil its catalytic and co-ordinating role.

The Regional Seas Programme was initiated by UNEP in 1974. Since then the Governing Council of UNEP has repeatedly endorsed a regional approach to the control of marine pollution and the management of marine and coastal resources and has requested the development of regional action plans.

The Regional Seas Programme at present includes eleven regions [1/] and has over 120 coastal States participating in it. It is conceived as an action-oriented programme having concern not only for the consequences but also for the causes of environmental degradation and encompassing a comprehensive approach to combating environmental problems through the management of marine and coastal areas. Each regional action plan is formulated according to the needs of the region as perceived by the Governments concerned. It is designed to link assessment of the quality of the marine environment and the causes of its deterioration with activities for the management and development of the marine and coastal environment. The action plans promote the parallel development of regional legal agreements and of action-oriented programme activities[2/].

The idea for a regional South Pacific environment management programme came from the South Pacific Commission (SPC) in 1974. Consultations between SPC and UNEP led, in 1975, to the suggestion of organizing a South Pacific Conference on the Human Environment. The South Pacific Bureau for Economic Co-operation (SPEC) and the Economic and Social Commission for Asia and the Pacific (ESCAP) soon joined SPC's initiative and UNEP supported the development of what became known as the South Pacific Regional Environment Programme (SPREP) as part of its Regional Seas Programme.

1/ Mediterranean, Kuwait Action Plan Region, West and Central Africa, Wider Caribbean, East Asian Seas, South-East Pacific, South Pacific, Red Sea and Gulf of Aden, East Africa, South-West Atlantic and South Asian Seas.

2/ UNEP: Achievements and planned development of UNEP's Regional Seas Programme and comparable programmes sponsored by other bodies. UNEP Regional Seas Reports and Studies No. 1. UNEP, 1982.

A Co-ordinating Group, consisting of representatives from SPC, SPEC, ESCAP and UNEP, was established in 1980 to co-ordinate the preparations for the Conference. As part of these preparations, 18 "country reports" and 13 "topic reviews" were prepared identifying the environmental problems of individual countries and the region 3/.

These reports and reviews were examined by a technical meeting (Noumea, June 1981) attended by experts from the South Pacific region.

The meeting also drafted the basic working documents which were submitted to the Conference on the Human Environment in the South Pacific (Rarotonga, 8 - 11 March 1982).

The Conference adopted: the South Pacific Declaration on Natural Resources and the Environment; the Action Plan for Managing the Natural Resources and Environment of the South Pacific Region; and agreed on the administrative and financial arrangements needed to support the implementation of the Action Plan and on the workplan for the next phase of SPREP 4/.

At the request of the States and Territories of the South Pacific Region, negotiations were initiated to develop, in the framework of the Action Plan, a Convention for the Protection and Development of the Natural Resources and Environment of the South Pacific Region with specific protocols related to (i) prevention of pollution by dumping and (ii) co-operation in combating oil pollution emergencies. In order to facilitate the negotiation of these legal instruments, the present document, reviewing the problems of hazardous waste storage and disposal in the South Pacific, was drawn up 5/.

As a contribution to the development of SPREP, a review of hazardous waste storage and disposal in the South Pacific Region was commissioned from Messrs. R. Golob and J. Egan of World Information Systems, Cambridge, Mass., U.S.A. The present document contains the review prepared by them.

3/ The Country Reports and Topic Reviews have been published by SPC, 1981. For an overview based on these documents see:

- A. L. DAHL and I. L. BAUMGART: The state of the environment in the South Pacific. UNEP Regional Seas Reports and Studies No. 31. UNEP, 1983.

4/ SPC/SPEC/ESCAP/UNEP: Action Plan for managing the natural resources and environment in the South Pacific Region. UNEP Regional Seas Reports and Studies No. 29. UNEP, 1983.

5/ The appendices referred to in this document have been published under separate cover (UNEP Regional Seas Reports and Studies No. 48/Appendices. UNEP, 1984).

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1/ Published under separate cover (UNEP Regional Seas Reports and Studies No. 48/Appendices. UNEP, 1984).

1. INTRODUCTION

In March 1982, the Conference on the Human Environment in the South Pacific took place in Rarotonga, Cook Islands, under the sponsorship of the South Pacific Regional Environment Programme (SPREP). The conference participants prepared an Action Plan for managing the environment and the natural resources of the South Pacific region. As part of the Phase 2 Workplan based on the Action Plan, the SPREP Co-ordinating Committee requested World Information Systems to prepare an overview paper on the storage and disposal of hazardous wastes, excluding radioactive wastes, in the South Pacific region.

Specifically, in its report, World Information Systems attempted to provide data and information on the following topics:

- types of substances stored or disposed of in the past and at present, or planned for storage and disposal in the South Pacific region;

- amounts of substances stored or disposed of in the South Pacific region, including their sources and countries of origin;

- environmental effects, observed or potential, resulting from the substances stored or disposed of in the South Pacific region, including effects on human populations; and

- evaluation of the hazardous waste problem in the context of other environmental problems facing the South Pacific region.

In December 1982, World Information Systems completed its initial report based on materials received prior to 1 December 1982. Then, in September 1983, the report was revised with the incorporation of information received subsequent to 1 December 1982.

2. DEFINITIONS

In this report, a waste is defined as hazardous if it may cause or contribute to death or serious illness, or if it may pose a substantial hazard to human health or the environment when it is improperly managed. Specifically, a waste is defined as hazardous if it has any of the following characteristics:

Corrosivity: Wastes that can dissolve containers, potentially resulting in environmental contamination. A waste may be defined as corrosive if it is aqueous and is highly acidic, having a pH value equal to or less than 2, or is highly alkaline, having a pH value equal to or greater than 12.5, or if it is a liquid and corrodes steel at a rate greater than 6.35 millimeters per year at a test temperature of 55°C.

Ignitability: Wastes that pose a fire hazard during routine handling. A waste may be defined as ignitable if it is a liquid, other than an aqueous solution containing less than 24 per cent alcohol by volume, and has a flash point of less than 60°C, or if it is not a liquid and is capable, under standard temperature and pressure, of causing fire through friction, absorption or moisture, or spontaneous chemical changes and, when ignited, burns so vigorously and persistently that it creates a hazard.

Reactivity: Wastes that may react violently during routine handling. A waste may be defined as reactive if it is inherently unstable and readily undergoes violent change without detonating, if it reacts violently or becomes explosive when exposed to air, water, shock, or heat, or if it generates toxic fumes.

Toxicity: Wastes that may threaten the life or damage the health of humans, animals, or plants. A waste may be toxic to humans and animals via consumption, inhalation, or skin contact, and to plants via uptake from the soil. The toxic effects may be acute, having a rapid onset and a short course, with severe symptoms, or they may be chronic, showing little change over a long period. A substance may be defined as toxic to humans if it is poisonous, causes cancer, chromosome damage or birth defects, transmits disease organisms, or causes psychological harm, such as psychosis or neurosis.

Examples of toxic substances include: asbestos, which is used in fire prevention and building; heavy metals, which are used in metal plating, timber preservation, and paint and agricultural chemical manufacture; polychlorinated biphenyls (PCBs), which are used in electrical transformers and capacitors; and cyanide, chlorinated hydrocarbons, organophospherous compounds, and sodium fluoracetate, all of which are used in pest control.

3. PROJECT METHODOLOGY

To conduct its study, World Information Systems used techniques to gather the greatest amount of useful information in the shortest amount of time. First, World Information Systems developed a detailed survey requesting information on hazardous waste management in specific areas (Appendices 1 and 2). This survey was sent via airmail to each of the island participants at the March 1983 Conference on the Human Environment in the South Pacific.

Since World Information Systems expected that some regions would not have detailed information on their hazardous waste streams, it included a general question on the types of industries in each region. By combining the information collected from these surveys with the statistical data obtained from the United Nations, World Information Systems was able to determine, from knowledge of typical hazardous waste streams produced by specific industries and services, some general characteristics of the hazardous waste problem in individual areas, even if direct information on the subject was unavailable.

All other participants in the March 1982 Conference were mailed letters requesting more general information on hazardous waste storage and disposal in the overall South Pacific region. In addition, letters were sent to several agencies and organizations not represented at the Conference, but which were thought to have useful information. These included the World Council of Churches, Government agencies in France, the United Kingdom, and the United States, the U.S. Peace Corps, and hazardous waste cleanup contractors.

The survey was supplemented by numerous telephone calls and telexes to relevant government agencies, research institutes, and private companies, and by an extensive literature search at the libraries of Harvard University and the Massachusetts Institute of Technology to gather relevant bibliographic materials.

World Information Systems conducted this project under strict time constraints. As a result, the delays due to overseas mailing hindered the timely collection of all

the information requested. World Information Systems initially wrote this report with information obtained prior to 1 December 1982 only and then updated it in early September 1983 with surveys and information received after 1 December.

4. INDEPENDENT ISLANDS

With the exception of Australia and New Zealand, the information available on hazardous waste storage and disposal in and around the independent South Pacific islands is sparse or nonexistent. These countries have not conducted hazardous waste surveys similar to the comprehensive surveys conducted in the U.S. Territories of the South Pacific. The extent of the hazardous waste problem, therefore, can only be inferred in these areas by identifying the types of industrial and service activities in each locale and then making estimates based on typical hazardous waste streams from those industries or services. Given that actual data on hazardous wastes is unavailable and that waste-generating activities are taking place in the area, the situation in these islands must be characterized as potentially serious.

Each government in the independent islands has its own rules and regulations designed to preserve the local environment. These rules and regulations are detailed in the "Country Reports" prepared in 1981 for SPREP and are available through the South Pacific Commission. Almost without exception, these regulations are inadequate to cope with the potential health and environmental problems resulting from the improper management of hazardous wastes and to ensure the future safe management and disposal of these wastes. The regulations vary greatly among individual governments, and most of them focus on environmental problems other than those typically associated with hazardous waste storage and disposal.

Whereas the U.S. Environmental Protection Agency (EPA) has the resources to monitor the hazardous waste situation in the U.S. Territories, no such resources are presently available in the independent island communities throughout the South Pacific region, with the exceptions of Australia and New Zealand. According to the U.K. Department of the Environment in London, no U.K. agency has centralized data on hazardous waste storage and disposal in former British Territories, even though a large fraction of the wastes stored in the former British Territories are likely to have originated from British activity in these regions.

Similarly, according to the French Ministry of the Environment, no French agency has centralized data on the hazardous wastes stored or disposed of in the region while these Territories were under French jurisdiction. It is unlikely, therefore, that a truly accurate assessment of the hazardous waste problem in the region could be made without conducting field surveys in this region.

4.1 International Maritime Organization Activities

The International Maritime Organization was designated by the contracting parties to the 1975 Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter to carry out the Secretariat duties in relation to that Convention. The Convention requests contracting parties to notify the Secretariat of all permits issued by their Governments for the dumping of wastes and other matters at sea.

According to M. K. Nauke, head of the Marine Science Section of the Marine Environment Division of the International Maritime Organization, as of 1 December 1982, only three States in the South Pacific region were contracting parties to the

Convention. These States, with their ratification dates, were Kiribati on 12 May 1982, New Zealand on 30 August 1975, and Papua New Guinea on 9 April 1980. In addition, the Convention was made effective on 30 August 1975 for the island States and Territories in the South Pacific region under the jurisdiction of the United States, on 17 December 1975 for those areas under the jurisdiction of the United Kingdom, and on 5 March 1977 for those areas under the jurisdiction of France.

According to Nauke, most of the contracting parties have submitted to the Secretariat information on permits issued for dumping. In some cases, the parties indicated that they had not granted any permits for dumping at sea. It is important to note that the information submitted to the Secretariat refers only to the dumping of dredged material and sewage sludge. So far, according to Nauke, there has been no information submitted on the dumping of hazardous wastes in the Pacific area. It should be noted, however, that the Secretariat has received no information from Japan.

In addition, since Australia is not a contracting party, it is not required to submit information. Australia, however, has been dumping industrial wastes in the South Pacific region, as described in a report prepared in 1978 by EG&G Environmental Consultants of Waltham, Massachusetts, U.S., and entitled "Criteria for the Management of Dumping Wastes at Sea." Other activities of the International Maritime Organization are detailed in "Topic Review" 12 and in "Information Papers" 2, 3, 5 and 7, which were prepared in 1981 and 1982 for SPREP and are available through the South Pacific Commission.

4.2 U.S. Peace Corps Activities

World Information Systems spoke with the South Pacific Desk of the U.S. Peace Corps in Washington, D.C., in an effort to obtain information on hazardous waste management in those areas with Peace Corps representatives. According to spokesman Steve Prieto, there are no official hazardous waste sites in the Cook Islands, Fiji, Micronesia, Solomon Islands, Tonga, Tuvalu, or Western Samoa - all areas in which the Peace Corps currently has activities.

Prieto said that France is known to dispose of and store hazardous wastes in the region. He said that he had reviewed a report detailing the French activities, but that he could not release it. According to Prieto, the issue of hazardous wastes, particularly radioactive wastes, is a volatile issue in the area, and the Reagan Administration has strongly emphasized the original Peace Corps mandate to refrain from political activities. Prieto, therefore, said that he would not release Peace Corps information on hazardous substances in the region. He did say, however, that the Peace Corps has attempted to help educate local populations about the health and environmental hazards associated with hazardous materials, particularly insecticides, as well as about the proper techniques for their handling, use and disposal.

4.3 Other Agencies

In addition to the above agencies, World Information Systems contacted the following directly:

- Atoll Research Unit in Bikenibeu, Kiribati;
- Department of Earth and Planetary Sciences at the Massachusetts Institute of Technology in Cambridge, Massachusetts;

- Economic and Social Commission for Asia and the Pacific in Bangkok, Thailand;

- Institute of Marine Biology at the University of Hawaii in Honolulu, Hawaii;

- International Organization of Consumers Unions in Penang, Malaysia;

- Organization for Economic Co-operation and Development in Paris, France;

- United Nations Educational, Scientific and Cultural Organization in Paris, France;

- United Nations Environment Programme in Geneva, Switzerland;

- World Council of Churches in Geneva, Switzerland;

- World Environment Center in New York, New York.

None of these groups had any significant information on the storage and disposal of hazardous wastes, other than radioactive wastes, in the South Pacific region. All of the groups said that the information is sparse when it exists at all.

4.4 Specific Countries

4.4.1 Australia

As a major industrialized nation, Australia is the largest generator of hazardous wastes in the South Pacific region, and recently the Australian Government has begun to focus its attention on the country's hazardous waste problem. In March 1982, the Australian House of Representatives' Standing Committee on Environment and Conservation issued a document entitled "Hazardous Chemical Wastes: Storage, Transport, and Disposal" as the first report of its Hazardous Chemicals Inquiry. The Committee undertook the inquiry to investigate the management of chemicals potentially hazardous to health and the environment and, rather than wait until the inquiry was completed, decided to present an early report on the hazardous waste problem, given its serious nature.

According to the report, the larger size of industry in the United States, as compared to that in Australia, as well as the distance from Australia of the major hazardous waste disasters worldwide, such as the Love Canal landfill in Niagara Falls, New York, has helped to foster the attitude that such events could not happen in Australia. The report said that the absence of major disasters in Australia, similar in magnitude to those overseas, has been largely the result of "good luck rather than good management."

As representative of the hazardous waste problem confronting Australia, the report cited the following incidents:

- Waste drums, which had been illegally disposed of in municipal garbage dumps, exploded, killing or injuring garbage workers and damaging machinery.

- Several hundred badly corroded drums of combustible waste were used for traffic barriers at a drive-in theatre in outer Melbourne.

- The site of an abandoned gasworks in Fremantle was proposed for a housing development. Like many gasworks sites, it was found to be contaminated with phenols and other toxic substances.

- PCB-contaminated oil which had been disposed of at a junk yard in Melbourne polluted a nearby recreational lake. The lake now contains high residue levels of PCBs, particularly in the sediments.

- In 1978, asbestos tailings were still being found throughout the town of Wittenoom, Western Australia - on streets, footpaths, and around the school and kindergarten - twelve years after the asbestos mine outside the town closed down. In 1978, the Public Health Department recommended to the Western Australian Government that the town be evacuated because of the health risks associated with the asbestos tailings.

In its inquiry report, the Committee said that it was "appalled at the lack of accurate information in Australia on the amounts of hazardous wastes being generated, stored, and disposed of, and consequently on the lack of predicted generation rates." According to the report, there is an "abysmal lack of information regarding quantities of waste generated" outside of Sydney and Victoria, and the data available for hazardous waste generation in those two areas is at best "incomplete." Since the Committee regards the identification and quantification of an area's hazardous wastes as essential in the development of a hazardous waste management programme, it said that the States and Territories will need to fill those "enormous information gaps" before they can establish effective programmes.

The Committee further stated that, because of a lack of information on current hazardous waste generation, the prediction of the types and quantities of waste likely to be generated in the future is extremely difficult. According to the report, increased generation will likely result from: increased industrial activity; greater chemical usage by existing industry; more stringent environment legislation and more rigorous enforcement. Reduction in the amount of waste requiring disposal will likely follow from: increased disposal costs; increase raw material costs; improved manufacturing processes; and increased recovery and recycling of materials.

The Australian Environment Council (AEC), which consists of state, territory and commonwealth ministers with prime responsibility for the environment, has been developing a management programme for environmentally hazardous chemicals. In 1977, the AEC established a National Advisory Committee on Chemicals (NACC) and identified the disposal of environmentally hazardous chemicals as a high-priority area for the NACC.

The NACC has begun work on hazardous waste disposal in two areas: the development of a policy-oriented national strategy, and a joint AEC/industry study. The main elements of the policy-oriented strategy cover waste identification, reporting, transportation, treatment, and disposal. The joint AEC/industry study on the management and disposal of hazardous wastes is expected to lead to recommendations on an appropriate national hazardous waste strategy that will complement state and regional strategies. The study is discussed below as the Maunsell report.

In conclusion, the Committee stated that "... there has been little improvement in the control of hazardous wastes by the Commonwealth and most state, territory, and local governments. The problem requires urgent action by governments to identify and quantify wastes and ensure they are safely stored, treated and disposed of." Specifically, the Committee urged the adoption of the recommendations listed in Appendix 3.

In 1983, the Australian Environment Council and the Confederation of Australian Industry released a report prepared by Maunsell and Partners in Canberra City, A.C.T., in May 1981 and entitled "Management and Disposal of Hazardous Industrial

Wastes in Australia." The findings of this report agreed with those of the Standing Committee's Inquiry. According to the Maunsell report, the quantification of hazardous wastes generally has received "little attention in Australia." The report found that, with the possible exception of Sydney and Melbourne, the currently available information does not provide a reliable description or quantification of hazardous wastes generated in Australia.

Based on visits and discussions with state co-ordinators and other officials, Maunsell assembled the data in Appendices 4, 5 and 6 as an indication of the types and amounts of hazardous wastes generated in Sydney and Victoria and throughout Australia. According to the Maunsell report, waste generators, transporters, and disposers will need to correct the current lack of record-keeping if Australia is to manage its hazardous wastes properly.

Although the Maunsell report acknowledged that the data was not readily available for an accurate assessement of the quantity of wastes generated, the report included an analysis of the main industry groupings in Australia to provide an indication of the types and locations of the hazardous wastes generated. The main industries identified include: basic metal; chemicals and petroleum; equipment; fabricated metals; leather and leather products; mining; paper and printing; rubber and plastic products; and textiles.

Based on an analysis of these industries, the Maunsell report said that Australia's industry is concentrated in Sydney and Melbourne and that these two cities each produce between five and ten times more hazardous wastes than each of the remaining state capitals. As a result, both Sydney and Melbourne will need relatively extensive facilities for treating the wastes from the large number of small establishments in each state. The manufacturers of equipment, fabricated chemicals, metals, paints, and printed products number about 5,000 in Sydney and 4,000 in Melbourne. The total quantity of wastes generated in any of the other States is usually an order of magnitude smaller than that in Sydney or Melbourne, but the wastes in those other States still have the same degree of diversity as those in Sydney and Melbourne.

The Maunsell report did, however, make an effort to estimate the total amount of hazardous waste generated in Australia, using rates per person per year derived for other countries. The report cautioned, however, that such rates can only serve as an indicator since countries often use different definitions of hazardous wastes, have different industrial bases and use different industrial processes, and use different survey methods. A study for Environmental Canada found hazardous waste generation rates in Canada ranging from 12 to 20 kilograms per person per year, excluding acids, alkalis, recoverable and diluted oils, and diluted aqueous wastes.

A similar survey for the United States revealed rates of 16 to 28 kilograms, while for England and Wales, the rate was estimated to be 14 kilograms per person per year. When these rates were applied to the Australian population, the total amount of hazardous waste generated was found to be between 200,000 and 400,000 metric tonnes per year, although this amount is probably an upper limit since Australia imports a substantial quantity of the chemicals used.

To deal with the hazardous waste problem in Australia, the Maunsell report made a series of recommendations, which closely resemble those made a year later by the House Standing Committee on Environment and Conservation. The Maunsell report urged the immediate establishment by AEC of an advisory committee to co-ordinate the implementation of a national hazardous waste strategy and to ensure a consistent approach throughout Australia. The proposed committee would have the task of advising Governments on:

- the location, funding and operation of a single, high-temperature incinerator for Australia. The incinerator would be convenient to Sydney and Melbourne and would be capable of disposing liquid and solid chlorinated wastes from throughout Australia;

- the development of uniform criteria for the location, design, and use of treatment plants and controlled landfills throughout Australia, and the development of a strategy for reducing current stockpiles of PCBs, pesticides, and chlorinated hydrocarbons either by incineration at sea or by treatment in suitable facilities in another country;

- the establishment of a consistent national approach to hazardous waste management, and the identification and estabishment of a prime hazardous waste management authority within each state of territory;

- the development, in collaboration with other Government agencies, of regulations for the transport of hazardous wastes;

- the encouragement and development of waste minimization, recovery, and exchange practices; and

- the stimulation of research into waste disposal techniques, especially chemical fixation and encapsulation, and the development of uniform nationwide performance criteria and testing methods for these techniques.

With regard to ocean dumping, World Information Systems received from the Australian Department of Home Affairs and Environment a listing of ocean dumping incidents off the eastern coast of Australia from June 1978 to February 1982 (Appendix 7). Most of the materials dumped were hazardous and, if not properly packaged and sealed, could someday contaminate the environment.

4.4.2 New Zealand

In response to the World Information Systems survey, the New Zealand Commission for the Environment provided detailed information on the current state of hazardous waste management in New Zealand (Appendix 6). Like Australia, New Zealand has begun to investigate the types and amounts of hazardous wastes generated in various regions because there is little available information on hazardous waste generation nationwide. The Commission for the Environment said that, at present, the country also has incomplete information on the amounts and types of hazardous wastes disposed of and stored there.

As indicated in the response to the industry question, however, a large number of industries that generate hazardous wastes are located in New Zealand. It can be expected, therefore, that the types of hazardous wastes generated in New Zealand are similar to those generated in Australia, although the quantities are smaller.

In New Zealand, as described in Appendix 6, several different laws contain provisions for regulating hazardous waste disposal; the Local Government Act of 1974 makes local Governments responsible for providing disposal services to industry for their hazardous wastes. The national laws related to hazardous wastes are administered by several different authorities, including the Department of Internal Affairs, the Department of Health, the Ministry of Agriculture and Fisheries, the Ministry of Health, and the Ministry of Works and Development.

As a result, New Zealand has a patchwork of laws, rather than a single national strategy, similar to that suggested for Australia. Without such a strategy, it is

difficult for the different Government bureaucracies to work together and monitor hazardous waste disposal and storage practices in the country.

With regards to hazardous waste incidents, the Commission for the Environment said that, although there have been incidents involving hazardous substances, few of these have involved waste sites. The Commission did note that, in one incident, toxic metals leached from the tailings at a closed mine in Te Aroha and contaminated a nearby stream used for the local water supply. The Commission said, however, that none of the waste-site incidents were major and that any accidental spills had been localized events. The Commission has been especially concerned about the contamination of the environment with PCBs from electrical capacitors and has begun to test incineration as a PCB disposal technique.

4.4.3 Cook Islands

World Information Systems received two responses from the Cook Islands (Appendices 9 and 10), and both responses indicated that, at present, the Cook Islands has no major industrial facilities and also has no industry that generates hazardous wastes. In addition, the Cook Islands does not have any hazardous wastes regulations or any storage and disposal facilities.

The Secretary of Health for the Cook Islands said that there have been no environmental impacts or health effects from any hazardous wastes stored or disposed of in the region. Since the responses indicate the presence of activities such as agriculture, fruit canning, health care, printing and publishing, and transportation, hazardous waste generation is, however, likely in the area of such activities and may demonstrate the need to inform local officials about the types of activities that generate hazardous wastes.

4.4.4 Fiji

World Information Systems received three responses from Fiji Government agencies (Appendices 11, 12 and 13) and one response from a private company (Appendix 14). According to Fiji Directorate of the Town and Country Planning, the Government has "a dearth of information on hazardous waste disposal and storage" in Fiji. The Directorate suspects that many chemicals entering Fiji under the general category of pesticides and herbicides are banned in overseas countries.

Although at present the industries in Fiji are "relatively clean", the Directorate expects that future development will likely increase the number of hazardous waste generators in the area. Already, according to the responses to the World Information Systems surveys, the following types of industries are based in Fiji: agricultural chemicals; agricultural services; drugs; fabricated metal products; fish processing; furniture and fixtures; gasoline service stations; gold mining; health services; lumber and wood products; non-electrical machinery; paints; plastics and synthetics; printing and publishing; and sugar processing. Most of these industries involve the generation of hazardous wastes; the Directorate indentified one local company - Emperor Gold Mining Co. - as a generator of sludge possibly containing cyanide residues.

Regarding disposal practices, the Permanent Secretary for Agriculture and Fisheries said that veterinary drugs are disposed of by burying or burning, and that empty agrochemical containers are generally disposed of by burying. Improper methods for disposing of these materials could result in contamination of the air, water, and land. With regards to a related problem, the Directorate expressed concern over the improper use of fertilizers and the resulting adverse impact on the environment.

According to the Directorate, Fiji has legislation that contains provisions for regulating hazardous wastes and that gives regulatory authority for hazardous waste to the Pharmacy and Poisons Board of the Ministry of Health. The Fiji Sugar Corp. said, however, that it was not aware of any legislation specifically regulating hazardous wastes.

4.4.5 Kiribati

In its response to the World Information Systems survey, the Kiribati Ministry of Health and Family Planning said that the country has the following types of industries: agricultural services; chemical warehouses; electric and electronic equipment; furniture and fixtures; gasoline service stations; health services; and printing and publishing (Appendix 15).

The Ministry of Health said that 20 cars per year are disposed of in the country but that no significant amounts of hazardous waste had been disposed of or stored in the country in the past. According to the Ministry, the Government already has legislation regulating hazardous wastes.

4.4.6 Vanuatu

According to the Vanuatu Ministry of Lands and Natural Resources (Appendix 16), Vanuatu does not have any legislation regulating hazardous wastes and also does not have information regarding the types and amounts of hazardous wastes that are currently disposed of or stored in the region or that have been disposed of or stored in the region in the past. The Health Inspector is the Government official responsible for overseeing current hazardous waste management activities.

The Ministry said that there had been no major hazardous waste incidents and also that there had been no environmental impacts or health effects from improper hazardous waste storage or disposal. Among the types of industries operating in Vanuatu are fabricated metals products, furniture and fixtures, gasoline service stations, health services, and lumber and wood products.

4.4.7 French Polynesia

No formal response received.

4.4.8 New Caledonia

No formal response received.

4.4.9 Niue

No formal response received.

4.4.10 Papua New Guinea

No formal response received.

4.4.11 Solomon Islands

No formal response received.

4.4.12 Tokelau

No formal response received.

4.4.13 Tonga

No formal response received.

4.4.14 Tuvalu

T. Taafaki of the Tuvalu Ministry of Commerce and Natural Resources told World Information Systems that Tuvalu has not conducted any surveys of hazardous wastes, and that the Government does not have the means to conduct such surveys.

4.4.15 Western Samoa

No formal response received.

4.5 General Conclusions (excluding Australia and New Zealand)

In the absence of detailed information on the types and quantities of hazardous wastes in countries of the South Pacific region, World Information Systems can only make general statements based on its limited knowledge of the local service, industrial, and agricultural activities in the islands. The following activities, found in some or all of the countries surveyed, are known to generate hazardous wastes, and an analysis of the typical waste streams of these activities may provide an understanding of the potential hazardous waste problems in these countries.

Agriculture: The control of crop pests and diseases in agriculture has increasingly involved the use of pesticides, including fungicides, herbicides, and rodenticides. The improper storage, use, and disposal of pesticides can have harmful effects on the environment and on human and animal populations. Particularly problematic to the island communities is the potential damage to reef organisms from pesticides and other hazardous substances. Any such damage would threaten the use of the affected areas for fishing, recreation, and tourism, and would also reduce their effectiveness as natural protective barriers against coastal erosion.

As in the Territories of the South Pacific under U.S. jurisdiction, pesticides are likely to be the dominant hazardous waste problem on most of the independent islands. Pesticides have probably been used on all of the islands for many years. Most pesticides are classified as toxic substances requiring stringent waste management procedures for storage and disposal. It is likely that none of the island States, except New Zealand and Australia, have implemented such stringent procedures.

Pesticides likely to be present in the island States include DDT, dieldrin, endrin, kelthane, malathion, parathion, sodium arsenate, and warfarin. A 1978 survey of Guam, for example, identified at least 42 different pesticides in use there. Typically, pesticides are not only toxic, but also ignitable and corrosive. Furthermore, spent pesticide containers, whether glass, metal, paper, or plastic, are also regarded as hazardous wastes and require appropriate treatment and disposal. Pesticides and pesticide containers are likely to be found in farm buildings, Government agricultural facilities, and industrial warehouses, as well as in abandoned waste sites.

UNESCO has investigated the effects of pesticides on local environments in the South Pacific and, from 14 to 17 July 1980, conducted a seminar at the University of Papua New Guinea on "Marine and Coastal Processes in the Pacific: Ecological Aspects of Coastal Zone Management." For the seminar, Marjorie Falanruw of the U.S. Forest

Service prepared an overview report on the impacts of pesticide spills in the Trust Territory of the Pacific Islands (Appendix 17).

In addition to pesticides, fertilizers are also used in agriculture. Fertilizers often contain acids which, in large enough concentrations, are hazardous. Tractors and other agricultural vehicles, moreover, produce waste lubricating oil, which requires proper disposal to avoid environmental contamination.

Forestry: Forestry is an activity in most of the independent South Pacific States, and herbicides, usually arsenous compounds, are often used in forestry for weed control. The timber is normally treated with copper and/or boron compounds, which are both hazardous substances. In addition, the lumber is often preserved with arsenic and chromium compounds, which are hazardous. Wood pulp processing and bleaching also often involve the use of such hazardous substances as azides, chlorates, perchlorates, and peroxides.

Health, Dental, and Veterinary Care: Hospitals and health care facilities for humans and animals generally produce significant amounts of a wide variety of hazardous wastes. Dentists, for example, often discard wastes containing mercury compounds, while hospitals produce pathological wastes and spent medicinal wastes. Health care and medical laboratory facilities produce the following: toxic wastes, such as histochemical stains, potassium cyanide, sodium arsenate, and sodium thiocyanate; corrosive wastes, such as acetic acid, ammonium hydroxide, hydrochloric acid, phosphoric acid, and zinc chloride; ignitable wastes, such as benzene, ether, formaldehyde, isobutyl alcohol, and xylene; oxidizers, such as perchloric acid, potassium permanganate, potassium persulfate, and silver nitrate; etiologic agents such as gross tissue specimens, pathological wastes, and solid waste; and other hazardous wastes such as aluminum sulfate, carbon tetrachloride, chloroform, lithium carbonate, and sodium fluoride.

Transportation: Air, water, and land transportation vehicles and transportation facilities generally produce petroleum wastes and waste lubricating oils, which are hazardous if improperly managed. Bottom sediments from oil storage tanks contain lead and other heavy metals, while the batteries in vehicles contain sulfuric acid and sometimes nickel, which are hazardous substances. Such wastes from transportation activities are likely to be generated in the greatest quantities in those locations, such as airports, shipping ports, and service stations, where transportation facilities and vehicles are the most concentrated.

Public works: Public works activities often involve the production of hazardous wastes, depending on the overall level of Government activities in a given location. Water treatment often requires the use of chlorine, and sewage treatment results in the generation of sewage sludge, which may often contain hazardous wastes. Road construction frequently involves the use of asphaltic oils, which are considered hazardous.

Electricity and Heating: The production of electricity on the islands generally involves the use of generators fueled by oil products. These generators produce similar wastes as those produced in the transportation sector. Electrical transformers often contain PCBs, a hazardous substance which can cause severe environmental and health hazards following its leakage from containers and transformers. Maintenance of electrical equipment involves the use of acids and mercury and nickel compounds, all of which are hazardous. In addition, heating and cooking often involve the use of liquefied petroleum gas and other petroleum products.

Construction: Private and public buildings and industrial construction projects

usually involve the use of asbestos, solvents, and paints, which often contain copper and lead compounds and heterocyclic organic compounds. Discarded paints and paint containers also present a disposal problem. Heavy equipment and vehicles used in construction also generate waste lubricating oils which require careful disposal. Moreover, dynamite and other explosives that are often used in construction require stringent control.

Light and Heavy Industry: Although most of the South Pacific islands are not highly industrialized, some of the industries which are based in the islands are known to generate hazardous wastes. Canneries produce waste lubricating oils, while leather tanneries produce acid sludges and cadmium, a heavy metal. Mining activities sometimes involve the use of acids and often produce hazardous heavy metal by-products. Cleaning activities involve the use of the following: detergents, which often contain acids, phosphorus, and/or boron; disinfectants, which often contain inorganic sulfur compounds; and dry cleaning solvents, which often contain organic halogen compounds.

Dyeing and pigmentation of textiles and clothing and other materials can generate copper and zinc compounds, as well as hydrocarbons and oxygen, nitrogen, and sulfur compounds. Processing of camera film and medical X-rays involves hazardous photochemicals and silver compounds which, after use, require proper disposal. Printing involves inks, dyes, and petroleum derivatives, which are also considered hazardous.

In conclusion, an accurate assessment of the magnitude of the hazardous waste problem in the South Pacific independent islands cannot be made without conducting comprehensive field surveys and analyzing local storage and disposal records. The above discussion indicates that a significant volume of hazardous wastes are probably now stored and annually generated in each of the independent islands. This situation is aggravated by the limited geographical size of the small island environments and by the lack of hazardous waste storage sites in these States. It is unlikely, moreover, that many of the local residents of these islands are aware of the types and quantities of hazardous wastes being generated daily on their islands, nor are many of the local Governments adequately equipped to manage the wastes, even if they became aware of the hazards.

5. U.S. INSULAR TERRITORIES: GUAM, AMERICAN SAMOA, NORTHERN MARIANAS, AND TRUST TERRITORY OF THE PACIFIC ISLANDS

5.1 RCRA and CERCLA: Overview

Each U.S. insular territory in the South Pacific is developing a hazardous waste management plan as required by the U.S. Resource Conservation and Recovery Act (RCRA), which became law on 21 October 1976. RCRA established a management system to track hazardous wastes from "cradle to grave" - from their generation point to their ultimate disposal at regulated facilities. The first RCRA regulations went into effect in January 1981, at about the same time as the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) was signed into law.

CERCLA established a $1.6 billion Superfund for the cleanup of hazardous substance spills and hazardous waste site contaminations. In addition, CERCLA empowered the U.S. federal Government to try to recoup its expenses for a waste-site cleanup from

the former operator of the site, from the company that produced the wastes dumped at the site, and even from the transporter who carried the wastes to the site. Moreover, according to CERCLA, if the Government is successful in identifying the "responsible parties" and they refuse to co-operate, they may be held liable for up to three times the cost of the cleanup.

5.1.1 RCRA: Waste Identification and Manifest System

The foundation of the RCRA system is the method of identifying given wastes as hazardous and thereby determining which of the parties involved in the waste disposal process are responsible for compliance with regulations. In the RCRA regulations, EPA listed specific process wastes as hazardous wastes and also defined about 400 chemicals as hazardous wastes when discarded. In addition, EPA identified four characteristics which individually qualify a waste as hazardous under RCRA: ignitability, corrosivity, reactivity, and toxicity.

Unless specifically excluded from regulation, a waste is considered hazardous if it is listed as such by EPA, if it is a mixture containing a listed waste, or if it has at least one of the four qualities defined as characteristics of a hazardous waste. EPA plans to add wastes to its list as it obtains additional information about the risks associated with specific wastes.

The first responsibility of a generator is determining whether his waste qualifies as a hazardous waste. If it does, RCRA requires the generator to assume numerous other responsibilities. Before shipping the waste off-site for treatment or disposal, a generator must package the waste, label the package, and placard the vehicle in accordance with regulations already established by the U.S. Department of Transportation for the safe transport of hazardous materials. Furthermore, the generator must keep records of the types and amounts of hazardous waste shipped from his facility and must submit an annual report to EPA detailing this information.

The generator sets in motion the "cradle to grave" tracking system by preparing, for each shipment of hazardous waste from his facility, a manifest describing the waste and designating both the transporter who will carry the shipment and the disposal facility that will receive the shipment. Both the generator and the transporter sign and date the manifest. The generator retains a copy for his records. All other copies accompany the shipment, and at subsequent transferrals, the two parties involved must also sign and date the manifest.

The operator of the treatment or disposal facility closes the information circle by returning a copy of the manifest to the generator within 30 days of receiving the shipment. If the generator does not receive this copy within 45 days of the time that the waste left his premises, he must report the situation to EPA.

The transporter must not accept any shipment of hazardous waste that is not accompanied by a manifest and, like the generator, must keep records of all the waste handled. In addition, in the event of an accidental spill during the transportation of the waste, the transporter assumes responsibility for taking immediate action to protect human health and the environment and to clean up the spilled hazardous waste.

5.1.2 RCRA: Waste Facilities

Under RCRA, all operators of treatment, storage, and disposal facilities for hazardous waste will be required to receive permits from EPA. The permitting process is not automatic, and EPA has begun to outline detailed technical standards of design and operation which facilities must meet in order to receive a permit.

The regulations also require that all of the following must now or in the near future conform with criteria designed to ensure that the hazardous waste is safely isolated from the environment: hazardous waste containers, storage or treatment tanks, surface impoundments, piles, landfills, land treatment sites, and incinerators.

The regulations further include requirements for establishing the security of facilities against unauthorized entry, for conducting regular inspections of the facilities, for training the facility personnel, for preparing contingency plans for emergencies, and for keeping records of the waste handled and reporting that information to EPA. Operators of surface impoundments, landfills, or land-treatment facilities must also regularly monitor the groundwater near their facilities for chemical contamination.

The operator's responsibilities do not end when he closes his facility. Recognizing that disposal sites may pose the greatest threat to the environment after they have been abandoned, EPA will require the operators of a disposal facility to submit, as part of their permit application, detailed plans for the disposal facility's safe closure and post-closure care, including monitoring of groundwater at the facility and maintenance of containment structures for up to 30 years after the facility ceases operation. The owners or operators must also guarantee that they have the necessary funds to pay for closure and post-closure care. In addition, during the operation of a facility, the owners or operators must maintain liability insurance against damages caused by sudden or gradual releases of chemical wastes.

5.1.3 RCRA: Enforcement

Nearly 60,000 existing facilities in the U.S. have notified EPA that they expect their operations to be subject to regulation under RCRA. Through these notifications, EPA has created a comprehensive inventory of all facilities in the U.S. that treat, store, or dispose of hazardous wastes, as well as inventory of the types and quantities of hazardous wastes handled by these facilities. EPA estimates that processing the permit applications for all these facilities will take several years. In the interim, EPA is requiring them to meet certain minimum standards of operation, including management practices which do not involve a significant investment of capital.

Given the enormous number of installations that handle hazardous waste in the United States, EPA has already limited its programme by excluding from regulation the generators of small quantities - less than 1,000 kilograms per month - of all but the most acutely hazardous wastes. According to EPA estimates, this limitation excludes from regulation about 91% of the U.S. hazardous waste generators - or 695,000 generators - generating 1% of the total hazardous waste volume.

Even with this limitation, EPA will still rely on agencies in the 50 States and the Territories for assistance in carrying out inspections, issuing permits, and discharging its other regulatory responsibilities. In fact, RCRA authorizes EPA to delegate to such States and Territories the responsibility for implementing, under EPA supervision, a hazardous waste management programme as long as the programme is consistent with and at least as strict as the federal regulations.

All of the South Pacific regions under U.S. jurisdiction have begun programmes to establish local hazardous waste management teams and to categorize hazardous wastes. Guam is developing a programme that will be comparable to the federal RCRA programme and is requesting the authority from EPA to manage its own programme. At the same time, American Samoa and the Commonwealth of the Northern Mariana Islands are developing programmes which are complementary to the RCRA programme. The Trust

Territory of the Pacific Islands is also planning to develop its own hazardous waste management programme.

5.1.4 CERCLA: U.S. Priority Superfund Sites

Given the limited size of the Superfund and the large number of abandoned sites in the United States and its Territories, EPA decided to allocate its Superfund monies to a limited number of high-priority sites and, on 20 December 1982, released its proposed National Priorities List (NPL) of 418 sites eligible for Superfund support. EPA selected the sites from a total of about 650 sites that the States and Territories had submitted for inclusion on the NPL. The sites were chosen as a result of their scores on the hazard ranking system, which EPA has been using to judge potential and actual pollution of groundwater, surface water, and air from wastes at individual sites.

EPA plans to review the sites on the NPL on a quarterly basis, allowing EPA to remove from the list those sites that have been cleaned up and to add new sites that are discovered by the States or EPA and that qualify by their hazard ranking scores. According to EPA estimates, the time span from the start of the investigation at a typical NPL site until the completion of the remedial cleanup will be about 44 months.

This year, EPA commenced activity under Superfund in each of the four Territories. The Government in each area identified a highest-priority hazardous waste site for possible remedial cleanup under the new Superfund. The sites described below were among the 418 sites on the proposed NPL, which was released in December 1982.

Taputimu Farm and Tafuna Power Plant, Tutuila Island, American Samoa: Tutuila Island covers an area about 25 miles long and 3 miles wide and has a population of 32,000. The Taputimu Farm site is part of an agricultural experimental farm owned by American Samoa. The site consists of a warehouse, which has been used for more than ten years as a storage area for unused chemicals and pesticides. According to EPA, many of the chemical and pesticide containers are leaking and have illegible markings or no labels. The known chemicals in the warehouse include dieldrin, methoxychlor, and 2,4,5-trichlorophenoxyacetic acid, and the estimated amount of hazardous wastes on-site totals about 2,000 pounds.

The warehouse is located in a depression, approximately 100 feet above sea level and 0.25 mile from a public beach. Flooding of the warehouse is a regular occurence, and some contaminated materials are reported to have been washed out of the facility. The materials have probably soaked into the ground surrounding the site, and they may have been transported to the beach by surface water. Contact with humans, marine resources, and drinking water is inevitable, according to EPA.

The Tafuna Power Plant site is a storage area for PCB transformers and capacitors. Eleven small capacitors measuring 1.5 feet by 2.5 feet by 0.5 foot and five large transformers are estimated to contain 1,000 gallons of PCB-contaminated oil.

PCB Warehouse, Saipan, Northern Mariana Islands: The PCB Warehouse is a temporary shelter built as an interim storage facility for approximately 1,400 gallons of PCB transformer fluid, with PCB concentrations of up to 25,000 parts per million. The structure was built as a first step to protect the public and the environment from PCB contamination. The fluid is currently stored in the warehouse awaiting shipment to a RCRA-permitted PCB disposal site. The storage site is adjacent to the Philippine Sea, which makes long-term storage there unsafe.

PCB Waste, Islands of Palau, Yap, Truk, Ponape, Kosrae, and Majuro, Trust Territory of the Pacific Islands: These islands all have storage areas that contain PCB transformers and PCB-contaminated transformers. More than 2,000 gallons of waste fluid are stored in these areas. The storage sites are unprotected and thus may lead to the contamination of drinking water sources and also of marine resources used for food. According to EPA, off-site migration of hazardous wastes has probably already contaminated surrounding areas.

Ordot Landfill and Containerized Wastes, Guam: The Ordot Landfill has been in use for over 40 years, mostly as an open dump. EPA said that accurate records have not been kept of the types and quantities of wastes disposed at the landfill. Recent information indicates that the wastes are now buried. The current landfill site occupies 47 acres, and it may be expanded to a total of 74 acres. Surface water from the site currently drains into the Pago River which discharges into Pago Bay, causing concern about direct human contact with the wastes and possible contamination of marine life. Guam has begun to monitor the surface water surrounding the site.

5.2 U.S. EPA Activities

EPA has begun preliminary investigations and feasibility studies at the priority sites as the basis for action plans to deal with the hazardous wastes at those sites. EPA contracted with Black and Veatch of Kansas City, Missouri, to perform the assessment. This firm is the EPA's standard contractor for Zone 3 of the United States, an area which includes the U.S. insular Territories of the Pacific. With EPA assistance, Black and Veatch is now surveying the air, soil, and water at each priority site and is obtaining hazardous waste samples for identification and analysis.

This preliminary assessment is one of seven projects that Black and Veatch will carry out as a zone contractor for EPA. Once the assessment is completed, Black and Veatch will issue a formal report describing the types and quantities of hazardous wastes at the sites and suggesting possible remedial actions, such as overpacking or capping. Then EPA will issue a request for proposals to perform remedial actions at the sites. If authorized by EPA, Black and Veatch will also develop a plan to initiate remedial action at the identified sites.

The EPA project officer for the Black and Veatch assessment is Nancy Willis in Washington, D.C., telephone: 202-382-2347, although Norm Lovelace, of the EPA Region 9 office in San Francisco, California, telephone: 415-974-7431, has been largely responsible for the administrative work associated with the project. EPA Region 9 deals directly with local agencies in the Territories themselves, as EPA has no offices in the South Pacific. The project liaisons for EPA are the following:

- American Samoa: Pati Faiai, Environmental Quality Commission, Office of the Governor, Pago Pago, American Samoa 96799;

- Guam: James Branch, Guam Environmental Protection Agency, P.O. Box 2999, Agana, Guam 96910;

- Commonwealth of the Northern Mariana Islands: George Chan, Division of Environmental Quality, Public Health and Environmental Services Department, P.O. Box 1115, Saipan CM, Northern Mariana Islands 96950;

- Trust Territory of the Pacific Islands: Nachsa Siren, Environmental Protection Board, Office of the High Commissioner, Saipan CM, Northern Mariana Islands 96950.

5.3 Pesticide Control

Each of the four major Territories is implementing its own programme for controlling the importation, marketing, and use of pesticides. These programmes have been established under another U.S. law - the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA). The programmes are locally implemented and administered in a way similar to that stipulated under FIFRA for individual States int he continental United States. Through these programmes, importation and marketing activities are monitored to ensure the use of registered pesticides only, and pesticide users are tested and certified to ensure that they use the pesticides properly. Each territory also initiates appropriate enforcement or follow-up actions for pesticide violations.

5.4 Waste Management at U.S. Military Installations

Johnston Island and Midway Island, together with other military installations in the Pacific, are under the jurisdiction of the U.S. Department of Defense. As a result, RCRA or CERCLA regulations do not cover these areas. In fact, the U.S. EPA has almost no information on the extent of any hazardous waste problems at the U.S. military bases. Moreover, much of the information pertaining to hazardous wastes in these installations is classified and generally unavailable to the public.

The immunity of military installations poses a particular problem to local populations, since those installations are very likely generators of significant amounts of hazardous waste due to the relatively high level of industrial and service activities associated with military operations. Roger Stillwell, spokesman for U.S. Congressman Won Pat of Guam, told World Information Systems that Johnston Island in particular is known to be a repository for significant quantities of hazardous wastes.

He said that he had seen classified documents describing the storage of old 155-milimeter artillery shells on the island as well as the by-products of nerve gas and biological warfare experiments. He did not discuss the details of the waste storage, but indicated that the U.S. Department of Defense is exploring ways to vaporize the wastes or detoxify them with high-energy lasers. He said that the stored materials do not include any radioactive wastes or fissionable materials. Stillwell verified the classified nature of the information on Johnston Island directly with U.S. Defense Secretary Casper Weinberger.

It is important to note that Johnston Atoll, Midway Island, and Wake Island, all of which house U.S. military installations, are not technically situated in the South Pacific region, but lie to the north of this region. They are mentioned here as indicative of the problems associated with determining the types and quantities of wastes on the other U.S. military installations in the South Pacific region (Appendix 18).

5.5 U.S. Military Installation Restoration Program

The U.S. Department of Defense recently established an Installation Restoration Program (IRP), which applies the same type of controls over hazardous wastes at U.S. military installations as does Superfund over nonmilitary sites. The programme is designed to identify and fully evaluate suspected problems associated with inactive hazardous waste sites at military facilities and to control the migration of hazardous wastes from such facilities, thereby eliminating the health risks to local

populations. Decontamination of some sites may be considered under the IRP, if such action appears to be the most feasible method of controlling off-site migration of on-site health hazards.

The IRP, as detailed in a June 1982 document issued by the U.S. Air Force, will be performed in the following four phases:

- Survey the military installations and analyze their records to identify and prioritize those inactive disposal sites that may now pose a hazard to public health or the environment as a result of contaminant migration. The IRP specifies a detailed methodology for assessing the relative severity of specific hazardous waste sites.

- Confirm by a comprehensive environmental assessment the presence or absence of contaminants that may have an adverse effect on public health or the environment. This phase involves drilling monitoring wells, sampling the air, water, and soil, and then analyzing the samples.

- Develop a technical data base with which to prepare a comprehensive contaminant control plan. This phase includes chemical analyses and toxicity studies.

- Implement the contaminant control plan and undertake remedial measures, such as barrier and liner construction, in-site stabilization, leachate collection, contaminant removal, site isolation, and chemical or biological decontamination.

In addition, under the IRP, the military must advise the EPA regional offices and state and local Governments of IRP activities.

As an example of the types and quantities of hazardous wastes that can be generated from military installations, World Information Systems has included a list, prepared in 1981 by Pacific Basin Environmental Consultants for the Guam Environmental Protection Agency, which details the types and annual quantities of hazardous wastes generated by the U.S. Navy in Guam (Appendix 19). Similar information for other U.S. military installations in the South Pacific is not available.

5.6 U.S. Coast Guard Activities

The 14th District of the U.S. Coast Guard includes Hawaii and the four South Pacific Territories that are under U.S. jurisdiction. The Coast Guard has responsibility for monitoring hazardous material spills and hazardous waste contaminations in these areas. Its authority for responding to hazardous materials spills and waste-site contaminations closely parallels its authority for responding to oil spills. In the South Pacific region, the Coastal Guard has the same responsibility for hazardous material spills as EPA has for such spills in the continental United States. Some U.S. analysts consider the Coast Guard programme to be inadequate for monitoring and responding to hazardous materials incidents over the thousands of square miles of water for which the Coast Guard claims jurisdiction.

The Coast Guard 14th District office in Honolulu told World Information Systems that, as of 1 December, the Coast Guard had received no reports of any hazardous material incidents in the South Pacific or, indeed, the entire 14th District. The District Office speculated, however, that a significant number of spills are probably occurring in the region but that they have not been reported.

While the 14th District recorded no hazardous material spills or dumping incidents in the 18 months between January 1981 and June 1982, the average number of reported spills during this period for each of the 13 other Coast Guard districts was greater than 11, according to a summary of such incidents published in the 1 October 1982 issue of Hazardous Materials Intelligence Report. In addition, the EPA Region 9 office told World Information Systems that EPA is not aware of any instances where hazardous materials have been deliberately dumped in U.S. waters or in U.S. Territories in the South Pacific in an environmentally harmful way.

5.7 U.S. Army Corps of Engineers Activities

The U.S. Army Corps of Engineers, which normally oversees construction and dredging activities in navigable U.S. waterways, has a Pacific Ocean Division based at Fort Shaften, Hawaii. Frank Rezac of the Pacific Office Division told World Information Systems that, in the South Pacific region, the Corps simply enforces the permit programme for building construction and other projects affecting the waterways in the islands. The Corps has also conducted coral reef inventories in American Samoa and Guam.

According to Rezac, the Corps would become involved in hazardous waste control only if a specific construction or dredging project involved oil, heavy metals, or other waste substances that could substantially affect the reefs, lagoons, or waterways. As of 1 December 1982, the Corps had not been involved in any hazardous waste incident in the South Pacific region.

5.8 Other U.S. Agencies

World Information Systems also contacted several additional U.S. agencies regarding hazardous wastes, not including radioactive wastes, in the U.S.Territories in the South Pacific. Among these agencies were the following: the International Programs Office of the U.S. Department of Transportation, the Nuclear Regulatory Commission, the Office of Territorial and International Affairs of the U.S. Department of the Interior, the U.S. Department of Commerce, the U.S. Department of Energy, and the U.S. Department of State. None of these agencies had significant amounts of information on hazardous waste management in the South Pacific region.

5.9 Specific Territories

5.9.1 Guam

Military installations compose about one third of Guam's 212 square miles. In April 1978, Garretson, Elmondorf, Zinov, and Reibin, an architect-engineering firm in San Francisco, California, completed a hazardous waste assessment of the non-military portion of Guam. The firm conducted extensive field surveys of the industrial and commercial facilities and public agencies on the island. Garretson, Elmendorf concluded that, although the territory generates a limited amount of hazardous wastes, these wastes nevertheless pose a significant threat to the small island environment of Guam.

In its final report entitled Hazardous Waste Management: Problem Strategy Formulation, Garretson, Elmendorf identified the types, quantities, sources, and locations of hazardous wastes being generated and stored by the civilian sector in Guam in 1977 and 1978 (Appendix 20). The EPA Region 9 office told World Information Systems that EPA plans to update this report in 1983.

The Garretson, Elmendorf report projected that the quantities of hazardous wastes generated would increase in the future, although the anticipated increase was not expected to change the overall magnitude of the problem or the management practices necessary to protect human health and the environment (Appendix 21). The firm also concluded that the civilian sector on Guam was managing several of the hazardous wastes in an environmentally unsound way (Appendix 22).

In early 1980, under an EPA contract, SCS Engineers of Long Beach, California, conducted a hazardous waste assessment covering all of the U.S. Territories in the South Pacific. SCS found the following in storage on Guam: 180,000 pounds of calcium hydroxide, 360 empty chlorine drums, 300,000 pounds of various hospital wastes, 950 pesticide containers, and 6,000 gallons of tetraethyl lead sludge. The EPA Region 9 office in San Francisco noted that the report contained other outdated information; for example, one particularly hazardous problem - the storage of 100,000 pounds of calcium hypochloriate - has already been eliminated. EPA said that Black and Veatch plans to revise the information as part of its ongoing assessment.

Following the initial assessments of 1978 and 1980, the Guam Environmental Protection Agency (GEPA) contracted with Pacific Basin Environmental Consultants (PBEC) to prepare a hazardous waste management plan for the island. In its study, PBEC updated the old inventories and assessments of civilian hazardous waste storage and disposal on Guam (Appendices 23 and 24). These records have been included as an indication of the types of information needed to assess the hazardous waste situation in a specific area.

In September 1981, PBEC submitted its hazardous waste management plan, recommending that Guam construct a hazardous waste staging and storage facility to manage toxic and hazardous wastes that are generated on Guam and that require off-island disposal. PBEC said that the rate at which the military generates hazardous wastes exceeds the rate at which the civilian sector does by at least an order of magnitude, although precise information on the amount of wastes generated by military installations was not available. PBEC also said that the hazardous wastes generated by the civilian sector on Guam are characteristic of Guam's nonindustrial nature.

According to PBEC, however, the overall hazardous waste problem on Guam, when the military installations are included in the assessment, is significantly more severe and, consequently, more difficult to manage. PBEC confirmed that hazardous wastes of many types were still being stored improperly throughout the island. In addition, according to PBEC the illegal disposal of these wastes occurs regularly on Government and private property throughout the island.

With U.S. federal support, many of Guam's hazardous wastes that had been identified in earlier inventories were shipped to an EPA-approved disposal site in California. Pepper Industries was responsible for shipping these wastes to the California site (appendix 25). In addition, Chem-Security Systems of Oak Brook, Illinois, handled the draining, repacking, and shipping of PCB transformers from the Government of Guam, as well as from the U.S. Navy on Guam, to another California disposal site.

In Guam, CEPA has the responsibility for overseeing hazardous waste management activities, and it derives its authority from the Guam Solid Waste Management and Litter Control Act. The hazardous waste management regulations for Guam apply to generators with a hazardous waste production of more than 200 kilograms per calendar month. According to GEPA, the types and amounts of hazardous wastes generated and stored on Guam each year are the following: flammables and combustibles - 40.5

tons; poisons - 13.9 tons; corrosives - 97.8 tons; etiologic agents - 18.25 tons; oxidizers - 0.25 ton; and other regulated materials - 1.35 tons (Appendix 26). GEPA reiterated that hazardous wastes from major generators are shipped to off-island sites for disposal.

According to GEPA, there are no major storage and disposal companies on the island. No changes are anticipated in the waste streams of the principal generators, and no plans are under development to increase the disposal capacity on-island. A centralized storage facility may, however, be constructed in the near future. Although no major hazardous waste fires or contaminations have occurred in Guam, GEPA cautioned that stored hazardous wastes present a potential risk of leaking from their containers and contaminating the groundwater.

5.9.2 American Samoa

All Government operations and most commercial activities in American Samoa are located in the harbor area of Pago on the main island of Tutuila. As in Guam, hazardous waste assessments were conducted in 1977 and 1978 by Garretson, Elmendorf and in 1980 by SCS Engineers. Garretson, Elmendorf identified a wide variety of hazardous wastes in American Samoa along with their quantities and sources (Appendix 27). EPA cautioned that some of the data from these surveys is now outdated.

While the Garretson, Elmendorf report said that the quantities of hazardous wastes indentified were small, it found these wastes to pose a significant hazard to human health and the environment in American Samoa. The types of hazardous wastes stored in 1977 and 1978 included pesticides and old PCB-containing transformers.

Garretson, Elmendorf also projected that the quantities of hazardous wastes would increase over time, although not substantially (Appendix 28). According to the firm, several of the wastes identified were not disposed of in an environmentally sound way (Appendix 29).

As mentioned earlier, EPA is planning to remove, under Superfund, about 2,000 pounds of unused agricultural chemicals stored at Taputimu Farm, as well as PCBs from the transformers stored at local power plants. Since the nearest U.S. laboratory for hazardous wastes is located in Los Angeles, California, and since the U.S. Department of Transportation prohibits the air shipment of large quantities of hazardous material, samples will have to be sent by sea, unless a waiver can be obtained from the Department of Transportation allowing air shipment.

5.9.3 Northern Marianas

The Northern Mariana Islands achieved Commonwealth status with the U.S. in 1978. The major island of the Northern Marianas include Saipan, Tinian, and Rota, with 90 per cent of the Commonwealth's population located on Saipan. As with the other Territories under U.S. jurisdiction, hazardous waste assessments were conducted in 1977 and 1978 by Garretson, Elmendorf and in 1980 by SCS Engineers. The Garretson, Elmendorf study concluded that, although a limited amount of hazardous wastes is generated in the Northern Marianas (Appendix 30), these wastes pose a significant threat to the small island environments. The study said, however, that significant quantities of hazardous wastes were being stored in Saipan and that these wastes included asphaltic oil, calcium hypochlorite, pesticides, and chlorextol.

Garretson, Elmendorf also projected that the quantities of hazardous wastes generated in Saipan would increase over time (Appendix 31) and that the current management practices for many types of hazardous wastes were inadequate (Appendix

32). The report did not identify any hazardous wastes on the other islands in the Northern Marianas, although small quantities of pesticides or other substances may be stored there. According to EPA, some of this data is outdated, and a new survey is underway.

According to the Division of Environmental Quality (DEQ) of the Commonwealth of the Northern Mariana Islands, data is not currently available on the types and amounts of hazardous wastes that are now being disposed of and stored in the Northern Marianas (Appendix 33). DEQ noted that, in the past, about 1 ton of agricultural pesticides had been disposed of and stored in the region. Although no information is available on any major hazardous waste fire or contamination in the Commonwealth, DEQ said that, in the event of a severe storm, PCBs stored in warehouses near the coast might leak out and adversely affect the flora and fauna in the marine environment. The Commonwealth is planning to ship the stored PCBs off-island for disposal.

5.9.4 Trust Territory

The Trust Territory of the Pacific Islands consists of more than 2,000 islands, of which less than 100 are permanently inhabited. These islands are located in an area of 3 million square miles in the Western Pacific Ocean, and yet they contain only 700 square miles of land. For administration purposes, the territory is divided into the following six districts, with its current headquarters in Saipan, Northern Marianas:

- Eastern Caroline Islands - District Center at Ponape;

- Kosrae - District Center at Kosrae;

- Marshall Islands - District Center at Majuro;

- Palau District, Western Caroline Islands - District Center at Koror;

- Truk District, Caroline Islands - District Center at Moen;

- Western Caroline Islands - District Center at Yap.

As in the case of the other Territories, a hazardous waste assessment of the Trust Territory was conducted in 1977 and 1978 by Garretson, Elmendorf and in 1980 by SCS Engineers. Garretson, Elmendorf concluded that, although a limited amount of hazardous wastes is generated in the district centers (Appendix 34), such wastes pose a significant threat to the environments of the small islands. The EPA Region 9 office cautioned that much of the survey data is outdated and that the report will be revised in 1983. According to the assessment in 1977 and 1978, the types of hazardous wastes in storage included asphaltic oil, calcium hyperchlorite, and pesticides (Appendix 35).

Garretson, Elmendorf projected that the quantities of hazardous waste generated would increase in the territory (Appendix 36). The firm also found that chlorine containers, hospital wastes, spent pesticide containers, tank sediments, tetraethyl lead sludge, and waste lubricating oil were being stored in an environmentally unacceptable way (Appendix 37). In 1981, Chem-Security Systems of Oak Brook, Illinois, conducted a survey of PCBs in the Trust Territory and found 294 transformers containing PCBs at various concentrations (Appendix 38).

6. CONCLUSIONS AND RECOMMENDATIONS

Hazardous waste storage and disposal pose a significant threat to the small and fragile island environments in the South Pacific region and to human health and safety there, even at the present levels of industrial, commercial, and residential activities in the region. In the independent States, a thorough investigation would likely reveal a number of abandoned or active dump sites presenting significant cleanup problems and major environmental and human health risks.

As industrial, commercial, and agricultural activities increase in these States over time, the potential hazards will increase accordingly. The implementation of strict regulations, as well as the enforcement of those regulations, along with increased efforts to educate the public, are required to ensure the proper management of hazardous wastes.

In the Territories under U.S. jurisdiction, careful implementation of existing local and U.S. federal programmes will be required to cope with the current and anticipated production of hazardous wastes. The results of this study indicate that wastes from military installations in the U.S. Territories present a potential threat to the local populations. For the most part, the hazardous waste situation in the civilian sectors of these Territories appears to be under control due to the applicability of U.S. federal regulations to the Territories and to past and ongoing field surveys of hazardous wastes.

World Information Systems believes that the independent States should vigorously pursue two goals with respect to hazardous wastes. First, each Government should undertake a comprehensive field survey of existing hazardous waste sources, including inactive waste sites and active waste generators. This survey should give highest priority to areas which are close to water supplies and environmentally sensitive areas. Secondly, the local authorities should establish small, appropriately located facilities for the temporary safe storage of hazardous wastes, pending final disposal or shipment of the wastes to licensed disposal facilities, most likely off-island sites.

In any event, the States must determine the types, quantities, and locations of hazardous wastes in their jurisdiction so that they can assess the magnitude of their hazardous waste problem and begin to develop solutions. In addition, the Governments must inform local populations both about the presence of any hazardous wastes in their area and the risks associated with such wastes, and the Governments must take steps to eliminate these risks.

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