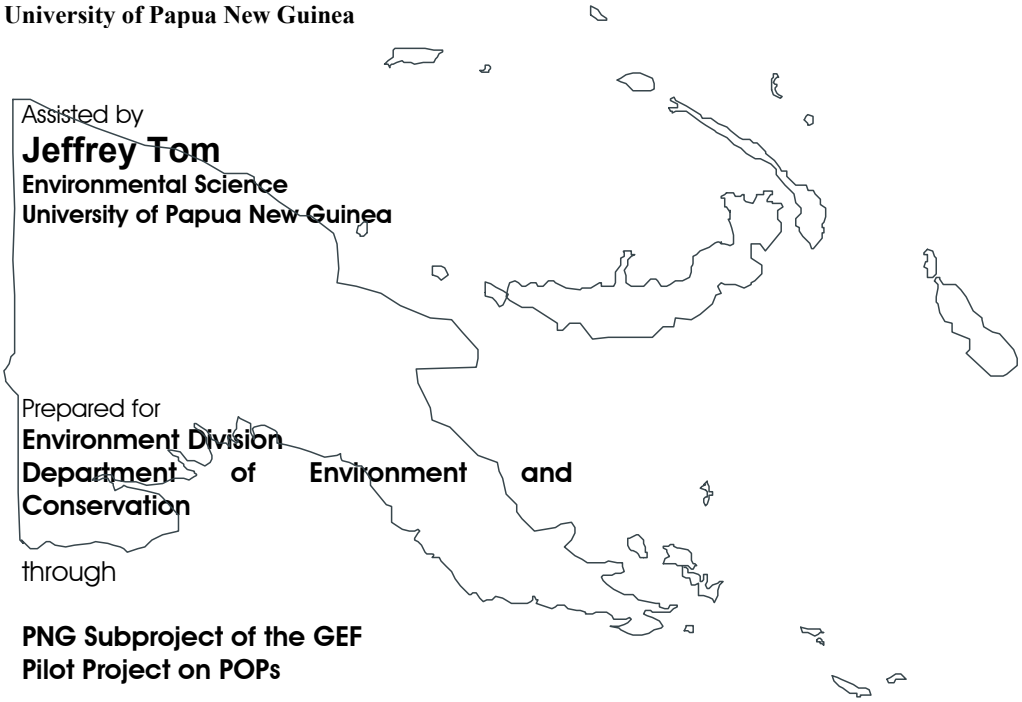
PAPUA NEW GUINEA

NATIONAL PROFILE OF CHEMICAL MANAGEMENT 2000 - 2004

by
David Mowbray

Environmental Science
University of Papua New Guinea



Assisted by
Jeffrey Tom
Environmental Science
University of Papua New Guinea

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Environment Division
Department of Environment and Conservation

through

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For copies of this second edition of

Papua New Guinea National Profile of Chemical Management

or queries or comments , please contact

Dr David Mowbray
Environmental Science Discipline
University of Papua New Guinea
PO Box 320 University PO
PAPUA NEW GUINEA

Phone: 3267413
Fax: 3260369
Email: david.mowbray@upng.ac.pg

Also note that the first edition is available on the web

on the web

Find it either at

http://www.unitar.org/cwm/nationalprofiles/index.htm or directly at

http://ecb.jrc.it/natprof/png/

David Mowbray and Jeffrey Tom

Environmental Science, UPNG

4th February 2005

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PAPUA NEW GUINEA NATIONAL PROFILE OF CHEMICAL MANAGEMENT 2000 -2004

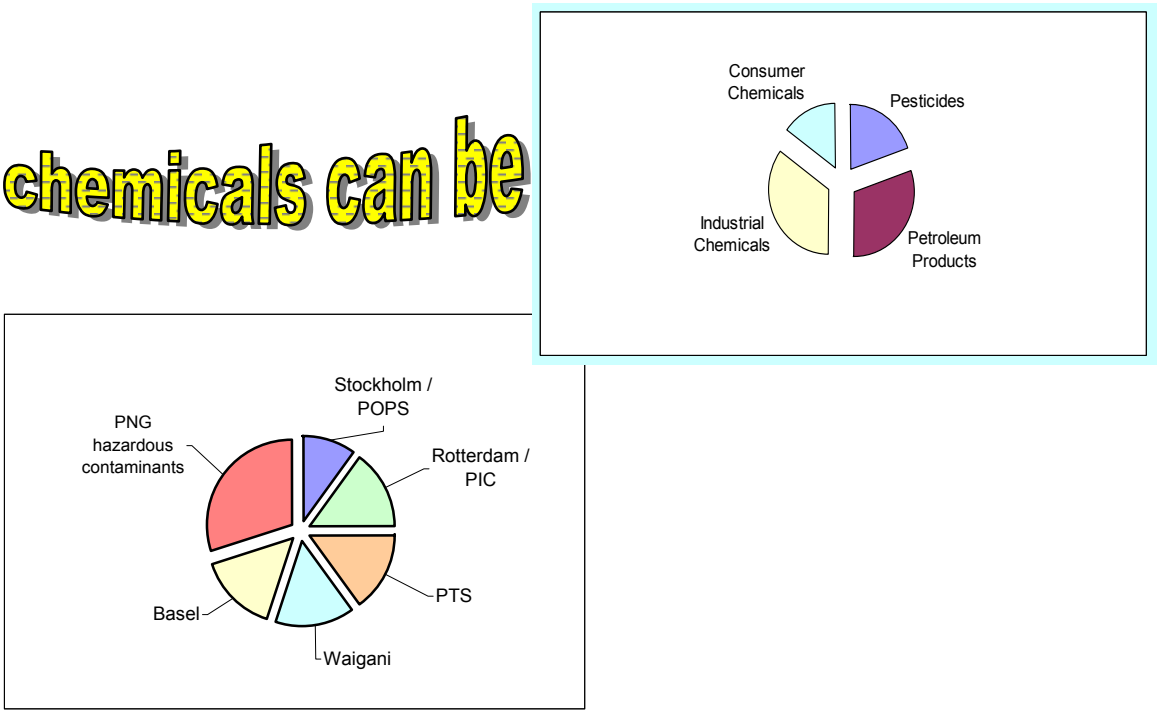
Second Edition

This second edition report is an update and revision of the initial Papua New Guinea National Profile of Chemical Management 1997 – 2000. Data and information and reviews of the present situation have been updated where possible throughout the whole profile. Websites referred to and helpful in chemical management have been updated.

This second edition includes information on Persistent Organic Pollutants or POPs. Two new chapters have been inserted to include summaries of information on POPs and POPs like substances in PNG (new Chapter 4) and information on health and environmental effects of chemicals in PNG (new Chapter 5)

Please provide any comments and corrections and updated information to

Ms Katrina Solien **POPS National Co-ordinator** **GEF Pilot Project on POPS** **PO Box 1212** **Waigani, Papua New Guinea**	**Phone 323 3910** **Fax 323 6037 / 3251481** **Email: katrinasolien@hotmail.com** **or popspom@datec.net.pg**
Ms Lois Nakmai **Assistant Secretary** **Environmental Protection Branch** **Environment Division** **Office of Environment and Conservation** **PO Box 6601** **Boroko Papua New Guinea**	**Phone: 325 0194** **Fax: 325 0182** **Email: enpchemmgt@datec.net.pg**
Dr David Mowbray **Environmental Sciences** **University of Papua New Guinea** **PO Box 320 University PO** **Papua New Guinea**	**Phone: 3267413** **Fax: 3260369** **Email:** david.mowbray@upng.ac.pg



This second edition was compiled as part of the GEF Pilot Project on POPS in Papua New Guinea.

National Profiles of Chemical Management have been promoted by the Intergovernmental Forum on Chemical Management (IFCS), a global grouping of governments working to implement the goals of Chapter 19 (Chemicals) of Agenda 21.

The original PNG National Profile on Chemical Management was prepared using the original UNITAR guidance document. This second edition of the PNG National Profile on Chemical Management has been compiled using the format suggested in the UNITAR Companion Guidance Notes, Working Draft January 2003. These being:

United Nations Institute for Training and Research (UNITAR), 1996. *Preparing a National Profile to Assess the National Infrastructure for Management of Chemicals. A Guidance Document*. Inter-Organizational Programme for the Sound Management of Chemicals (IOMC). The latest version is now available at internet site: http://www.unitar.org/cwm/publications/npdoc/index.htm

United Nations Institute for Training and Research (UNITAR), 2003. *Preparing / Updating a National Profile as part of a Stockholm Convention National Implementation Plan..Companion Guidance Notes, Working Draft January 2003.*. Inter-Organizational Programme for the Sound Management of Chemicals (IOMC).

EXECUTIVE SUMMARY

to the Papua New Guinea National Profile of Chemical Management,
2000-2004

The Papua New Guinea National Profile was prepared to assess the present chemical management situation in Papua New Guinea. It aims to determine the infrastructure, to identify problems, weaknesses and gaps, to identify existing mechanisms, to identify priorities, and to make recommendations on what might be done. This second edition is an up date of the first edition. Much of the contents have changed. Information and data has been brought up to date. However there are still many gaps as much remains uncertain. Much of the text, if appropriate, remains the same as in the first edition.

This second edition has been updated to incorporate information collected through 2004 particularly information on persistent organic pollutants (POPS) in PNG, but also information on other chemicals and on chemical management in PNG.

This National Profile is based on information collected by the authors with the assistance of the very many persons involved in the GEF Pilot Project on POPS, run from the Department of Environment and Conservation (referred to in the report as DEC). The major author is an Environmental Scientist / Biologist with the University of Papua New Guinea who has worked closely with DEC, particularly in the area of chemical management, for 25 years.

This National Profile, like the first edition, has been intentionally written still with many gaps. It is intended to serve as an improved baseline assessment of chemical management in Papua New Guinea. It clearly shows what is known and what is not known. It is hoped that this second version of a PNG National Profile can assist by spurring better and a more cooperative approach to chemical management in PNG in future years.

Chapter 1 provides an overview of PNG's present situation. PNG is a land rich in natural and cultural resources. The National Constitution enshrines a commitment to sustainable development. The development strategy of the country though has been based on resource exploitation. Agriculture, forestry, mining and petroleum all contribute significantly to the economy. Unfortunately the economic and financial benefits accruing have not been translated into corresponding benefits in human development and environmental protection. The manufacturing sector is small. PNG is said to be a country that has "urbanised without industrial development". Consequently the types and of amounts of chemicals imported into and used in PNG is small. Important data from commerce is limited or missing- such as number of motor vehicles and numbers of small business or amounts of waste generated need. This information is needed if we are to gain good indications on the amounts of chemicals and types of chemicals that may be used across the country. Easily available information is not available The Department of Environment and Conservation, which has the principal mandate to manage chemicals, has limited financial resources and staff, and despite the occasional rhetoric has limited political clout. Through 2002-2005 the GEF Pilot Project on POPS has enabled a detailed review and assessment of chemical management.

Up to date and accurate data and information on chemicals remains hard too obtain. Obtaining information on specific groups of chemicals or any particular chemical is very difficult, almost impossible with a few exceptions. **Chapter 2** provides a summary of information on chemicals available from the Internal Revenue Commission / Customs and some information on pesticides from the Department of Environment and Conservation. That available was for imports and exports. However data is on volumes and moneys earned from duty by PNG government. PNG imports most of its chemicals, and apart from minerals and petroleum products exports very little. Little manufacturing occurs though some formulation does occur.

Data / records on manufacturing and formulation is not kept or is not readily available. The classification / categorisation for chemicals used by Customs is the Harmonized Commodity and Coding System (HS) as required by international agreement and as collected only puts chemicals into general groups, so restricts the type of information one can access. Modifications specifying further categorisation of chemicals even specific chemicals into subcategories can be made, but must be done so by agreement between eg DEC and Customs / Finance, and in conformity with international rules. Information on chemicals by category exists for pesticides but again by general groups. Other information on pesticides exists in DEC, but these records are in part inaccurate and incomplete. Information on inventories, on emissions and discharges are also lacking. No information has been collected on these for years. Regular environmental auditing / monitoring need to be done involving co-operation between government and industry to determine chemicals used, manufactured and wastes discharged / emitted. . Through the POPs project compilation of such inventories has commenced. A computerised database covering pertinent information on all chemicals needs to be established with data provided by and shared across departments and industry, and with health and environmental information available to the public.

Chapter 3 gives an overview of what students doing Environmental Science see as the main pollution problems in PNG. Chemicals are recognised or perceived to be an important contributor to health and environmental problems, but hard data does not exist except for pollution from mining and some adhoc information. Data from the PNG Natural Disaster Centre ranks chemicals as lower hazards in PNG compared to natural events. This chapter remains little changed and mainly focuses on priority concerns in chemical management, and gives the collective views of the authors and the pertinent DEC officers back in 1997. The situation has little changed. The authors:

- Noted that scales of problems vary from local to national, and can be rural or urban.
- Expressed concern of effects (perceived risk) is highest for pollution of waterways especially by mining and agriculture, contamination of drinking water, hazardous waste treatment and disposal, chemical accidents in small operations, import of unknown chemicals, storage and disposal of obsolete chemicals and waste disposal.
- Noted areas of concern (perceived risk) due to a low ability to control include air pollution, ground water pollution, soil contamination, chemical residues in food, occupational health in agriculture, forestry, and small industries, chemical accidents in small industries and small transporters, import of unknown chemicals, storage and disposal of obsolete chemicals, chemical poisoning and wastes from households.
- Noted there is virtually no available statistical data on pollution by chemicals and effects on human health in PNG (other than from mining environmental plans, environmental management and monitoring documents and associated reports which are beyond the scope of this report). There is a real lack of systematically collected data and any adequate databases in the country related to pollution and chemicals.
- Believe that chemicals that cause most problems include heavy metals, organic wastes, hazardous chemicals and pesticides and timber treatment chemicals and those in air pollutants. Occasionally poisoning occur in communities due to illegal consumption of low grade and toxic alcohols, and spillages occur from transport accidents , eg. cyanide spills.
- Ranked areas with highest priority for action needed are generally those where the perceived risk is highest, that is, where the level of concern is high or medium and the present ability to control these problems is low. They may represent real problems (eg pollution of inland waters, waste disposal) or perceived problems (chemical accidents, import of unknown chemicals into PNG).

There is a small literature on chemical poisoning in PNG, and a vast amount of information on pollution problems resulting from mining operations, the latter beyond the scope of this study. It was also noted that in recent years severe accidents have occurred in PNG. One (in 1995),involving explosives, killed workers at the Porgera Gold Mine, and a second (in March 2000) involved a cyanide spill from a helicopter carrying the chemicals to an isolated mine.

Chapter 4 introduces POPs, PIC and other chemicals which the PNG POPs project included in their inventories and assessment. The DDT study confirmed that DDT is still used in vector control, that there are stockpiles still scattered around the country and that it is used in agriculture illegally. It recognized that much still has to seems to find alternative methods so DDT can be phased out. PCBs are still used in old electrical equipment throughout the country. However the major use (PNG Power) has committed itself to

replace all PCB equipment and to dispose of old PCB oils and equipment safely. It has started this by active involvement in the POPs project. A preliminary assessment, using the UNEP Tool Kit , was made of sources and possible levels of dioxins and furans. The hotspots or main sources of the unintentional POPs were identified to be uncontrolled burning, power generation and hospital waste incineration. Very little is known on hazardous chemicals in PNG since regulations on such chemicals do not exist. No POPs or POPs like chemicals were identified in the industries surveyed other than some timber treatment chemicals. However other hazardous chemicals were found such as mercury, and missing from the list were fumigants and asbestos. Important here is the need to establish the process of regulating hazardous chemicals, for government to work more closely with industries and to encourage more environmentally friendly products and processes and cleaner production.. Fewer pesticides are used for economic reasons. No POPs were found to be used in agriculture (except DDT illegally) though some PIC chemicals and unregistered pesticides were being used. Pesticides were not being sold, used, stored or disposed of safely. Old containers were used as water containers. The unifying priority expressed is the need to create a better understanding of chemicals amongst users and in the community by awareness programmes and activities covering both chemical awareness and better management.

No recent information exists on health and environmental effects of chemicals including POPs in PNG, and an updated review is necessary. Most data is dated. Studies done in the 1970s,1980s and early 1990s confirm the presence of organochlorine pesticide and PCB residues in both human and animal tissues. A few samples had high concentrations but most are very low. Poisoning by chemicals in the past is documented, particularly from paraquat and anecdotal informal tells of ecological problems after DDT spraying. More generally people do recognize / perceive that chemicals / air pollutants can make them sick! These are the focus **Chapter 5.**

Legal and non-regulatory mechanisms managing chemicals are covered in **Chapter 6**. DEC regulates hazardous chemicals under the *Environment Act.* In the past it was regulated principally under the *Environmental Contaminants Act*, and to a lesser extent under the *Environmental Planning Act* and the *Water Resources Act*, all are responsibilities of DEC. Unfortunately except for pesticides no regulations still exist to cover hazardous chemicals. At times the *Health Act* has also been used. Other important acts that contributor to chemical management include acts under the responsibility of Labour and Industrial Relations and Petroleum and Energy. Many officers in different government departments are unsure of, even confused, of their responsibilities in managing chemicals. Consequently enforcement of chemical management and pollution control has been poor.

In recent years DEC has long recognised that environmental management needs to be greatly improved and made effective in PNG. Consequently in the 1990s DEC underwent a strengthening exercise and a structural reorganisation, and developed the new Environment Act, implemented as from 2004. These should strengthen chemical management in PNG. There has been much discussion and work done on streamlining this environmental legislation (ie new regulations gazetted in 2002) and making it both workable and more effective. This has also involved a general recognition of the need for a coordinated approach to chemical management; an approach that involves not just DEC but includes the many arms of government, including provincial government and also industry, NGOs and community groups.

Chemical legislation in PNG is inadequately coordinated. However it has been agreed in PNG that DEC retains responsibility for chemicals and pollution management under their mission of environmental protection. However this is complicated by the intention to decentralise some of DEC's present functions to the provinces under the Provincial and Local Level Government reforms. Accordingly with the various legislation given and with such reforms, responsibilities under the various legislation need be clearly defined and delineated, particularly and aptly now under the *Environment Act, 2000.* Manpower and resources, considered by many as insufficient, need also be reviewed.

New regulations and guidelines need to be further developed and gazetted for the Environment Act to cover the most important / high-risk consumer and industrial chemicals. Some standards have been developed but new ones need to be established quickly for use and for discharges / emissions, and written into

guidelines. Safety standards need to be established for exposure. Existing codes of conduct/practice should be written into the law (as for pesticides) and environmental monitoring and auditing of manufacturing industries, as well as extractive ones, made a regular practice. Further codes of practice need to be established. Analytical facilities for basic testing of chemicals need to be established (and maintained!) in PNG. (This is a real obstacle to enforcement of standards). Legislation need to be enforced; compliance needs to be more rigorously and frequently checked. Strategies for obtaining industries to cooperate (be they legal, economic, technical or otherwise) and for environmental auditing need to be developed. Much also still needs to be done to make effective use of economic instruments in PNG. Industry needs to adopt 'best practice', not just compliance Ratification of international mechanisms (treaties, conventions and protocols) need be done and written into our local laws. General education of the public and industry on laws and best practice, and a "political will" for effective chemical management are all necessary prerequisites.

Chapter 7 reviews the main departments managing chemicals in PNG. DEC is the main department responsible for chemical management in PNG. Within DEC most responsibilities for chemical management lies with the Environmental Protection Branch. But many other departments are also involved for specific groups of chemicals or for different stages in the life cycle of such chemicals. Little is documented on their activities.

The only groups of chemicals for which a regulatory process seems to exist in detail and is implemented are pesticides and petroleum chemicals. Presently such a process is still been developed for industrial chemicals and much is been developed on measures to control and prevent pollution especially through the development of codes and standards and inclusion of a requirement for cleaner production in the new Environment Act and under the new regulations. Little has been done to date on consumer chemicals.

In compiling this report the authors came to realise the poor communication and co-ordination between departments in chemical management. Although persons / sections in various departments could be named who had "interests" in various aspects of chemical management, it seemed very little was being done, except in DEC. Here the section dealing with chemicals is poorly staffed and poorly funded, hence there are many constraints on what it can do. The few staff have too many responsibilities, which seems to effect their ability to do any one thing, as they would like. Moreover DEC would appear to need further strengthen their links and communication with other departments involved in chemical management. An audit on chemical management activities by the various departments is needed. The POPs project in 2003 and 2004 has contributed to a limited review by persons within departments of their responsibilities; this must be sustained.

Expertise and information on chemical management outside of government, is covered in **Chapter 8.** It only resides in industry itself and amongst a few academics and professional staff at both the University of PNG and the University of Technology. Trade organisations, trade unions and non-government groups, (with a few exceptions) are at present not active in these areas, and to date have little involved themselves in such, except when it involved matters related to mining.

In **Chapter 9** it was found that existing co-ordinating mechanisms between government departments do not seem to work as effectively as they should. Persons within the different departments do communicate with each other when they feel it appropriate or necessary. However it seems that meetings of co-ordinating committees are few and infrequent, and often key persons do not come. It would appear that most of these committees have not met for years. The POPs project in 2003 and 2004 has contributed to improved co-operation between departments and this must be sustained

Participation by non-government persons in such committees also seems fragmented and infrequent. Ways of broadening industry and NGO representation and participation may be beneficial. Outside organisations whether private or community need involve themselves more with working with the government departments involved. Existing legislation does provide for such private and public participation.

Chapter 10 covers data access and use. On inspection in government departments and libraries there is an abundance of general information on specific chemicals, but pertinent information on other chemicals and in particular on chemicals as used in PNG is hard to access. PNG derived information on chemicals is very difficult to access / locate, and is scattered around many departments or sections in departments and then usually its collection has been done unsystematically so often vital bits of information / documents are missing. Few departments systemically or regularly collect such data and information. The exception is the Internal Revenue Commission / Customs who must by law, but the type or form of information they collect is not always what is needed by chemical managers. Data on specific chemicals groups or chemicals is not available. A plethora of information and databases on chemical management available are relatively easy to access on / avail through the internet and their websites are given. Many of these databases could usefully assist PNG personnel in chemical management. However many government departments do not make use of such information , often because they are not connected to the internet or email, often because phone bills are not paid or for technical reasons. It would seem that very few have made use of the sites and databases listed in the first PNG National Profile.

No scheme presently exists for exchange of information on chemicals in PNG. Improved mechanisms to store, retrieve and exchange information on chemicals need to be developed in PNG.

Chapter 11 covers technical infrastructure. There is still no Government or private laboratory that can do the wide range of analytical tests of the types needed to support the Government's needs in overall chemical management. The intention of Government is to try to ensure that the NARI National Agricultural Laboratory develops the capability of servicing Government functions in the areas of chemical management. Alternatively the National Analytical Laboratory at the University of Technology also needs strengthening. The Government must be prepared to both allocate more funds now and to give a long term funding commitment such that such a laboratory is not only strengthened now but can serve the long term needs in chemical management for the country for the next 20 years and beyond.

Most Government departments have computers. Unfortunately many have limited access to email and the internet, and many are inadequately protected against computer viruses.

The Universities and technical colleges are at presently severely restricted in what they can do because of a severe cut back in their funding by Government, although student numbers continue to increase. Infrastructure and equipment have become severely run down and the purchasing power to buy necessary materials just to keep for example the science laboratories running for teaching, let alone research and consultancies, are limited. This and the reduced number of staff have had a severe impact on the quality of technical and general training and education programmes provided both at the universities and the technical colleges. There is a drastic need for support and funding of the Universities in PNG in general. Two examples are given. In the past overseas funding from UNEP and SPREP provided 'state of the art' chemical analytical and other technical equipment to the universities. Due to lack of funding much of this equipment is now run down and poorly maintained or even obsolete. Funds for other basic supplies of glassware and chemicals and gases have evaporated. In the 1990s AusAID provided support for Environmental Science training and the Environmental Science Programme was strengthened. Reduced funding for such a programme today severely limits what can be achieved. Yet training in analytical chemistry and environmental science are two key areas needed for producing chemical managers , in government, industry and the community.

Websites for international and regional organisations, programmes and bodies involving chemical management are listed; as are websites for international and regional agreements related to chemical management…in **Chapter 12**. The author was able to determine the status of PNG signing and ratifying various international agreements, many through accessing websites. However the authors were unable to determine whether Papua New Guinea has incorporated international agreements into national legislation and implementation activities. The author is however aware that aspects of the Montreal Protocol on Substances that Deplete the Ozone layer has been incorporated into the Pesticide Guidelines now under the Environment Act (CFC containing substances were banned!). Guidelines on this protocol were to be

developed. The intention was also to incorporate aspects of this protocol on CFCs etc. into the draft hazardous chemicals regulations, still to be written. International Organisations, in particular United Nations Agencies assist PNG Government Departments. UNDP, FAO and WHO all have a very active presence in PNG, as do the World Bank and AusAID. International guidelines and standards are often referred to and used where appropriate.

Unfortunately, apart from climate change and pesticides, and now POPs, there seems to be little effective co-ordination at the national level with respect to implementation of international activities and agreements in the area of chemical management. Regular meetings between government departments and / or industry groups to discuss international concerns, for example PIC, PTSs and POPs, do not occur, except on an ad hoc basis and on specific issues (or when a consultant arrives to do a specific task). There appears to be little co-ordination of such activities to do with chemical management.

The author understands there is a mechanism and procedures to ensure co-ordination between ministries / agencies responsible for aid activities and projects that involve the use of chemicals and may cause pollution. The Department of National Planning and Rural Deverlopment and its section overseeing all Aid projects in PNG, together with the Department responsible for the specific project, should liaise with both the Occupational and Environmental Health section of the Health Department, and the Environment Division of DEC. I understand this does occur from time to time. However aid projects have been run in the past in PNG where PNG legislation is ignored - both chemical registration and quarantine requirements.

One of the main obstacles to implementing and incorporating international agreements into PNG legislation, regulations and guidelines over recent years have been the scarcity of trained legal persons working in DEC, and the very few staff working in the appropriate section of Multilateral Division of the Department of Foreign Affairs in areas to do with international agreements. On top of this is the apparent low priorities given by the Government and legislative counsel to such matters, and the time it takes to make the necessary changes in the legislation.

At present many bilateral and multilateral aid projects exist in PNG. An important one that ceased in 2000 related to chemical management was the AusAID Strengthening project but there are others supported by the other AusAID and EC projects both in DAL and DEC. The AusAid program assisted in establishing the new environmental regulatory framework and the Environment Act. The GEF Pilot Project on POPS is now assisting DEC determine what needs to be done in chemical management over the next few years. A necessary co-requisite however is Government allocating more funds and persons to work in these areas; ie give the area of chemical management a greater priority. Across all departments persons responsible for areas related to chemical management are far too few, and all carry enormous responsibilities and often lack experience or lack more experienced officers to counsel them.

In **Chapter 13** it is recognised that all departments and industry should take more responsibility to establish training programmes in safe use and handling of chemicals. Departments and industry should take more responsibility to establish education and awareness raising activities to both increase awareness in the community and the workplace on risks associated with chemicals. Departments need also to improve and enforce better forms of risk communication in the work place and in shops which sell hazardous chemicals. Industries, NGOs and training and educational institutions should do likewise. Better chemical education is needed in schools. Media programmes on chemical awareness need to be initiated. Awareness could be more directed at children and women's groups. Innovative forms of risk communication pertinent to PNG culture and society are needed.

As detailed in **Chapter 14**, at present chemical management and pollution management receives minimal human and financial support at the national level in PNG, and next to no support at the provincial level. This is reflected in the few staff employed whose primary responsibilities seem to be directed toward any aspect of chemical management. DEC is grossly under financed and under staffed. Yet effective implementation of the new environmental regulatory framework depends upon allocation of sufficient

human and financial resources within DEC and both at the national and provincial government level. These problems must be addressed.

Chapter 15 provides recommendations from the national profile for improved chemical management. It provides an action plan for continuing / regular up dating the National Profile and Chemical Management system in PNG (and an action plan / NIP for POPs)……It includes recommendations taken from the end of each of chapters 2 to 14.

In the last few years in PNG the need for better environmental management has been recognised and acted upon particularly at the bureaucratic level. This is reflected in the new strategic plan, the new environmental regulatory framework, and the Environment Act. DEC also recognised this by establishing the GEF Pilot Project on POPs with support from UNEP Chemicals. Now political, private sector and community support is needed to enact these across the country. Institutional capabilities and mechanisms and forms of environmental governance are needed at the provincial as well as national levels. Sufficient financial and manpower resources must be allocated, and new forms of co-operation between Government departments, between government and industry and between government and the community are needed.

One critically important focus in environmental management must be that of chemicals. This revised / second edition National Profile of Chemical Management is an attempt to provide a base from which a more co-ordinated and effective chemical management strategy can be developed. By reading this report it is clear that much still needs to be done. It must involve all stakeholders. That is the challenge!

ACKNOWLEDGEMENTS

This second edition and update of the PNG National Profile on Chemical Management has been made possible because of the GEF Pilot Project on Persistent Organic Pollutants (POPS) project. As part of this project the authors, were given the responsibility to:

- Update the first PNG National Profile of Chemical Management to include / with special emphasis on the Persistent Organic Pollutants (POPS) under the Stockholm Convention on POPs and Persistent Toxic Substances (PTS).existing
- Develop an Action Plan for further work required on the National Profile and Chemical Management systems in PNG.

This second edition of the National Profile of Chemical Management in Papua New Guinea has been prepared principally by David Mowbray, Associate Professor and Strand Leader of the Environmental Science Discipline at the University of Papua New Guinea. Dr Mowbray was the author of the first National Profile of Chemical Management in Papua New Guinea and also has acted as an adviser to DEC on chemical (mainly pesticide) management matters for almost 25 years. Mr Jeffrey Tom, a graduate in Chemistry and Environmental Science from the University of Papua New Guinea assisted Dr Mowbray to collect the information to update the National Profile.

The update has been done mainly in October 2004 to February 2005. Many persons have assisted. Many rename unnamed. They are mainly but not exclusively persons associated with the POPs project, from both inside and outside government. The names of some key contributors are listed in the table below:

Persons involved in contributing information to second edition of the PNG Chemical Management Profile include

	Name	Where from	Contributing Group
	Dr Vele Ila'ava	consultant	Consultancy on Education/ training, research and awareness raising programs
	Ms Cynthia Kenny	Internal Revenue Commission, Customs	Member , NCC POPs Project
	Mr Gedisa Kone	Environment Officer, Department of Petroleum and Energy	Member, Task Team 1 – provided information on petroleum products
	Mr Noel Kuman	consultant	Task team/ consultancy on Inventory and Inventory of POPs and POPs-like chemicals used in agriculture
	Ms Lois Nakmai	Environmental Protection Branch, DEC	Task team/ consultancy on Inventory and Inventory of POPs and POPs-like chemicals used in forestry and industry
	Mr Edward Nicholas	Environmental Protection Branch, DEC	Task team/ consultancy on Inventory and Inventory of POPs and POPs-like chemicals used in agriculture
	Mr Ian Onaga	Department of Agriculture and Livestock	Chairman, NCC -POPs
	Dr Peter Petsul	Chemistry, University of Papua New Guinea	Task team/ consultancy on Inventory of Source Categories and Assessment of Unintentionally

	Name	Where from	Contributing Group
			Produced POPs / furans and dioxins
	Mr Zamzai Sinikupa	Eastern Highlands Provincial Administration	Task Team on DDT used in health.
	Mr Andrew Solien	Logohu Enterprises	POPs Awareness Raising Campaign
	Ms Katrina Solien	Environmental Protection Branch, DEC	National Co-ordinator, POPs Project
	Mr Ben Tolimanaram	PNG Power	Task team/ consultancy on Inventory and Assessment of PCB containing equipment and waste oils
	Mr Robin Totome	Biology, University of Papua New Guinea	Task team/ consultancy on Inventory of Source Categories and Assessment of Unintentionally Produced POPs / furans and dioxins
	Mr Stewart Wossa	Chemistry, University of Papua New Guinea	Consultancy on DDT used in health.
	Dr Benedict Yaru	consultant	Consultancy on Evaluation and Assessment of Chemical Regulatory and Institutional Framework

A full list of participants in the POPS project is included as Appendix Table 1, including those on the national co-ordinating committee which oversaw the whole project and the update of is national chemical management profile. It also includes task team members, consultants and participants at workshops.

This report is as factual as possible for the situation up to December 2004. Any errors of fact or interpretation are the authors' responsibility.

This report, like the first one has been intentionally compiled and written with many gaps and queries. It is intended to serve as an improved baseline assessment of chemical management in Papua New Guinea. The author chose to stick to the UNITAR guidance documents suggested format *so that what is known and what is not known are both clearly visible. However two new chapters incorporating a summary / review of the information collected by the POPs project, and the health and environmental issues are included, hence the new chapters 4 and 5.*

It is the author's intention that this report will be a public document and will be widely circulated in Papua New Guinea amongst all those involved in chemical use and chemical management in the country. It is hoped by the authors that Government departments involved in any way whatever with chemical management in Papua New Guinea, and referred to in this report, will consider seriously the contents of this report, will correct factual errors and provide missing and up dated information to the Environmental Protection Branch of the Environment Division of DEC and to Dr Mowbray (see inside cover).

This updated Papua New Guinea National Profile on Chemical Management includes an action plan on what is still needed to update this Chemical Management Profile. Hopefully the involvement of key stakeholders as listed above will be sustained and that further persons, particularly from the private sector and NGOs become involved.

ABBREVIATIONS / ACRONYMS

Acronym	Name
ADB	Asian Development Bank
ai	active ingredient
ARSAP	Agricultural Requisites Scheme for Asia and the Pacific ; part of ESCAP.
AusAID	Australian Agency for International Development
BFCA	TTC containing boron, fluoride, chromium, arsenic
BHC	organochlorine pesticide (a POP)
BPNG	Bank of Papua New Guinea
CCA	TTC containing copper chrome arsenic
CIRAD	Centre de cooperation internationale en recherche agronomique pour le development
CRAM	Chemical Risk Assessment and Management
CRES	Centre for Resource and Environmental Studies, Australian National University
DAL	Department of Agriculture and Livestock
DAL-NAL	DAL National Agricultural Laboratory
DAL-RS	DAL Rural Statistics
DCI	Department of Commerce and Industry; now Department of Trade and Industry
DDT	organochlorine pesticide (a POP)
DEC	Department of Environment and Conservation
DEC-EP	DEC- Environment Protection
DLIR	Department of Labour and Industrial Relations
DLM	Dr David Mowbray (major author)
DMP	Department of Prime Minister and National Executive Council/NEC
DOH	Department of Health
DOH-EH/OH	Environmental Health Division, Department of Health
DOS	disk operating system
EA	Environment Australia
ECA	Environmental Contaminants Act
EMMP	environmental management and monitoring plan
EO	environmental officer
ENTRI	Environmental Treaties and Resource Indicators Services
EP	environmental plan = environmental impact statement
EPA	Environmental Planning Act
ESCAP	Economic Commission for Asia and the Pacific / United Nations
ES-UPNG or UPNG-ES	Environmental Science Program, UPNG
FAO	Food and Agricultural Organisation / United Nations
FIM	Forestry Inventory Mapping System
HS	Harmonized System
IBMs	computers-most today are IBM clones or Apple MacIntosh.
IDP	now IDP Australia (formerly, International Development Program of Australian Vice-Chancellor's Committee).
IPA	Investment Promotion Authority; part of Department of Trade and Industry

Acronym	Name
IRPTC	International Register of Potentially Toxic Chemicals; now called UNEP Chemicals
IRPTC PC	IRPTC personal computer
kg	kilogram
MASP	Mapping Agricultural Systems in Papua New Guinea
NARI	National Agricultural Research Institute
NARI/PP	NARI Plant Protection
NATA	National Association of Testing Authorities, Australia
NCD	National Capital District; Province that includes Port Moresby
NGO	non government organisation
NISIT	The National Institute of Standards and Industrial Technology; now under Department of Trade and Industry
NPI	National Pollution Inventory
NRPTC	national register of potentially toxic chemicals
NSO	National Statistics Office
OTML	Ok Tedi Mining Limited
PCB	poly chlorinated biphenyl (a POP)
PIC	prior informed consent
PNG	Papua New Guinea
PNGRIS	Papua New Guinea Resource Information System
POM	Port Moresby
POMGH	Port Moresby General Hospital
POP	persistent organic pollutant
PRTR	pollutant release and transfer register
PTS	Persistent toxic substance
SPC	South Pacific Commission, now The (Secretariat of) Pacific Community
SPESD	South Pacific economic and social database / National Centre for Development Studies, Australian National University
SPREP	South Pacific Regional Environment Programme, now Pacific Regional Environment Programme,
ton	2240 lbs = 1016 kg (long ton) or in US = 2000 lbs = 907 kg (short ton)
tonne	metric ton = 1000kg
TTC	timber treatment chemicals
UNEP	United Nations Environment Programme
UOT	PNG University of Technology, Lae
UOT-NAL	UOT National Analytical Laboratory
UPNG	University of Papua New Guinea, Port Moresby
WCO	World Customs Organization
WHO	World Health Organisation / United Nations
WHO-PEPAS	Now Environmental Health, WHO Regional
WRA	Water Resources Act

Further abbreviations and acronyms are given in tables in chapters 8 and 10 where organisations and mechanisms are named with their appropriate websites.

INTRODUCTION and AIMS of PAPUA NEW GUINEA

NATIONAL CHEMICAL MANAGEMENT PROFILE (second edition)

Background[1]

(modified from first edition with additions)

A general agreement was struck by all participating nations at the 1992 United Nations Conference on Environment and Development to achieve sound management of chemicals by the year 2000. Papua New Guinea is one of the countries that signed both the *Rio Declaration (Earth Charter*) and *Agenda 21*. Chapter 19 of *Agenda 21* outlines strategies / goals…towards achieving such a goal. Chapter 19 is titled "Environmentally Sound Management of Toxic Chemicals including Prevention of Illegal International Traffic in Toxic and Dangerous Products".

International commitments to Agenda 21 have been reaffirmed at both New York in June 1997 and at Johannesburg in August 2002.

The 1994 Stockholm Conference on Chemical Safety established the "Inter- Governmental Forum on Chemical Safety " or IFCS, through which countries discuss activities and priorities for the sound management of chemicals, and to develop mechanisms for the implementation of the recommendations in Chapter 19 of Agenda 21. In 1995 FAO, ILO, OECD, UNIDO, UNEP and WHO established the "Inter-Organization Programme for the Sound Management of Chemicals " or IOMC, whose task was to co-ordinate activities in the area of sound chemical management.

Since the late 1980's several international policy instruments have been adopted which address specific aspects of chemical management. These instruments include for example:

- UNEP London Guidelines for the Exchange of Information on Chemicals in International Trade (as amended in 1989)
- FAO International Code of Conduct for the Distribution and Use of Pesticides (as amended in 1989)
- ILO 1990 Convention on the Safety of Chemicals at the Workplace (No 170)
- ILO 1993 Convention Concerning the Prevention of Major Industrial Accidents (No 174)
- the Montreal Protocol on Substances that Deplete the Ozone Layer (entry into force 1993)
- Kyoto Protocol to the UNFCCC, ratified in 2002.
- Stockholm (POPs) Convention, adopted by PNG in May 2001 (entry into force in May 2004).

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[1] Parts of the text are taken from the UNITAR Guidance Documents
United Nations Institute for Training and Research (UNITAR), 1996. *Preparing a National Profile to Assess the National Infrastructure for Management of Chemicals. A Guidance Document*. Inter-Organizational Programme for the Sound Management of Chemicals (IOMC). The latest version is now available at internet site: http://www.unitar.org/cwm/publications/npdoc/index.htm
United Nations Institute for Training and Research (UNITAR), 2003. *Preparing / Updating a National Profile as part of a Stockholm Convention National Implementation Plan..Companion Guidance Notes, Working Draft January 2003.*. Inter-Organizational Programme for the Sound Management of Chemicals (IOMC).

- Rotterdam Convention (PIC) Convention, (entry into force in September, 2004).

The General Assembly of the United Nations by Resolution 44/226 adopted resolutions and conventions which address the management of chemicals, for example on "Traffic in and Disposal , Control and Transboundary Movement of Toxic and Dangerous Products and Wastes". The Basel Convention was adopted in 1989 and is in full called " Convention on the Control of Transboundary Wastes and their Disposal". A similar regional convention signed by PNG is the Waigani Convention, agreed to by South Pacific countries in September 1995. Fourteen of 16 Forum countries signed the text. The Waigani Convention came into force in October 2001.

There are now many such international and regional conventions and agreements.

One such mechanism aimed to ensure implementation of Chapter 19 of Agenda 21 is to assist countries to establish and implement their own national programmes for the sound management of chemicals, a scheme or schemes covering agricultural, industrial and consumer chemicals. Chapter 19 of Agenda 21 lists basic elements of such programmes to include

- adequate legislation
- information gathering and dissemination
- capacity for risk assessment and interpretation
- establishment of risk management policy
- capacity for implementation and enforcement
- capacity for rehabilitation of contaminated sites and poisoned persons
- effective educational programmes
- capacity to respond to emergencies

In Papua New Guinea the only general and published reviews of chemical management up to 2000 were those published in Volume 4 of the Waigani Seminar Proceedings held in August 1993, by Mowbray, Grant & Windridge (1996) and by Singh (1996). Part of the Waigani Seminar recommendations also covered chemical management (Department of Environmental Science UPNG & NEC, 1993)).

A necessary precursor for effective chemical management is for each country to develop a *National Chemical Management Profile*. In 1995 UNITAR under the umbrella of IOMC and in close co-operation with IFCS initiated a programme to assist countries to develop their own *National Profiles*. [2] Accordingly UNITAR produced *Guidelines* for countries to develop such a *Profile*.[3]

Using these Guidelines the first edition of the Papua New Guinea National Chemical Management Profile was published in September 2000 with the assistance of SPREP and Environment Australia.

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[2] More information can be got from the National Profile Homepage at http://www.unitar.org/cwm/nationalprofiles/ . As of 19th December 2005 48 countries have their National Profiles on the web including PNG. The UNITAR website dated 2003 staters that both Tonga and Vauatu have completed their National Profiles, Though they were not on their website. Both Kiribati and Samoa's National Profiles were "still in preparation".

[3] United Nations Institute for Training and Research (UNITAR), 1996. *Preparing a National Profile to Assess the National Infrastructure for Management of Chemicals. A Guidance Document*. Inter-Organizational Programme for the Sound Management of Chemicals (IOMC). The latest version is now available at internet site: http://www.unitar.org/cwm/publications/npdoc/index.htm

The Intergovernmental Forum for Chemical Safety also affirmed that … "countries should continuously update national profiles, using the UNITAR/IOMC guidance document, with the involvement of all concerned parties, and to use conclusions based on these assessments to define priorities to be addressed through national action programmes for strengthening chemicals management…"

National Objectives and Anticipated Benefits of Preparing the Profile

The major objectives in preparing a national profile is to

- assess / evaluate the national infrastructure for the management of chemicals
- determine our current capabilities and capacity for management of chemicals
- to determine areas of specific improvements

The fourth of the Five Directive Principles and Goals of the Papua New Guinea Constitution is titled "Natural Resources and Environment", and it states

> **Papua New Guinea's Natural Resources and Environment should be conserved and used for the collective benefit of all and should be replenished for future generations**

There are many ways by which Papua New Guinea's natural resources, such as fisheries, forests and water etc and the environment as a whole can be put at risk, amongst such risks is the production, use and disposal, and spillage and emission of dangerous and toxic chemicals. If they are not managed properly they will be detrimental to the environment and to human health.

To conserve and protect the environment from dangerous chemicals we must ensure that there exist environmentally sound schemes for managing dangerous and toxic chemicals. Such schemes must be formulated within the framework of the principles of ecologically sustainable development accounting for sustainable livelihoods, ecological integrity and improved quality of life.

Accordingly, as an important step toward building an improved and strengthened chemical management scheme in PNG, this National Chemical Management Profile has been developed with the objectives listed below. It is anticipated that this National Chemical Management Profile document will assist to strengthen the existing chemical management system in PNG both at the national and provincial levels, and in the workplace, the marketplace and in homes; and at the same time serve to facilitate important national social and economic and trade objectives.

The UNITAR Guidelines (pages 21-22) suggest that the benefits of developing such a National Chemical Management Profile are as follows;

Improved Efficiency of Government Operations

- to provide practical information on on-going programmes and activities in the country which are concerned with the management of chemicals.
- to establish a process which can facilitate the exchange of information and dialogue amongst government ministries concerned with the sound management of chemicals, and to assist ministries in learning from each other's experiences as a basis for improved co-operation.
- to strengthen national decision-making capabilities related to the management of chemicals.
- to facilitate the exchange of information and dialogue between government and parties outside of government such as industry, and non-governmental organisations (NGOs).
- to establish an authoritative document which can serve as a basis for further efforts to strengthen the national system for the management of chemicals through the involvement of all concerned parties.

Social Benefits

- to provide a basis for improved worker, public and environmental protection as a consequence of improved knowledge and understanding of potential problems and an alternative means of addressing them.

- to provide a basis of improved awareness of chemical risks among workers and the public and help to develop a national safety culture.
- to establish a national dialogue on chemicals, safety and management involving all concerned parties and sectors of society.

Economic / Trade Benefits

- to facilitate trade in chemicals, and agriculture and industrial products which rely on chemicals.
- to help ensure that chemicals produced, imported and exported are supporting economic goals and are not creating economic burdens through health, environmental and safety problems.
- to provide awareness of potential pesticide residue problems which could limit opportunities for agricultural exports4
- to indirectly improve the productivity of workers through improved worker safety

More Effective Participation in International Activities

- to ease compliance with international and regional reporting schemes in a consistent and efficient manner
- to facilitate communication among countries, which will permit improved learning from others' experiences and lead to increased co-operation.
- to provide a basis for identifying needs for technical and financial assistance and for mobilising assistance resources available from international and bilateral sources

The purpose of the Papua New Guinea National Chemical profile is to

- to document the chemical and chemical management situation in Papua New Guinea,
- to include specific reference to persistent organic pollutants
- to identify problems and potential problems related to chemical management,
- to identify existing or possible mechanisms which might be available to address these problems
- to make recommendations.

The National Profile will also help

- to identify important gaps or weaknesses in the existing systems as a first step in defining where further steps may be required, and
- to determine priorities for future action
- to develop a National Implementation Plan as required under the Stockholm Convention.

The Profile will also serve as

- an awareness tool to determine / expose what different departments and organizations are doing in terms of chemical management, particularly where such activities are presently little known, and
- a means to establish and clarify the different roles and functions of the various government agencies in the area of chemical management.

[4] (Not appropriate for PNG? Author's comment)

The Profile should also

- facilitate exchange of information and dialogue amongst government ministries and other concerned organizations and the community on what needs to be done to improve chemical management

Purpose of the Second Edition

This is the second edition of the PNG National Chemical Management Profile. It is part of the process of us re-evaluating chemical management in PNG. The purpose of this second Papua New Guinea National Chemical profile is to update the situation of five years ago when the first edition was produced. It is crucial that further feedback be received with input from all government bodies, industry and community groups involved in chemical management in Papua New Guinea as soon as is feasible.

This second edition has also been prepared as part of the process of Papua New Guinea fulfilling its obligations as a Party to the Stockholm Convention on Persistent Organic Pollutants. It also aims to incorporate information on POPs and POPs related chemicals into the profile. It is being prepared as part of the process of PNG developing its own National Implementation Plan. The update of the national profile is a fundamental component of the POPs National Implementation Plan.

The recently adopted Stockholm Convention of Persistent Organic Pollutants (POPs) calls for countries like Papua New Guinea (PNG) that have ratified it to develop their National Implementation Plans on the management of Persistent Organic Pollutants. This involves updating their National Chemical Management profile. The PNG POPs Subproject has commenced to establish an inventory of the POPs and POPs-like chemicals and to assess their management in the country. This is covered in Chapter 4.

The management of chemicals, in many industries has not been regulated properly or in a comprehensive manner at the national level due to a number of reasons among them the lack of implementation of legislation, overlaps and/or duplication of responsibilities, and lack of awareness and concern about hazardous chemicals in PNG. Some of these have been highlighted in the existing National Chemical Profile (1997-2000) (Mowbray 2000). Although, some industries may have their own policies in place, the national legal framework has not been fully developed to allow for a comprehensive mechanism that would ensure proper management of chemicals and their wastes at all levels of society. This has led to chemicals entering the country without proper and informed clearance procedures and wastes and obsolete stockpiles being dumped without proper "Duty of Care" and with no monitoring of such activities. In addition, the absence of a proper inventory or database in the country, means that the control and management of these substances is an almost impossible task. There is, at present neither a proper inventory of [hazardous] chemicals nor information on their distribution or the fate of obsolete stockpiles and wastes in the country.

The past decades did not see any real regulatory framework covering hazardous chemical substances. The principal Act governing the importation, exportation, use, manufacture, handling and disposal of hazardous substances was the Environmental Contaminants Act 1978. It was never adequately implemented. It has now been integrated into the Environment Act 2000, effective from January 2004,

Where no proper management controls are in place, some chemicals brought into the country for specific purpose, there continues to be a potential for misuse in areas other than those intended for.

The *objective of* this exercise is

- To update the existing National Profile using the UNITAR Guidance Notes and develop an action plan for maintaining a “national profile on chemicals management” with the aim to protect human health and the environment.

This involves a reviewing, correcting and up dating information. It involves incorporating into this document all pertinent data and information (as suggested in the UNITAR Update Guidance Notes).

How the Second PNG National Profile was Prepared

This second national profile was prepared as part of the GEF Pilot Project on POPs, run under The Department of Environment and Conservation. The POPs project has run from 2002 to 2005. Many meetings have been held involving a large number of people, though mainly government personnel.

A key meeting was that held in Lae in September 2003 where Task Teams were formed to collect the required information for developing the PNG POPs National Implementation Plan. Some task teams were very active and collected much information through 2004. Others did very little due to various constraints. In mid 2004 a series of consultants were selected to work with the tasks teams to collect the required information. Some consultants started their tasks then, others started in early November 2004. Much information were collected by the various consultants working co-operatively throughout November and December 2005., and in January 2005.

This update to the National Profile was prepared from October 2004 to February 2005. The information obtained in this period was compiled and incorporated as amendments or new materials into the existing national profile. This was done by Mr Jeffrey Tom and Dr David Mowbray . Many persons were involved in collecting and providing the information to us in this period. Most were associated with the POPs Project. Dr Mowbray and Mr Tom decided to initially collect general background data and information from Government departments and key organizations and so replace all outdated background information, particularly that in chapter 1 (PNG national background) and chapter 2 (chemical production, import, export and use). Mr Gidesa Kone collected information on petroleum chemicals. For other chapters, relevant information was also collected by visiting or interviewing persons and with the help of the various consultants. Key persons who assisted are listed in Table under Acknowledgements. This was done to verify or update the current status of chemical management as portrayed in the original national profile. Where necessary changes have been made. In many places the situation remains the same so much of the text of the original profile remains the same. Websites given in the first profile have been checked and where necessary modified and corrected. A few new sites have been added.

Each of the consultants also produced assessment reports submitted to the POPs project in December 2004 and January 2005. Their reports are listed under “References and Bibliography”. The various reports produced by all consultants were then evaluated and summarised and important information included into the National Profile. Their proposed action plans for each key area are reported in the separate POPs reports. On the basis of the National Profile and the POPs reports a National Implementation Plan has been prepared for POPs chemicals in PNG. Information from these reports are incorporated into Chapter 4.

Chapter 1. Papua New Guinea: National Background Information.

This chapter provides general background information on Papua New Guinea. It provides information on the overall geography, and demographic, political and economic situation in the country, and the development objectives of the country. The agricultural, forestry, industrial and mining characteristics of the country's economy are also outlined. Allocation by government for the Department of Environment and Conservation is given in proportion to total funds allocated in the yearly budget. It is within this context that the PNG environment, and chemicals in particular, need to be managed.

Papua New Guinea5 is a socially complex, resource rich developing country undergoing rapid change. Unfortunately many of the economic, social and environmental indicators are not good. PNG ranks low on the UNDP list of countries with medium human development. A summary of some interesting economic, social and environmental indicators for Papua New Guinea is given in Table 1.1.

A brief background providing the context of chemical management in PNG follows.

1.1 Geography

Papua New Guinea (PNG) is a group of 600 islands including the eastern half of the island of New Guinea placed between the Coral Sea and the South Pacific Ocean, east of Indonesia and north of Australia. See Figure 1.1. Papua New Guinea has a total land area of 462,840 square kilometers. 360,000 square kilometres (78%) are covered in forests. The total sea area of PNG is 3,120,000 square kilometers with a coastline totaling 17,110 km and has a land boundary of 820km with the Indonesian Province of Papua (formerly Irian Jaya).

The climate is tropical and is generally hot and humid but varies dramatically throughout the country. Typically there is a northwest monsoon (December to March), with a southeast monsoon (May to October) and slight seasonal temperature variation. Annual rainfall varies from over 8000mm in the Star Mountains of Western Province to only about 1150mm in Port Moresby. Temperature generally remains between 20 and 32.5oC but can get to as low as 5oC in the highlands. The country is mostly mountainous with the mainland having a central cordillera and with coastal lowlands and rolling hills. Large rivers flow down from these mountains, the Fly and Purari to the south coast, and the Sepik, Ramu and Markham to the north coast. The highest mountain is Mount Wilhelm of height 4509 m.. Some of the islands are mountainous and many are low lying coral atolls. PNG is subject to frequent severe earthquakes, landslides and occasional volcanic eruptions. Papua New Guinea has very high biodiversity6 with a remarkable variety of landscapes, ecosystems and species. It is ranked as one one the world's top 20 megadiverse countries, within some groups 90% endemism. The coasts include species-rich mangroves, lagoons, wetlands, coral reefs and atolls. The lowland rainforests are highly diverse with other common vegetation types including savannas, swamps, semi-deciduous forests, low to high mountain forests, grasslands and small areas of high alpine vegetation. About 70% of PNG remains forested. Traditionally plant species have been used for subsistence and traditional activities and continue to provide much of the population with their basic needs for building materials, food, medicines and cultural activities.

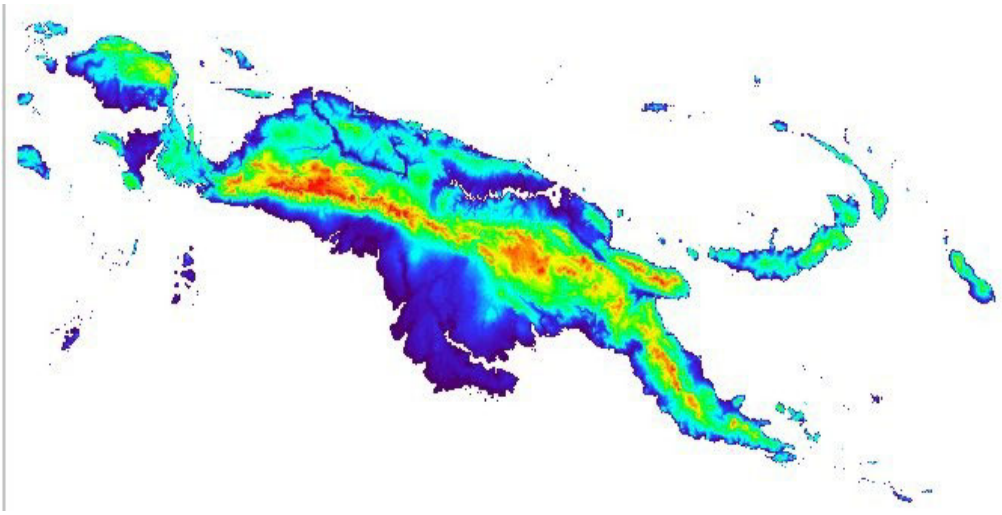
[5] There is a plethora of general information that is easily obtainable on PNG. General information on Papua New Guinea can be got from many websites These are listed in Bibliography and in Appendix 2.
[6] Refer PNG Country Study on Biodiversity (Sekhran & Miller,1994)

Table 1.1 Some Economic, Social and Environmental Indicators for Papua New Guinea

Indicator	Unit	Year	Measure
Human Development Index	No unit	2002	0.542 ; rank = 133/177
Population size	million	2002	5.6
Population density	Persons per 1000 hectares	2000	110
Urbanisation	%	2002	13.2
Contraceptive prevalence	Any method/ %	1990-98	26
Women in Government	Seats in parliament held by women	2004	0.9
Poverty rate	Measured as human deprivation index	1996	43.7
Poverty rate	Measured as human poverty index (HPI-1) – as %	2002	37; rank = 62
Infant mortality rate	Per 100,000 live births	2004	79
Life expectancy at birth	years	2002	57.4
Gender-related Development Index	No unit	2002	0.536; rank = 106 / 144
GNP per capita	US$	2004	530
Average Annual Growth Rate of GDP	%	1990-2002	0.5
Average Annual Growth Rate of GNP	%	1975-95	0.7
Agriculture and Forestry as a % GDP	%	2002	27.6
Manufacturing / construction industry as a % GDP	%	2002	12.9
Petroleum & Mining as a % GDP	%	2002	25.8
Services / services sector as a % GDP	%	2002	33.7
Population without sustainable access to an improved water source water	%	2000	58
Energy consumption	Petajoules/ commercial + traditional	1995	96
Fertiliser consumption per cropping area	Kg ha-1 a-1	1994	30
Public Expenditure on Health	% GDP	1996	2.8
Military expenditure	% GDP	1996	2
Food Intake	Daily calories supply per capita (kilocalories)	1996	2253
No of doctors -	Physicians or doctors per 100,000	2003	0.6
HIV/AIDS	AIDs cases per 100,000	1997	6.8
Carbon dioxide emissions	Million tonnes	1996	2.4
Greenhouse Index	Share of global CO2 emissions	1996	0
Total freshwater withdrawals annually	Cubic metres per capita	1987-95	28
Deforestation	Average annual rate of deforestation	1990-95	0.4
National Protected Areas	% all protected areas –0 IUCN categories I- V of total land area	1996	0.1
% mammals at risk/ threatened	No at risk over no of species known	1990s	26.7
% birds at risk/ threatened	No at risk over no of species known	1990s	4.8
%higher plants at risk/threatened	No at risk over no of species known	1990s	1

Sources are UNDP (1999, 2004); WRI et al. (1998), Office of National Planning (1999 #39.)

Figure 1.1 Map showing island of New Guinea



Map shows terrain / physical features. PNG comprises the eastern half of the island. The western half is the Indonesian province of (West) Papua (formerly Irian Jaya). Map is a DEM provided by Mike Hutchinson and Janet Stein of CRES and is a digital elevation model (DEM) constructed for CRES/PNG Biorap Programme, 1997

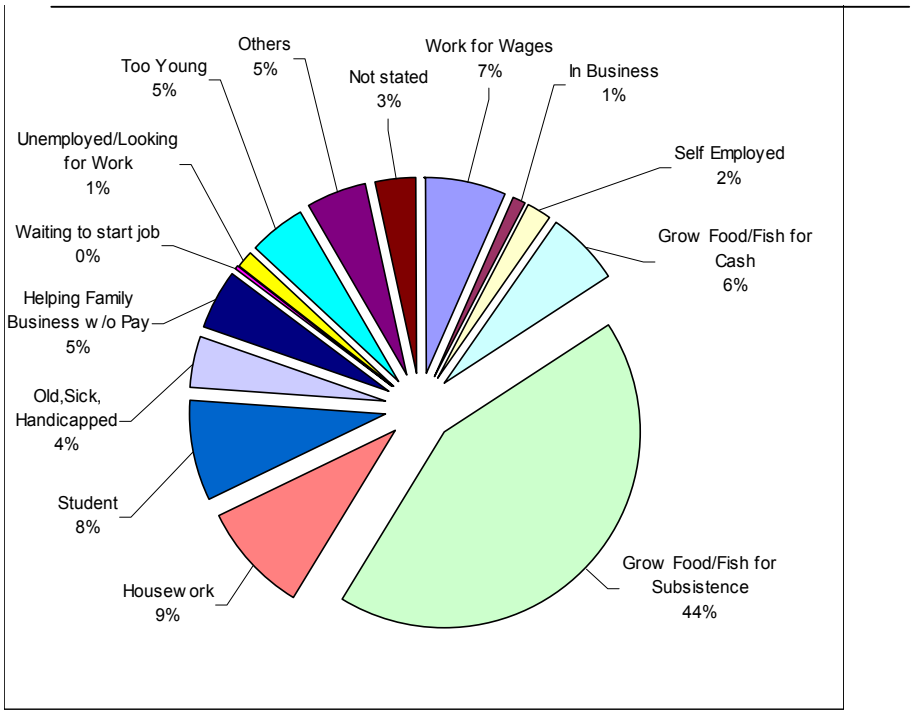
1.2 Population

Papua New Guineans represent a wide variety of cultural groups, collectively described as Melanesians. Papua New Guinea had an estimated population in 2000 (Census) of 5.2 million people giving a population density of about 11 persons per square kilometre, with 40% below 15 years of age and a current population growth rate of 2.7 per annum (1980-2000), total fertility is 4.6 children born per woman, infant mortality rate of 64 per 1000. The average age of the population is about 24 years. Life expectancy is about 54 years with only about 2.4% older than 65 years. 13.1 % of the population live in urban areas, the largest town being Port Moresby estimated to have a population in 2000 of 250,000. There are 715 indigenous languages with 40% literate in English, 45% in Tok Pisin (pidgin), 5% in Motu and 42% in Tokples. Literacy in at least one language is 51% in females and 61% in males averaging 56% overall. UNDP (2004) gives literacy a value of 64.6% for 2002. English is the medium in all schools after the 3rd year of schooling. English is the official language for formal business activities, the education system, government bureaucracy and the mass media, though Tok Pisin is being used more and more in these areas. Motu is only spoken in the Papuan region. The working age of the population ranges from 15-60 years and covers 58% of the population, though only about 270,000 people are employed in the formal sector, the rest being either in non-formal employment and most being subsistence farmers.

Few people who commence school continue on to tertiary institutions including, universities. Women particularly are disadvantaged. There are still very few PNGians with schooling and qualifications beyond grade 10. The education system is PNG is changing to try and rectify this situation with many community schools now teaching to grade 8 and provincial high schools teaching to grade 12. They are now six universities in the country offering a range of tertiary programmes.

Figure 1.2 diagrammatically shows what most people say they do for a living / livelihood in PNG. Most are subsistence farmers and village folk.

Figure 1.2 What people say they do



1.3 Political Structure and Development Objectives[7]

PNG is a parliamentary democracy. It achieved political self-independence from Australia on the 16th September 1975. PNG is a member of the Commonwealth of Nations. There is a Governor General who represents the Queen as the head of state but he only plays a ceremonial role. The political leader and head of Government is the Prime Minister. There are 109 elected members of the national parliament. The capital of the country is Port Moresby. The country is divided into twenty provincial governments, but within each are lower level or local government councils. This is shown in Figure 1.3 with gives also provincial capitals. The 20 provinces are: Central, Eastern Highlands, East New Britain, East Sepik, Enga, Gulf, Madang, Manus, Milne Bay, Morobe, National Capital, New Ireland, North Solomons (Bougainville), Oro (Northern), Simbu (Chimbu), Southern Highlands, West Sepik (Sandaun), Western, Western Highlands, and West New Britain. For convenience the provinces are often grouped into four regions: Southern or Papuan, Highlands, Islands and New Guinea Mainland, the last also called Northern or Momase.

Papua New Guineans have long placed great emphasis on "localisation "of government employment and the decentralisation of many government functions, particular in health, education and agriculture to the 20 provincial governments.

PNG is proud of its National Constitutions that boast Five Directive Principles and Goals as its major development goals. These are outlined in Box 1.1.

[7] Useful reference on PNG development is Connell (1997).

Box 1.1. The Five Directive Principles and Goals of the PNG National Constitution

1. Integral Human Development

Every person should be dynamically involved in the process of freeing himself or herself from every form of domination or oppression so that each man and woman will have the opportunity to develop as a whole person in relation with others.

2. Equality and Participation

All citizens should have an equal opportunity to participate in and benefit from the development of our country

3. National Sovereignty and Self-Reliance

Papua New Guinea should be politically and economically independent and our economy should be basically self-reliant.

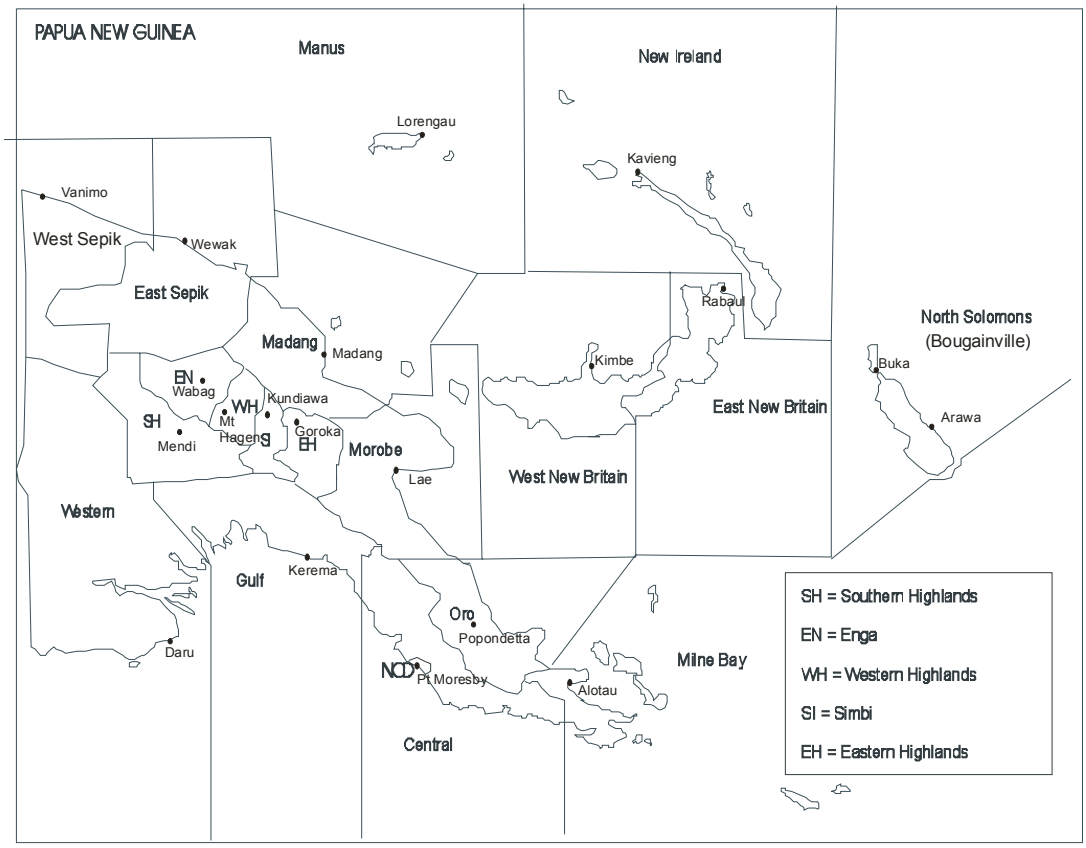
4. National Resources and Environment

Papua New Guinea's natural resources and environment should be conserved and used for the collective benefit of all and should be replenished for future generations.

5 Papua New Guinean Ways

Papua New Guinea should achieve development primarily through the use of Papua New Guinean forms of social, political and economic organisations.

Figure 1.3 Map showing Papua New Guinea's provinces and majors towns



1.4 The Economy

PNG has a large informal base principally relying on agriculture and a small formal base.

Agriculture is one of the most important economic activities in PNG, for the most part practiced on a subsistence level. It is said most Papua New Guineans are farmers! Coconuts, sweet potatoes (kaukau), bananas and yams are the most important subsistence crops. Other important staple crops are taro, potato, sago, and cassava. Betel nut and betel peppers are very important crops grown as a mild drug important culturally in PNG. Agriculture provides a subsistence livelihood for 84% of the population.

The cash economy of PNG is resource based although exploitation is constrained by the rugged terrain and the high cost of developing infrastructure. Agriculture, forestry, fisheries, mining and petroleum make up the primary sector and contribute half the nation's wealth, when measured in terms of gross domestic product (GDP). See Figure 1.4. The total GDP for 2002 was K10.9 billion . In 2002 the primary sector was projected to contribute approximately 53%, followed by the tertiary or service sector contribution of 34% and the secondary sector consisting of manufacturing and construction only 13%. This proportion has remained relatively constant over the last few years. Budgetary support from Australia and development aid under World Bank auspices has helped sustain the economy. The GNP per capita in 2000 was K 1900 (US$700), placing PNG among the lower middle income countries.

In the primary sector, agriculture continues to be the most important source of GDP for the country. Agriculture in this case is mainly tree crops cultivated for cash income. The major tree crops being coffee, cocoa, copra and palm oil. Agricultural together with forestry and fisheries has contributed 28% of GDP. The major contributors are oil palm, logs, coffee and cocoa.. The mining and petroleum sector also had a large share in the overall component of the GDP, contributing 26% of GDP.

The secondary sector that contributed 13% to the gross domestic product was mainly manufacturing (9%) and construction (4%). This sector is to a large extent overlooked in terms of it's potential. Since Papua New Guinea lacks comparative advantage in manufacturing and much of its exports are raw materials, the secondary sector is undeveloped. PNG has been described as a country undergoing urbanisation but without industrialisation.

The tertiary or services sector contributed 34% towards the GDP of PNG. This sector consists of commerce (9%), electricity and other services (1%), transport and storage (5%) finance, insurance, real estate and business services (4%), community and social services (13%) and import duties of (2%).

Mining of mainly copper, gold and silver, together with petroleum now constitutes the major export earnings for PNG. See Figure 1.5. Total export earnings for 2002 was K6.4 billion. The mining and petroleum sector account for about 75% of export earnings . However despite its much higher contribution to export earnings and its high contribution to GDP mining and petroleum employ far fewer people than do agriculture and the manufacturing sector. This is discussed in section 1.7. Agriculture crops, forest logs and marine products constitute most of the rest. Few manufactured products are exported.

The PNG economy has gone through a crisis in recent years. This is probably well illustrated by the decreasing value of the kina against both the US and Australian dollars since 1975. The value of the kina was highest against the Australian dollar in 1987 when K1.000 =AUS$1.579, but highest against the US$ back in 1980 when K1.000 = USD$1.553. Today the kina is AUS$0.40 and US$0.31.

Figure 1.4 Sectoral share of real GDP, expressed as a proportion for 2002

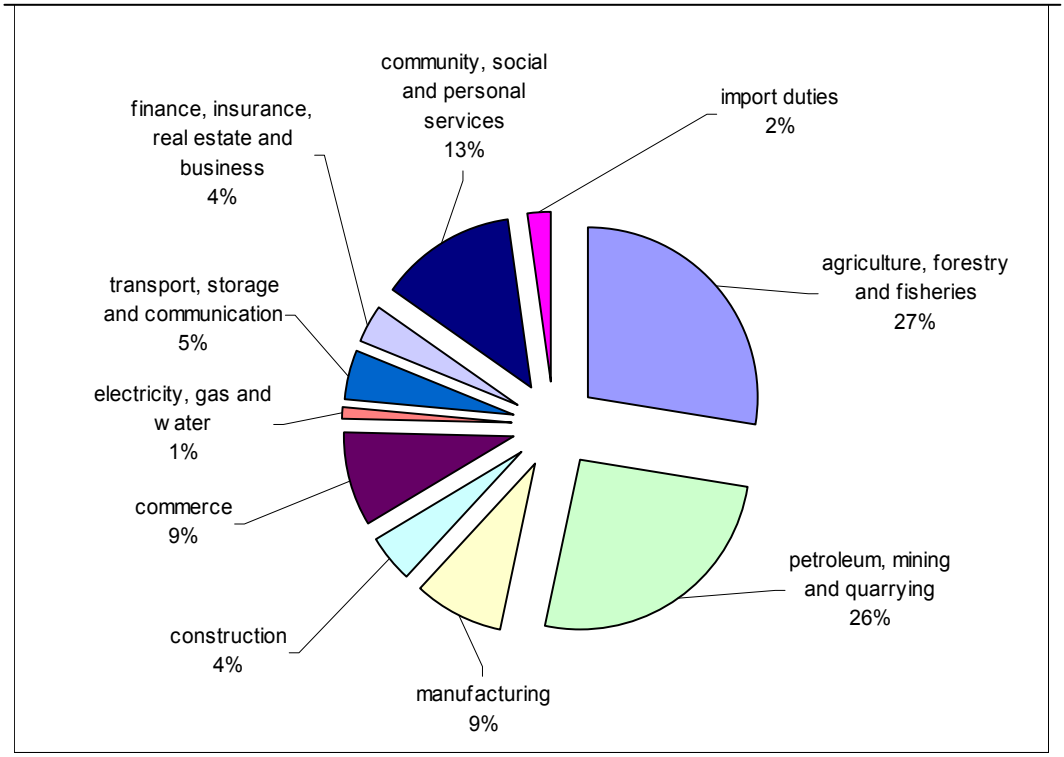
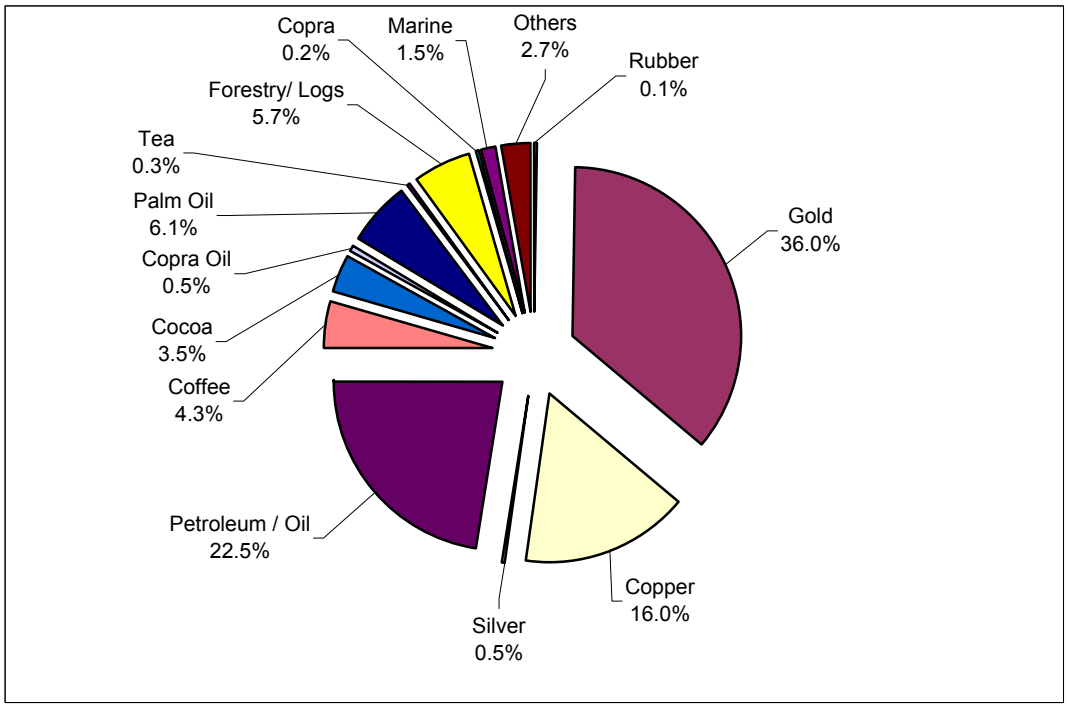


Figure 1.5 Export value for commodities, expressed as a proportion of whole, 2002



1.5 The Economy and HDI[8]

GDP for the decade to 2002 increased at an annual rate of only 1.1%. With a GDP per capita of US$523 or as PPP$ 2270 in 2002, PNG ranks low in terms of its comparison in other social indicators such as the UN's Human Development Index (HDI). Though the country's GDP per capita is above it's Melanesian neighbour of the Solomon Islands (US$541) its HDI is lower. It is also less than its two Asian neighbours of Indonesia (now US$ 817) and Philippines (US$975), whilst Vanuatu is US$1138 and Fiji is US$2281. Its Human Development Index is much lower than most South East Asian countries and its Pacific neighbours. (Table 1.2)

Unfortunately PNG's expenditure on education (particularly higher education – which has been drastically reduced for the last 7-8 years), health and services sector in its yearly budgets does not reflect better outcomes on the nations ranking in the UN's human development index. According to the UN's 2004 Human Development Report Papua New Guinea ranks 133rd out of the 177 countries. This ranking is well below most of Papua New Guinea's neighbours in the South East Asia and Pacific region (refer to Table 1.2).

Table 1.2 also gives data on the associated measures which are used in calculating the HDI. PNG's placing on the HDI clearly shows that although PNG has large resource base in terms of mining and petroleum, forestry and agriculture which contributes to the increase in it's GNP, the country has failed to translate it's relatively high per capita income into corresponding levels of human development.

Table 1.2: Human Development Index of PNG and other South East Asian-Pacific countries. (ranked according to HDI). (data are 2002 data)

Country(*)	Human Development Index(HDI)**	Educational Enrolments	Adult literacy (%)	Life expectancy at birth (years)	Adjusted real GDP per capita (PPP$)
Australia (3)	0.946	100	99.0	79.1	28,260
Japan (9)	0.938	84	99.0	81.5	26,940
New Zealand (18)	0.926	100	99.0	78.2	21,740
Singapore (25)	0.902	87	92.5	78.0	24,040
Malaysia (59)	0.793	70	88.7	73.0	9.120
Tonga (63)	0.787	82	98.8	68.4	6,850
Samoa (Western) (75)	0.769	69	98.7	69.8	5,600
Thailand (76)	0.768	73	92.6	69.1	7.010
Fiji (81)	0.758	73	92.9	69.6	5,440
Philippines (83)	0.753	81	92.6	69.8	4,170
Indonesia (111)	0.692	65	87.9	66.6	3230

[8] Key references here are UNDP's 2004 Human Development Report (UNDP, 2004) and PNG's 1998 Human Development Report (Office of National Planning, 1999)

Solomon Islands (124)	0.624	50	76.6	69.0	1,590
Vanuatu (129)	0.570	59	34.0	68.6	2,890
PNG (133)	0.542	41	64.6	57.4	2,270
Bangladesh (138)	0.509	54	41.1	61.1	1,700
Timor-Leste (158)	0.436	75	58.6	49.3	-

Source: UNDP (2004) pp. 139-142 (data for 2002)

* is HDI rank for 2004 for 177 countries. ** HDI is an indicator derived from adjusted GDP, educational attainment, adult literacy and life expectancy.

PNG has lacked the mechanism to translate its wealth into a better and more sustained level of human development. Spending on education, health and other government services has not brought forth better results. PNG's adult literacy rate in 2002 was given by UNDP to be 64.6% (although it is probably more likely to be around 56% (from 2000 census), a combined (first, second and third) level of gross educational ratio of a low 41% and a life expectancy at birth of 57.4 years.

In terms of education and literacy PNG's human capital is low compared with countries of the same income level. Though in relation to some Asian and Pacific countries it's allocation of GDP to education is higher, yet it's returns are not. Some explanations to these low returns are the rate of dropouts from the education system at early stages, and the restricted opportunities in tertiary and technical education and in the formal employment sector. This has resulted in semi literate populations of persons with high expectations and disaffection, in many instances leading to the horrific crime situation in particular in the urban areas and in some geographic regions of the country.

1.6 Disparity in Income and HDI within Papua New Guinea

The distribution of income and living standards in Papua New Guinea is uneven. The uneven development in the provinces is reflected in the data in Figure 1.6 taken from the Papua New Guinea Human Development Report (Office of National Planning, 1999)) which reflects the inequity between provinces present still today. This shows the HDI value for each province, though the HDI has been calculated using a different method to that by UNDP. Full details are provided in the first chapter of the first chemical management profile (Mowbray, 2000). The highest HDI values are for National Capital (Port Moresby) and those provinces which have commercial mining or logging activities and cash crops. Those with the highest HDI are Western (with Ok Tedi), and the islands provinces with the highland and Sepik provinces lowest. Human development indices remain low in areas where people heavily rely on the informal sector or non-market sources of income. High dependence on subsistence sources of income in PNG provinces indicated poor infrastructure facilities, with a consequent poor delivery of health and educational services. Inversely provinces which income generating activities have better facilities such as bridges and roads hence get good health and educational facilities and so tend to perform better than those relying heavily on subsistence activities.

Many PNG people can be regarded as extremely poor. Table 1.1 gives a value for poverty for PNG measured as the Human Deprivation Index. For PNG as a whole the value is 43.7. Its range varies from a low of 14.5 in National Capital to 60 in West Sepik. The higher value reflects early death, lack of knowledge/exclusion from world of reading and communication, and a low living standard ie without adequate access to safe water, health services and have underweight children under the age of 5 (NPO, 1998). This in effect is a measure of Poverty. UNDP ranks PNG as 62 for developing countries with a Human Poverty Index of 37% (UNDP, 2004). The state of being poor in PNG is often defined in terms of cash income. Rural and village people regard themselves poor only due to their narrow income base. Most (but not all) people have the basic necessities of food, water, shelter, clothing and land. The major problems from low cash incomes are that it limits peoples' opportunities and access to better nutrition, health and

schooling. Poverty in PNG can also be defined as where communities are constrained by unproductive environments, high population densities, land degradation, low cash incomes and poor access to services. Many communities in PNG are therefore classified as vulnerable and poor (as outlined / documented in the PNG Rural Development handbook (Hanson et al, 2001).

1.7 Sectoral Employment

Sectoral employment has remained much the same over the last twenty years. Figure 1.7 illustrates formal employment in 2000 (taken from 2000 Census). Outside government agriculture still employs the most persons. Mining and petroleum employs very few persons despite their contribution to export earnings and GDP. The manufacturing sector employs half that in agriculture and forestry. Most agricultural workers are generally employed outside the formal sector.

According to the PNG Yearbook (2003), there are probably less than a quarter of a million formal jobs in the whole of the PNG economy, including government workers. There were 246,000 in 1998 compared to 213,000 in 1980. The year book gives the following figures for 1992: agriculture 55,529 and for manufacturing 18,425. For 2000 the figures are for agriculture 46,863 (a decrease) and for manufacturing 24,536 (an increase). No data is given for mining but it states that employment has increased 137% of 1989 figures, and numbers remain small. One estimate is that only 10.4% of those working are employed in the formal sector , the remaining are engaged in semi-subsistence and subsistence activities.

Figure 1.6 Map of Papua New Guinea showing HDI for each province.
(HDI for PNG = 0.363)

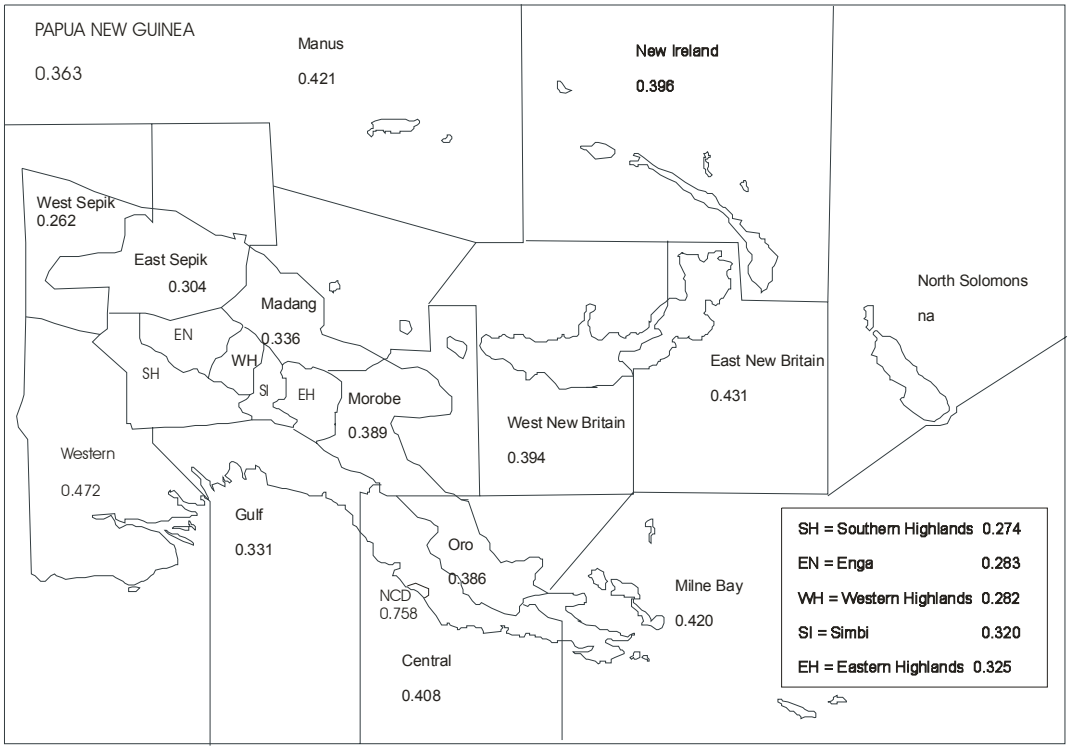
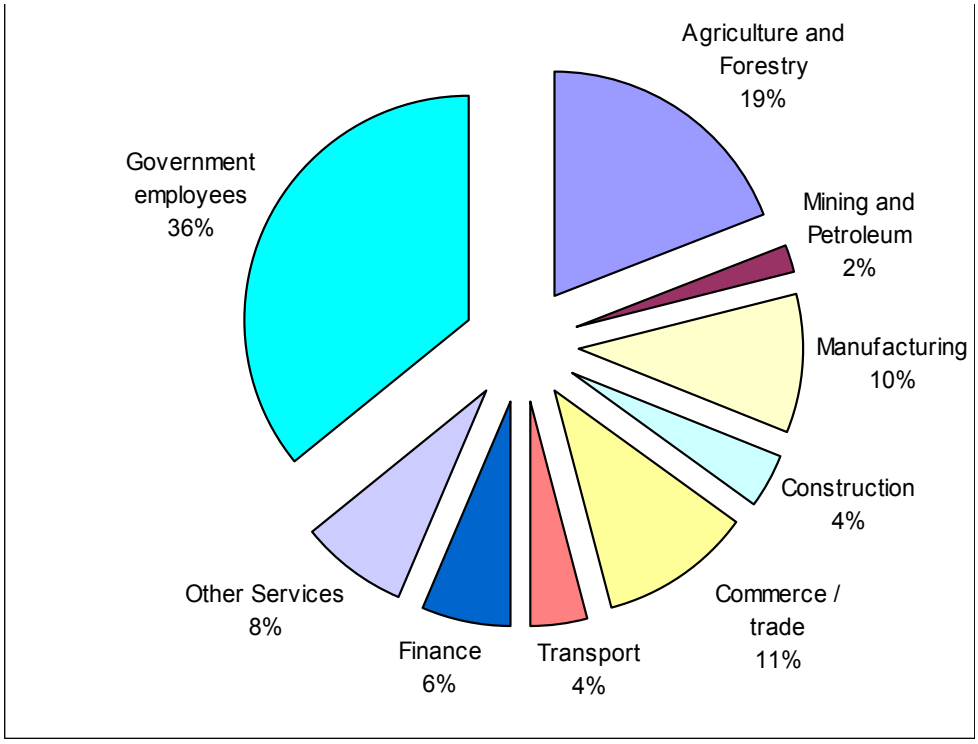


Figure 1.7 Employment by Economic Activity in PNG, 2000



1.8 Sectoral Overview

1.8.1 Agriculture

On a commercial basis agriculture will continue to be the mainstay of the economy. Together with forestry and fisheries in 2002 it accounted for 27% of GDP and by itself to 15% of the total export earnings (Figures 1.4 and 1.5). Numbers vary slightly depending upon the source. According to the 2000 census which excluded the rural non-village sector (eg Government out-stations, mission stations etc.) approximately 84% of the population in Papua New Guinea live from agriculture both directly and indirectly. The colonial administrators, traders, and settlers introduced the commercialisation of agriculture in PNG. Since then commercial agriculture has developed and progressed to being the country's major export earner outside mining and petroleum.

The value of commercial agriculture to the export economy of PNG for 1993 to 1997 averaged approximately K500 million annually, but for 1999 to 2003 increased to approximately K900million annually. Much of this increase is due to oil palm and in recent years cocoa. The real significance of this sector is experienced with in the rural areas where residents rely heavily on agriculture for both their basic needs and cash income.

As a renewable resource commercial agriculture forms the main base of the economy. Together with forestry it provides cash income and employment for up to 45,000 to 50,000 persons or up to 19-20% of paid jobs in the formal employment sector. The commercial export crops include coffee, cocoa, copra and oil palm plus other minor crops of tea, rubber and spice products of cardamom, chilli and pyrethrum. Vanilla is a recent addition.

Table 1.3 Cash crop production by province (2003), (tonnes)

Province	Coffee	Cocoa	Copra	Rubber	Oil Palm

	2003	2003	2003	2003	2002
Western				583	
Gulf			752		
Central	21		1054	3515	
National Capital District					
Milne Bay		1	4856		193821
Northern (Oro)	43	886	459		283134
Southern Highlands	999				
Enga	2392				
Western Highlands	34507				
Simbu	3262				
Eastern Highlands	19171				
Morobe	5331	1152	2663		
Madang	71	3771	28508		
East Sepik	338	3574	3641		
West Sepik/Sandaun		441	688		
Manus		12	1568		
New Ireland		1257	18177		124037
East New Britain		17901	42717		
West New Britain		1051	19303		996984
North Solomons		11225	16174		
Total	66135	41271	140560	4098	1597976

Tables 1.3 provides an overview of cash crop production by province in PNG for 2002 -2003 for the five major agricultural cash crops of coffee, cocoa, copra, rubber and oil palm. These data give an idea of where the major cash crops are grown in PNG. Coffee grows mainly in the highlands provinces, cocoa grows mainly in East New Britain and North Solomons though it is expanding, copra is restricted to most coastal or islands, and oil palm grows mainly in West New Britain, Oro , Milne Bay and New Ireland. Rubber only grows in Central and Western.

For chemical management it is important to have an idea of the size and distribution of the agricultural sector since they are the major consumers of pesticides and fertilizers in the country.

1.8.2 Forestry[9]

In terms of development the forestry sub-sector has always contributed significantly to the economy of Papua New Guinea. Forest have been through time a significant life sustaining resource physically, culturally and spiritually for Papua New Guineans. The resource is utilised as a source of building and gardening materials, wildlife habitat, herbs and plants for medicinal purposes and for food and recreation. In addition this sector has recently contributed significantly to export earnings from the export of logs to overseas markets especially to the Asian region. By August of 1994 there were approximately 120 timber companies in the country, either registered or unregistered but still operating. This number has dropped dramatically since with the sector now dominated by a few large companies.

[9] Useful references on PNG forestry and PNG forest policy in the late 1990s include: Filer (1997); Filer & Sekhran (1998)

In PNG today a growing concern in this sector is the future development of the industry based on sustainable yield basis. There are many problems both technical and political in developing and managing forest resources on sustainable basis. In valuing forests little or no consideration is given to ecological services.

There are various estimates of how much of PNG forests can be harvested sustainably, but one such estimate is that 7.0 million hectares out of 34 million hectares of forests can be commercially productive. However the rates of sustainable yield are debatable, one such figure being 3.5 million m3 per year . The Forestry Sector's main contribution to the economy of the country is through log exports to overseas markets. The country's export of logs is especially to Japanese and other Asian markets. The total export value of logs in both 2002 and 2003 was K370million or about 5-6 % of total export earnings.

West New Britain and the island provinces exports a sizeable proportion of timber from PNG. The Papuan or Southern region also contributes substantial amounts; Momase providing a lesser amount and negligible from the highlands. Since May 2000 there has been a virtual moratorium on all new forest activities in PNG whilst the PNG Government reassesses its forest policies.

Forestry is also a small but important user of chemicals. Little is used in forest silviculture / forest management but very poisonous chemicals are used to treat cut timber and logs. These include BFCA and CCA, both chemicals containing arsenic. Creosote is still used whilst PCP was used in the past. According to the Department of Labour and Industrial Relations there are sixteen registered sawmills in the country. How many unregistered ones are not known. Most would use these hazardous chemicals. No licencing system existing in PNG as yet for using these very hazardous chemicals.

1.8.3 Industrial / Manufacturing Sector

The manufacturing sector of Papua New Guinea following the decade of independence grew quite rapidly in terms of its importance in the economic activity and formal employment generation. The sector as a secondary level of production in the economy of the country is of vital importance in the overall development and well being of the nation.

Through 1999 to 2003 it has contributed on average K800-900million or about 9% of GDP. The main areas include (1) food, beverages, tobacco.; (2) textile/ clothing and leather goods; (3) paper products; (4) wood, wood products and printing; (5) chemicals and plastic products; (6) food / fish processes (7) metal refining . No recent data was available on the numbers of facilities or total employment in each, their output and the types of chemicals they produce. Most manufacturing and industrial activities in PNG (except for the mines and petroleum) are small scale. They collectively discharge a wide range of air and water pollutants / chemicals into the environment.

A count in the PNG Business Directory (source) gives an indication of the number of companies involved in this sector, most of whom may use or produce chemicals. Table 1.4 provides a summary of the numbers and types of businesses involved in this sector. This information is important as it gives an indication of the many types of businesses, though not exclusive, which may be using chemicals and/ or producing chemical wastes in PNG.

A breakdown of the manufacturing sector / industries by size and distribution is given for 1988 in the first national chemical profile (Chapter 1) for 1988, but no recent data was found. The situation remains similar in 2004. Lae in Morobe Province is the major industrial town in PNG. Port Moresby the second major industrial town is in the Papuan region. The major centre in the islands is Rabaul/ Kokopo and the two major towns in the highlands are Goroka and Mount Hagen.

Papua New Guinea lacks international competition in regard to manufacturing. The country's manufacturing sector is ineffective in the world markets due to relatively high internal cost structure and

various other barriers. The manufactured exports represent no more than 4 per cent of its total exports. Since independence from Australia in 1975 PNG has been largely an import-driven formal economy, except for the influence of the mining and petroleum and agricultural products and logs.

1.8.4 Mining and Petroleum

The mining and petroleum industry in Papua New Guinea play a major role in regard to the development of the economy. Since the earliest discovery of gold in PNG and its development, the sector was responsible for many of the infrastructure developments.. The sector over the period 1999-2003 accounted for 70-80 per cent of the total export earnings (Figure 1.5) and like agriculture contributed to more than a quarter share of the GDP (Figure 1.4). The sector also contributed significantly to major spin-off benefits. These are in the form of business, contractors and retailers.

Table 1.5 and Table 1.6 gives production figures for 2003 for both mines and petroleum. Major mines in the country and their province are: Porgera,/Enga (gold),Ok Tedi / Western(copper and gold), Misima / Milne Bay(gold) closed in 2004, Lihir/New Ireland (gold), and Tolukuma /Central(gold). The Bougainville/North Solomons (copper and gold) mine is still closed since the civil war and the restoration process. Current petroleum production is from the Kutubu, Gobe , Moran oil fields and Hides natural gas all in Southern Highlands, and now contributes substantially to PNG exports and GDP / general revenue

However, the sector despite it's prominence in the investment of funds, export sales and the general revenue remains an "enclave" in the economy of the country. It employs no more than 2- 3 per cent of the workforce However PNG governments have successively over the years justified mining and petroleum exploitation as it earns the necessary revenue needed to fuel PNG's development objectives in particular the development of infrastructure and agriculture.

Mines and petroleum industries use and produce hazardous chemicals. Both cyanide and mercury are used in PNG for gold extraction causing pollution problems and health risk. Of great concern is the environmental effects of the large mines due to them discharging their wastes containing heavy metals and sediments directly into the river systems or the sea. Pollution caused by the Panguna copper mine partly precipitated the war in Bougainville. Pollution of the Ok Tedi and Fly River systems (Pernetta, 1988) have lead to enormous compensation claims from landowners (Banks & Ballard, 1997)). However the Ok Tedi , Porgera and Lihir mines remain major and necessary contributors to the PNG economy.

Table 1.4 Summary of Industry types in PNG, 2004

Activity	Number of Companies	Number of Localities
Abattoirs	2	2
Abrasive blasting, manufacturing, distribution & merchants	7	9
Agricultural chemicals manufacturing & distribution	13	18
Analysts & or Assayers	4	4
Bitumen & or Bituminous Products	3	5
Bitumen sprayers	3	8
Boat & Yacht Builders & repairs	20	26
Boilermakers	2	2
Brewers &/or Maltsters	1	3
Cement Merchants/distributors	2	2
Concrete (ready mix, blocks, dist,)	17	19
Chemical Mfrs & Distributors	11	13
Coca Distributors	5	6
Coconut oils & products	4	4
Coffee & coca machinery	2	2
Coffee Merchants & Exporters	45	50
Diesel Engine & Petrol Mfrs/ Distributors	4	5
Dry cleaners	3	3
Electric Power supply	1	1
Explosives	1	2
Fertilizers manufacturers	5	5
Fiber glass products mfrs & repairs	12	13
Fire protection consultants/stations	23	25
Funeral directors	1	1
Gas suppliers (industrial & medical)	5	10
Hospitals	20	20
Jewelry (retails)	8	8
Laboratory equipment	5	5
Laundry & launderettes	2	2
Lawn Mower sales & services	5	5
Logging contractors/machinery mfrs	3	3
Medical Gas supplies	2	2
Motor Oil Merchants	4	4
Oil Companies, distributors/field supports etc	10	140
Paint & Accessories/Decorators	17	29
Pest Control	6	7
Plastic Bag mfrs & distributors	4	4
Plastic Bottle & Containers manufacture & distributors	4	4
Plastic products mfrs & distributors	8	9
Precious metal refiners/dealers	2	2
Rubber goods/stamps mfrs & dist.	3	8
Sawmillers	15	15
Sawmilling Equipment/machinery	9	10
School supplies Mfrs & Distributors	21	24
Scrap metal Merchants	2	2
Ship Builders & repairers	8	9
Soft Drink manufacturers	4	9
Soap Manufacturers	2	2
Spray painting equipment mfrs & Distributors	2	2
Steel fabrications/merchants etc	20	33
Timber exporters, merchants & sawmillers	40	42
Tobacco & cigarette mfrs & dists	1	1
Transport equipment specialists/supplies/agents	44	48
Tyre dealers	15	23
Veterinary Surgeons	1	1
Vinyl floor coverings	3	3
Waste collection & disposals	2	2
Water testing	13	13
Welders/welding equipment & supplies	22	22

Table 1.5 PNG Mineral Production, 2003 (tonnes)

Mine	Gold	Silver	Copper
Ok Tedi	16.0	34.5	202,300
Porgera	26.5	5.1	
Misima	3.7	16.8	
Lihir	17.1		
Tolukuma	2.5	5.5	
Small scale	2.2		
Total	68.0	61.9	202,300

Source: Chamber of Mines and Petroleum (http:// www.pngchamberminpemcom.pg).

Table 1.6 PNG Oil and Gas Production, 2003

Field	Oil Production (MBBLS) 1	Gas Production (MMSCF)2
Hides3		4926
Kutubu	7724	70,859
Gobe	5177	32,479
Moran	4921	27,501
Total	17,822	135,765

1 – thousand barrels of oil;. 2 – million standard cubic feet of gas;
3 - Only gas from the Hides field is sold and gas from the other fields are mostly injected into wells
Source: Chamber of Mines and Petroleum (http:// www.pngchamberminpemcom.pg).

1.9 Environment and Conservation10

The five national goals of PNG's constitution reflect a commitment to sustainable development. This commitment to sustainable development was reiterated when the PNG National Executive Council endorsed the PNG National Sustainable Development Strategy in 1994 (Department of Environmental Science UPNG & NEC ,1993)).
The Directives supporting the Fourth Goal call for

Wise use to be made of our natural resources and the environment in and on the land or seabed, in the sea, under the land and in the air, in the interests of our development and in trust for future generations
The conservation and replenishment, for the benefit of ourselves and posterity, of the environment and its sacred, scenic and historic qualities
All necessary steps to be taken to give adequate protection to all our valued birds, animals, fish, insects, plants and trees

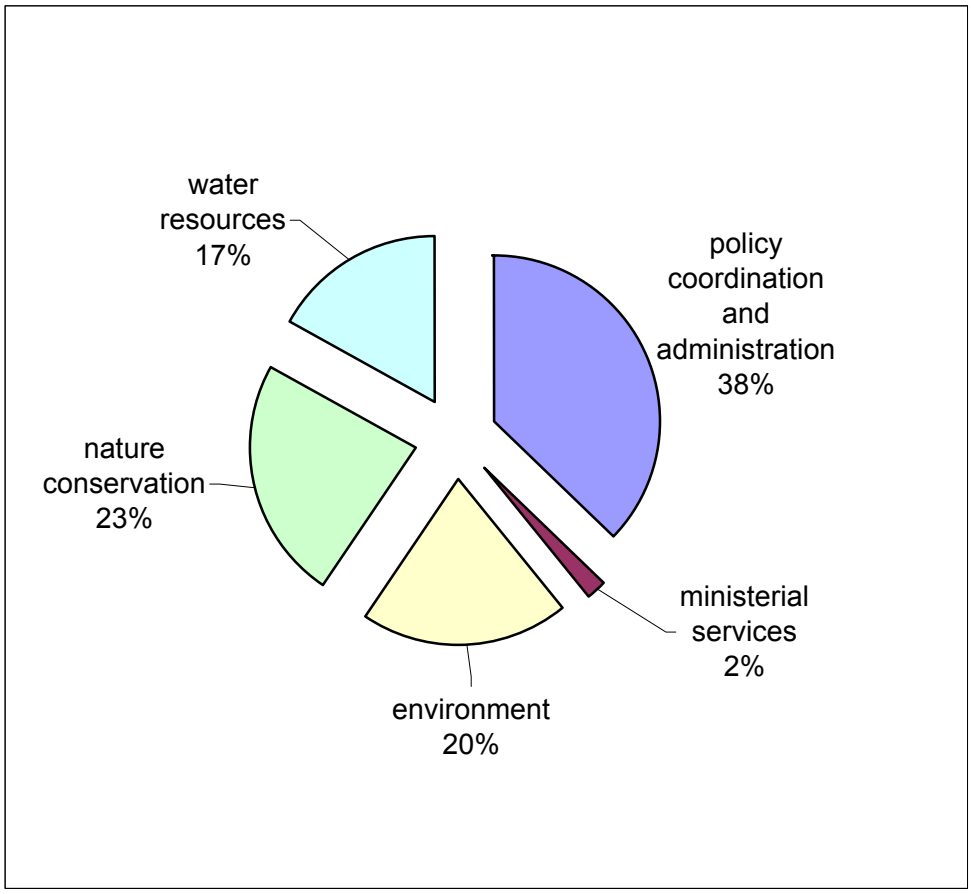
In a key publication on Strategic Directions for 1996-1998 DEC (1996a) stated as one of its key objectives "To develop and maintain a regulatory framework to safeguard the air, water, land, wildlife and marine environment by ensuring effective management of industrial and domestic wastes, hazardous chemicals and unsustainable use of resources. " A second DEC publication, released in March 1996 DEC (1996b) outlined the then proposed new regulatory framework for environmental protection. This is outlined in more detail in Chapter 6. With the passing of the Environment Act 2000 and the gazettal of the associated regulations in 2002, the act came into force in early 2004. The new regulatory framework is based on an number of

[10] Useful books on PNG environment is Gladman, Mowbray & Duguman (1996); Sekhran & Miller (1994), Unisearch PNG (1992)

important principles, being: certainty and integrity, transparency, consultation and communication., flexibility and practicality, cost-effectiveness and efficiency, "polluter pays" and integration of economic and environmental decision-making.

Unfortunately budgetary allocation to DEC have over the years always been very small compared to allocations to the sectoral departments and other departments. DEC received in the 2005 budget K5.2 million out of a government budget of K6.9 billion , including K2.9 billion was for recurrent expenditure and K1.9 million in development spending. The amount allocated to DEC is less than 0.1 per cent of the total government budget. Over the years the amounts allocated or spent has varied between K2 million to K5 million with half million to one million kina allocated/ spent on environmental protection and pollution control. This is about 20% of the actual expenditure or allocated budget to DEC(see Figure 1.8) The Environment Division includes the Environmental Protection Section which is responsible for chemical management. Given the small allocation of funds allocated by the PNG Government for environmental protection, new approaches to environmental management and chemical management are being developed. These are discussed briefly in Chapter 6.

Figure 1.8 Appropriation to DEC, 2005



Source: Department of Treasury website www.treasury.gov.pg

Chapter 2 Chemical Production, Import, Export and Use

This chapter summarizes basic information, both available and unavailable, about the types and amounts of chemicals produced or imported (and exported), and used in Papua New Guinea. Data for petroleum products produced is included but is at variance with data included in Chapter 1 (section 1.8). Data and information were collected over the period October to December 2004.

2.1 Chemical Production, Import, Export and Use

Information available on chemicals in PNG covers mainly only imports and exports. This information and data are collected and available from the Internal Review Commission (IRC), under the Customs Division. However no summary information was available. We had to analyse the data. Unfortunately units for quantities vary within categories, making the calculations time consuming. However data on values in kina were easily summed / collected. These values represent the kina value from duties etc collected by IRC at the various ports. They therefore can only be used to contrast the relative value of different groups of chemicals and do not give the true value of the chemicals imported or exported. Some information is also available from the Department of Environment and Conservation on pesticides, though data on quantities and values for individual pesticides are not available. Data on minerals and petroleum exports are included in Chapter 1. No data are available on wastes. Data on production and formulation are also unavailable (except for minerals and petroleum). Very little manufacturing occurs in PNG, except for production of petroleum products. Some formulation does occur but it seems data on these either do not exist or, if they do, are not readily available. Recent data collected by the POPs project is given in Chapter 4. These data cover DDT, PCBs, dioxins and furans and other chemicals including timber treatment chemicals and more on agricultural chemicals.

The data and information that are presented in this Chapter are as indicated in Table 2.1 below. The ticks and crosses indicate whether the data and information were or were not available to us. Such data and information covering each category / chemical type and each column are most important if chemical management is to be all-inclusive. However no adequate summary of chemical data overall for PNG are readily available, even in the Department of Trade and Industry Statistical Digest (2003).

Table 2.1 Chemical Production and Trade – data and information available

Chemical Type	Production/ Manufacturing (tons/year & value – or units as specified)	Imports (tons/years & value)	Formulation /Packaging (tons/year & value)	Exports (tons/year & value)
Pesticides	x	√	×	√
Fertilisers	x	√	×	√
Petroleum Products	√ (in section 1.8.4)	√	× / na	√
Industrial (used in manufacturing / processing facilities)	×	√	×	√
Consumer Chemicals	×	×	×	×

* data on value on kina collected from imports and exports only determined)

IRC data are lumped into broad categories as defined by the Harmonised System. (see section 2.2.). Data are available in chemical subgroups as in Table 2.2 under sub categories as provided by IRC. Information on quantities and values of specific chemicals or chemical products produced / manufactured or formulated are not systematically collected in PNG. No databank covering such data exists in PNG at present.

The data collected and summarized on earnings from imports and exports of chemicals is summarized in Tables 2.2 (imports) and 2.3 (exports). Data are listed according to the categorization / classification under the Harmonised System (see section 2.2). Their relative importance is given in Figures 2.1 (imports) and Figure 2.2 (exports). The values and proportions reflect importance of the chemical groups (though the author believes absolute values need to be verified).

On Imports

Table 2.2. Value of Collected Earnings from Chemical Imports: 2003

Commodity Code	Description of Goods	Value in '000' kina
25-26	Crude fertilizers & minerals	46613
27	Petroleum Products/Fuels	785567
28-29	Various organic/inorganic chemicals	78578
30	Pharmaceuticals and medicines	66054
31	Manufactured Fertilizers	61531
32	Pigments, paints & varnishes	49203
33	Essential oils, perfumes & cosmetics	15256
34-35	Soaps & waxes, candles, starches	17516
36	Explosives, matches	7319
37	Photographic equipment	15490
38	Pesticides	12154
39	Plastics	106680
40	Rubbers	138919

Source: IRC (Customs)

PNG imports most of its chemicals (other than petroleum products). Observation of recent data from both the tables and the graphs show that value earned by petroleum products and fuels remain the highest for imports .In the manufacturing sector plastics are the highest for import. Crude fertilizers and minerals, various inorganic and organic chemicals, manufactured fertilizers, pharmaceuticals and medicines remain important. In terms of value rubber is also important. Pesticides are only imported in very small amounts.

On Exports

Table 2.3. Value of Collected Earnings from Chemical Exports: 2003

Commodity Code	Description of Goods	Value in '000' kina
25-26	Crude fertilizers & minerals	9707333
27	Petroleum Products/Fuels	5404
28-29	Various organic/inorganic chemicals	734
30	Pharmaceuticals and medicines	2108
31	Manufactured Fertilizers	23
32	Pigments, paints & varnishes	1003
33	Essential oils, perfumes & cosmetics	36
34-35	Soaps & waxes, candles, starches	985
36	Explosives, matches	0
37	Photographic equipment	67
38	Pesticides	152
39	Plastics	729
40	Rubbers	13936

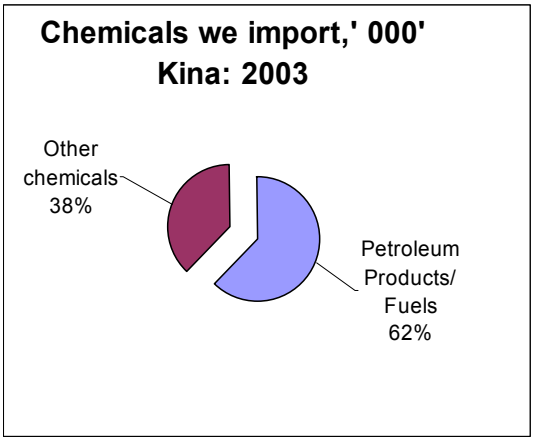
Source: IRC (Customs

PNG is a large exporter of minerals particularly of gold and copper. Minerals are the highest for export both in volume and value and petroleum products and fuels remain the second highest for exports. Rubber exports also contribute significantly (though in Chapter 1 trade statistics export earnings are small). Apart

from these the moneys earned from export of chemicals from PNG from export is low. A small amount of pesticides are sold to Solomon Islands.

The data on minerals and petroleum products seem at variance with data from both Chamber of Mines and Petroleum and the Department of Petroleum and Energy ; as does rubber with trade statistics. Both need to be further checked.

Figure 2.1 Chemicals we import into PNG, 2003 – proportion of value in kina



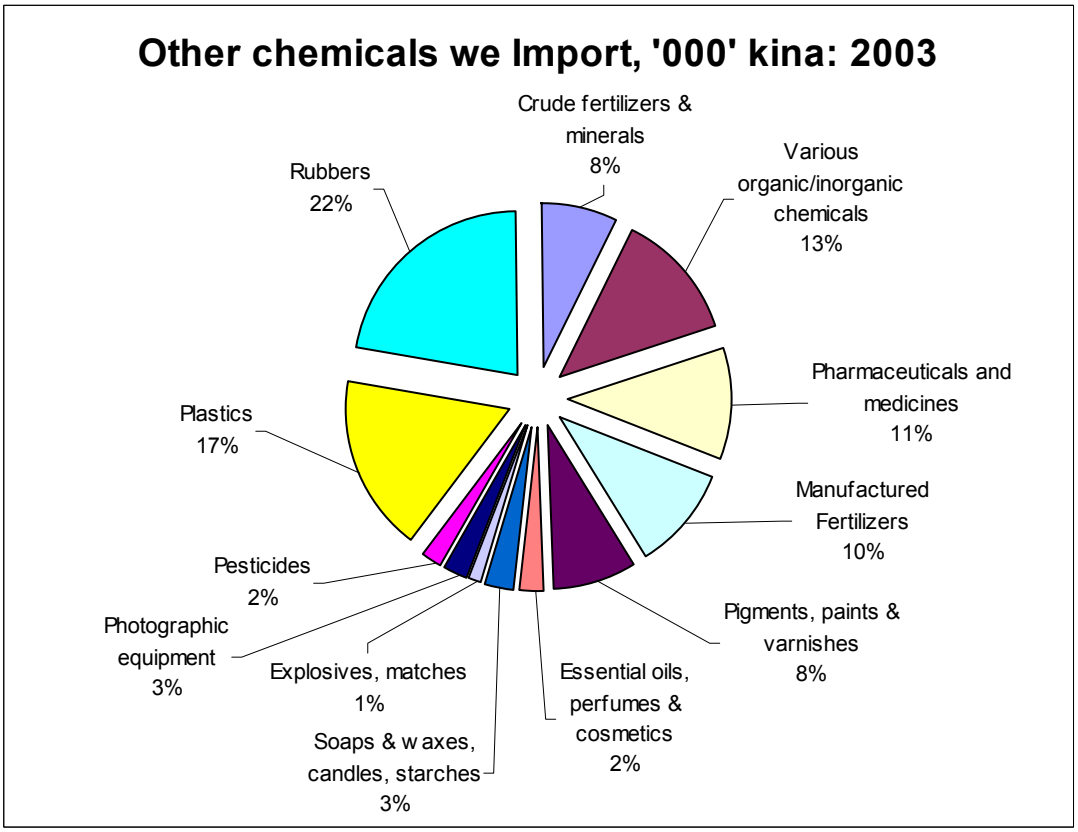
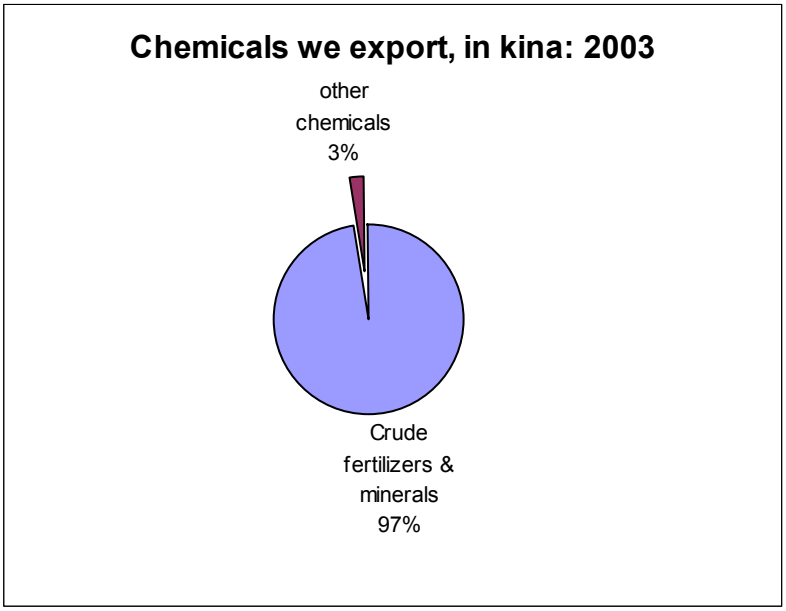
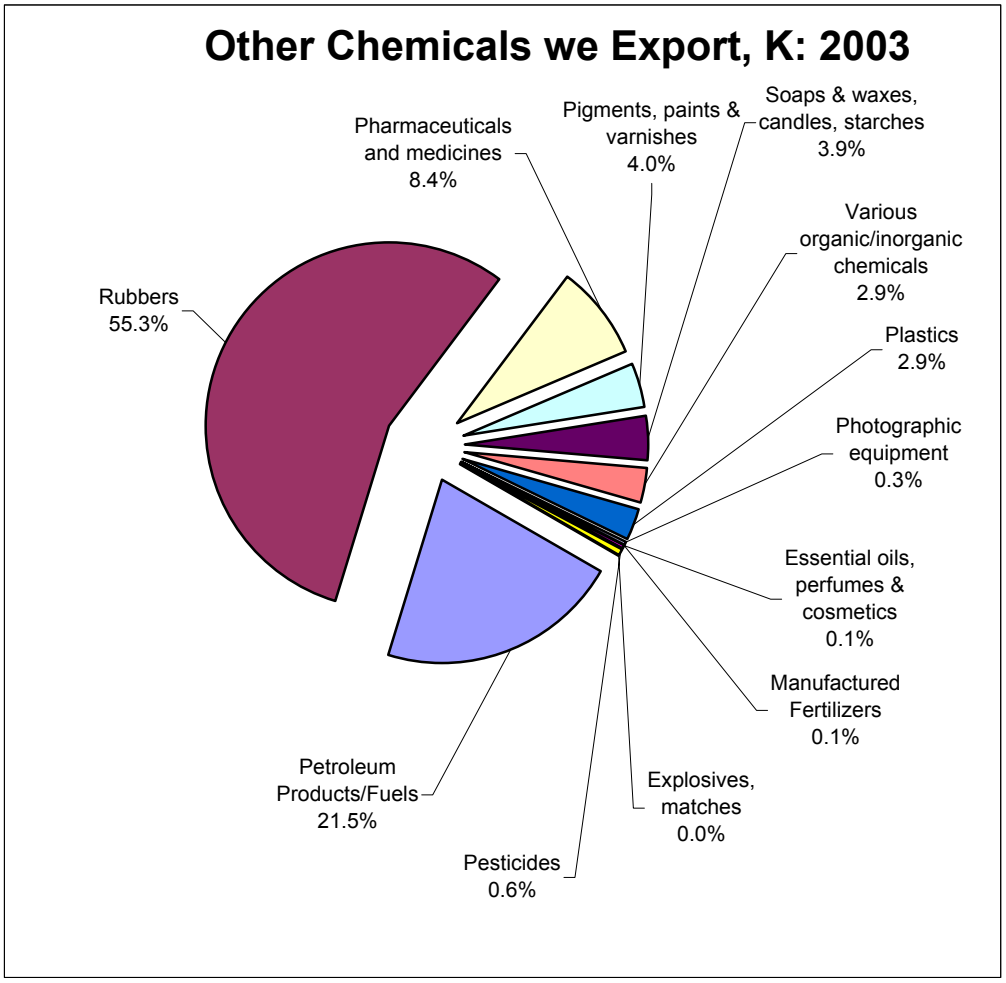


Figure 2.2 Chemicals exported from PNG, 2003- proportion of value in kina





2.2 Chemicals used by categories

When considering chemicals, instead of using the Harmonized System, it is often convenient to group them into convenient categories such as agricultural chemicals (pesticides and fertilisers), petroleum products, industrial chemicals, and consumer chemicals.

Specific data on pesticides is available from the Department of Environment and Conservation (DEC). DEC keeps a database or register of pesticides which are allowed to be imported into PNG. No pesticides are manufacture in PNG. Specific data on petroleum products are kept by the Department of Petroleum and Energy.

Tables 2.2 and 2.3 are summaries derived from the IRC database where they use the Harmonized System Apart from this no systematically collected data exists per category for industrial chemicals. Neither the Department of Trade and Industry nor trade organisations were forthcoming with such information. No data exist for consumer chemicals. This category lacks a real definition in Papua New Guinea. No one can precisely define what should be included as consumer chemicals. No one has collected data on these chemicals, since no body in PNG has taken responsibility for them. The ICCC (Independent Consumer and

Competition Council) formerly Consumer Affairs Council was approached, but had no information. The ICCC focuses on price control and regulation, not on chemicals in consumer products.

Information sought that are available by use categories are as outlined in Table 2.4

Table 2.4 Chemical Use by Categories

Type of Chemical	Information and data
Pesticides - Agricultural	some √
Pesticides - Public Health	some √
Pesticides - Consumer Use	×
Fertilisers	some √
Petroleum Products	some √
Industrial Chemicals (used in manufacturing/processing facilities)	×
Consumer Chemicals	×

The Harmonized Commodity Description and Coding System

Import and export information on all chemicals are collected by IRC using Customs import categories, shown in Tables 2.2 and 2.3, which are based on this system adopted internationally. The classification / categorization used by Customs is that used / and required by international agreement. This is the International Convention on the Harmonized Commodity Description and Coding System. The classification system is called 'The Harmonized Commodity Description and Coding System', generally referred to as "Harmonized System" or simply "HS"[11]. It is a multipurpose international product nomenclature developed by the World Customs Organization (WCO). It comprises about 5,000 commodity groups, each defined by a six digit code, arranged in a legal and logical structure with well defined rules to achieve uniform classification. The system is used by most countries as a basis for their Customs tariffs and for the collection of international trade statistics. PNG is listed, as of 18 April 1997, as having applied to be a contracting party to the Harmonized System Convention. PNG uses HS. The classification system is divided into sections, many of which may include chemicals / chemicals in commodities. Chapters 25 to 40 cover all chemical groups, or at least those considered pertinent for consideration in this profile.

Under the harmonized system countries may subdivide categories . For example , the structure of HS dealing with pesticides is as follows:

38 – Chapter
Miscellaneous Chemical Products
38.08 – Heading = Pesticides
Insecticides, rodenticides, fungicides, herbicides, anti-sprouting products and plant-growth regulators, disinfectants and similar products, put up in forms of packing for retail sale or as preparations or articles, for example, sulphur-treated bands, wicks and candles, and fly-papers.
38.08.10 – Insecticides
38.0810.10 – Mosquito spirals and coils
38.08.10.20 – Camphor
38.08.10.30.- Flypaper
38.08.10.90 - Other.

11

Information on HS can be got at the following websites:
Harmonized Commodity Description and Coding System (HS): http://pacific.commerce.ubc.ca/trade/HS.html
Harmonized System Convention – General Information: http://www.wcoomd.org/HSC/Hsconve2.htm

38.08.20.00 – Fungicides
38.08.30.00 – Herbicides, Antisprouting agents and plant growth regulators
38.08.40 – Disinfectants ….

Here, under the international system the first six digits can not be altered. However countries may add further subcategories depending upon their needs. This needs to be approved by Treasury if recommended by eg either DEC or DOH. For example DDT can be given a separate category under 38.08.10 (insecticides) if DEC or DOH requests IRC to create one. ….In the past subcategories have existed for mosquito spirals and coils (38.08.10.10), camphor (38.08.10.20) and flypaper (38.08.10.30). DEC can also suggest that specific categories be given a "P&R" listing. This flags "IRC" that such a group of chemicals are 'prohibited' or 'restricted'. To date DEC has not requested such sub-categorization.

However the system has possible flaws. The authors would contend that Customs Officers are neither familiar with the multitude of chemical types / groups nor familiar with agricultural chemicals as a group in particular. They probably rely on labeling and trade documents attached to materials imported. They themselves most probably do not check what is actually imported, at least by category or type of agricultural chemical. Hence Customs officers are not trained to recognise what chemical / pesticides are in what category, so accurate records on specific subgroups can not be kept. Both DEC and IRC Officers recognize the need for training of their officers in recognizing chemical groups and being able to check themselves / verify labeling of chemicals. Both DEC and IRC Officers recognize the need for improved consultation between each other.

Pesticides

Recent information on import statistics were obtained for pesticides from IRC. This included data on pesticides by type. Comparison of data, given in Table 2.5 shows that there has been a significant decrease in the quantities but an increase in the value of pesticides imported into PNG compared to the late 1980s and 1990. The values in the tables are the value of moneys collected from duties and taxes but can be used in comparison to reflect trends in the real value. Due to the costs of agricultural chemicals farmers / village farmers are turning more to traditional and cultural practices, for example - weeding instead of using so much herbicides. This is a trend noted by Kuman (2005) of the POPs project in his survey of agricultural chemicals.

It seems fewer manufactured fertilizers are imported now but the cost of what is imported is very much more. Agricultural chemicals are expensive items particularly for the small farmer.

The amounts of agricultural chemicals exported is very small, being mainly due to one supplier exporting these chemicals to the Solomon Islands.

Table 2.5: Imports of Agrochemicals. Comparison between 1987-1990 and 2001-2004
(Value is moneys earned from taxes and duties)

Type	Quantity ('000' kg)				Value ('000' kina)			
	1987	1988	1989	1990	1987	1988	1989	1990
Insecticides, Herbicides, Fungicides, Rodenticide, Disinfectants	2157	2463	2160	2261	5615	7216	4230	4885
Fertilizers, manufactured	26357	36446	31991	34840	5414	6590	6298	6251
	2001	2002	2003	2004	2001	2002	2003	2004
Insecticides, Herbicides, Fungicides, Rodenticide, Disinfectants	451	659	961	643	6941	9006	12154	7233
Fertilizers, manufactured	18169	25958	31904	23121	47311	55936	61531	40997

Note: IRC checking quantities (personal communication); 2004 incomplete

A summary of amounts for each category of pesticide imported by volume and value is given in the Tables 2.6. Herbicides remain the most important and used type but an increasing proportion of insecticides seem to be used. However total import (in quantity) and hence use seems to have dropped quite significantly. Very little pesticides are exported

Table 2.6: Types of Pesticides Imported into PNG, 2001-2004.

Types of Pesticide	Volume in '000 tonnes'				Value in '000 kina'			
	2001	2002	2003	2004	2001	2002	2003	2004
Insecticide	203	251	418	268	2920	3285	4000	2692
Herbicide	229	351	499	337	3727	5115	7420	4138
Fungicide	19	20	18	12	295	313	368	194
Rodenticide	0	0	0	0	0	0	157	0
Disinfectants	0	39	26	26	0	294	209	209
Total	451	659	961	643	6941	9006	12154	7233

Note: IRC checking quantities (personal communication); 2004 incomplete

The only chemicals presently required to be registered in PNG are pesticides, under the Pesticide Regulations formerly under the *Environmental Contaminants Act,* but now part of the *Environment Act, 2000.* Pesticides required to be registered include all pesticides used in agriculture and public health, timber treatment chemicals, and those used by commercial pest control operators. Not included are many household pesticides including mosquito-coils, repellants, aerosols and products sold in bottles for use against parasites, unless otherwise specified. A register of all registered pesticides is kept, and at the end of each year all importers must notify the Pesticide Registrar (Secretary of DEC) of the amount and value imported over the previous year. This is not necessarily followed. In theory, the Pesticide Registrar (DEC) should have an accurate record of all imported pesticides. However this is not the case. A perusal of supermarkets and trade stores in Port Moresby would also suggest that some pesticides not exempted from the pesticide legislation are available for sale on the shelves.

According to IRC the numbers of companies importing pesticides into PNG between 2001 and 2004 varied from 68-97. Only one exported pesticides (to the Solomon Islands). According to DEC in 2004 only 21

companies are registered to import pesticides for which a permit is required. Presumably many small companies are importing those not required to be registered (eg aerosols and mosquito coils) or are importing illegally. IRC database does not distinguish between those pesticides that are registered and those that need not be. DEC does not do an adequate check on suppliers checking what they sell.

Table 2.7 provides a full list of registered active ingredients by pesticide types and the numbers of companies importing each into PNG, as taken from the DEC Pesticide Registration database. The numbers of pesticide products registered as of August 2004 is probably much less than in 1997. It is recognised that importers are, for various reasons, economic and administrative, not importing pesticides that they legally could. However the author would suggest that much more is being imported than the Registrar's records suggest. However despite this the numbers of pesticides now available in PNG is probably much less than in the early 1990s. Detailed lists of all pesticides known to be used then in PNG (and the South Pacific overall) were compiled by the author with the assistance of ARSAP and SPC first in 1990 (ARSAP/CIRAD/SPC/SPREP,1990) and then revised and updated and again published in 1994 (ARSAP/CIRAD/SPC ,1994). These lists included product names, active ingredients and recommended uses, but not amounts nor value of amounts used.

There were 275 pesticides products registered/available in PNG in the mid 1980's (Mowbray, 1988), then about 311 by 1990, but with registration this was reduced to 105 by 1992/93 and 87 by 1996. The reasons for this dramatic drop in the early 1990s were largely due to a large importer closing down. It is also in part due to commercial reasons, due to costs involved in registration, hence fewer different formulations are imported; partly due to the more hazardous older pesticides being banned or restricted in their use; and also by better practices advocated by DAL and DEC. However one report in 1996 gives 186 plus pesticide products as registered in PNG for use. Table 2.7 lists those pesticides registered in PNG at present (though some registrations have expired, as of August 2004). It lists 195 products consisting of 71 active ingredients. Kuman (2005) surveyed many agricultural concerns and found 106 products including 57 active ingredients. Of these 6 actives were not registered. Nakmai (2005) found two more unregistered pesticides / timber treatment chemicals. By far the two most used pesticides are the herbicides paraquat and glyphosate. Both Wossa and Sinikupa (2005) and Kuman (2005) note that DDT is being used illegally in agriculture.

Table 2.7 would suggest there are as many pesticide products around today. However this is probably is not the case as the DEC registration database is known to include expired registrations and covers a four year period. The author suggests that many importers either are not aware that a pesticide registration system exists, or they do not know what they need to register, or they ignore the registration system. An accurate and up to date database on currently registered and imported pesticides needs to be compiled. Exact information on the numbers of pesticide actives, products and their quantities and kina value is difficult to get.. Records need to be kept on use as well. Such could be done through revamping / streamlining the pesticide registration process. Further information and discussion on pesticides is in Chapter 4 on the pesticide inventory compiled under the POPs project by Kuman (2005).

Other hazardous chemicals

Kesu (2005) has commenced an inventory of chemicals in PNG. This is discussed in Chapter 4. Records are needed for POPs (Stockholm) , PIC (Rotterdam) chemicals and other PTSs and or specified chemicals covered under the Waigani and Basel Conventions or regarded to be hazardous under PNG conditions of use, as may be specified under regulations under the Environment Act or the other acts covering health and environment aspects of chemical management. Detailed records at present are not kept for hazardous / industrial chemicals, and consumer chemicals.

2.3 Petroleum Production and Exports

Precise and detailed information does exist for petroleum chemicals. These can be obtained from either the Chamber of Mines and Petroleum or the Department of Petroleum and Energy. Their statistics do differ but are similar. Contributions to GDP and export earnings from petroleum is given in Figures 1.3 and 1.4. Data on production of petroleum from the Chamber of Mines and Petroleum is given in Tables 1.5 and 1.6. They are quite different from that provided by IRC. They include production data and not import and export data. However parts of the data need be interpreted against the IRC data, but given the format of the IRC data this seems not possible. This is an area that needs to be clarified.

Table 2.7. Types of Pesticide Imported into PNG

Type of Pesticide	Active Ingredients	Total number of products	Number of companies importing
Herbicide	2,4-D, ametryne, atrazine, dicamba, fenbutatin oxide, glufosinate ammonium, glyphosate, metsulfuron, mono sodium methyl arsenate, paraquat, simazine, triclopyr, trinexapac ethyl **(13)**	51	10
Insecticide	acephate, aldicarb, benzine hexachloride (HCH), pirimicarb, bacillus thuringiensis, bendiocarb, bifenthrin, carbaryl, carbofuran, chlorpyrifos, coumaphos, cyfluthrin, cypermethrin, DDT, deltamethrin, diazinon, dicholorvos, dicofol fenbutatin oxide,, fenitrothion, fenthion, imidacloprid, lambdacyhalothrin, lindane, malathion, , methamidiphos, methiocarb, monocrotophos, permethrin, petroleum oil, phosmet, pirimiphos-methyl, propoxur, tau-flavunate, tebufenzoide, temephos. **(35)**	101	13
Fungicide	benomyl, chlorothalonil, captan, copper hydroxide, copper oxide, copper oxychloride, cupric hydroxide, hexaconazole, metalaxyl, phosphorous acid, sulfur, thiabendazole, thiram, triadimefon, tridemorph, **(15)**	22	6
Fumigant	aluminum phosphide, methyl bromide **(2)**	4	1
Molluscide	metaldehyde**, (1)**	4	4
Rodenticide	brodifacoum, bromadiolone, , coumatetralyl, flocoumafen, warfarin **(5)**	13	5
Total		195	21

from PNG Pesticide Registration Database - Source: Department of Environment & Conservation

The Department of Petroleum provides the following data for 2003:

Total commercial oil production: 13,196 thousand barrels of oil (17, 822 in Table 1.6) , US$ 339million or K92million.

Total gas production: 119,033 million standard cubic feet (135,765 in Table 1.6)

Kutubu produces oil and other petroleum products which include aviation fuel, diesel and kerosene which are consumed at the project site and the nearby domestic markets. Gas flaring occurs and is possibly a source of dioxins and furans. The Hides Gas fields produce naphtha, diesel, condensate, residue and gas for electricity. The Porgera Gold Mine in Enga province is a significant consumer of most of the gas sold from Hides while other processed products are sold to local markets (mainly in the highlands region). Residues incinerated, gas flaring and venting emissions also probably contain dioxins and furans.

2.4 Chemical Wastes

No information have been collected in any systematic way or are available on the amounts of chemical wastes generated in PNG. Chemical wastes are neither imported nor exported. There have been attempts in the past to import wastes and recently an exporter has proposed to export transformers purchased from PNG Power to India. An arrangement exists whereby radioactive waste materials resulting from the use of radioactive isotopes imported into PNG for research or medical reasons are returned to the supplier (Lucas Heights, Australia), as per acceptable arrangements and allowable under the Waigani Convention .

There would be a plethora of waste produced from the industrial, agricultural and mining sectors and from forestry, small food and fish processing etc. But very little quantitative data outside mining and some agricultural concerns exists.

One study was done for the National Capital District Commission (now National Capital Government) in 1995 on solid waste production in the National Capital District. This study estimated that the daily waste production (in tonnes) in Port Moresby was as follows: domestic 45.9 (27%); city and market cleaning 25.3 (15%), commercial 51.6 (30%), industrial 17.5 (10%), institutional 5.7 (3%), construction 22.4 (13%) and lawns and agriculture 3.7 (2%). However no mention was made of chemical wastes as such. (Wilbur Smith Associates (1995),Wilbur Smith Associates (1996).

In an attempt to ascertain both the types and quantities of some wastes produced by selected industries in PNG an exercise was carried out in 1995 and 1996 by officers of DEC to compile a trial or preliminary" industrial emissions" inventory. A small summary is provided in the next section.

2.5 Industrial Emission Inventory

In early 1995 PNG tried to develop a Pollutant Release and Transfer Register (PRTR) for waste emissions. This is discussed in Mowbray (1997a), and in the first chemical management profile (Mowbray, 2000). Officers in the Environmental Protection Section of the DEC with the assistance of a member of the AusAID Support Team) initiated what they termed an "*Industrial Emission Database Inventory*". The objective of this exercise was to create a **PNG Industry Environmental Database,** and as such to assist personnel in the Environmental Protection Division of DEC to monitor emissions from various industries with the intention of regulating industrial emission, developing standards and codes of practice and eventually reducing industrial emissions. The study was unable to construct a meaningful inventory because few industries either knew what or how much emissions they were producing, or were unable or unwilling to provide DEC with meaningful information. Only a small amount of the information provided was quantitative and could be used to estimate emissions and discharges.

It could be possible to extract relevant information from trade information and from information meant to be provided under the *Environment Act.* Certain information on imports, sales, emissions are required by law. Unfortunately often this information is neither forthcoming nor incorrectly formatted / categorised, or is grossly inaccurate. Some, though limited data, would be available from the published literature on air and water pollution in PNG. Much data would be available on mining discharges, and limited data from discharges in forestry and agriculture projects from EIA / environmental reports. However much of this data is not in a form to enable determination of discharges and releases (and transfers). Probably mining data and data required for water discharge permits may be suitable; the rest is probably too qualitative.

Most companies seem to neither practice "cradle to grave philosophy" nor have a commitment to good environmental stewardship. They neither recognise nor worry about polluting … moreover most believe it is both easier and cheaper to discard wastes "as normal". Few seem to do environmental / waste management audits. Most have no quantitative or even qualitative information about emissions / discharges

In PNG there are few laboratories capable of analysing chemical emissions to the air and water. Some do basic checks on waste water eg do pH, BOD, turbidity only . Even where simple analytical methods are possible companies usually do not have instrumentation nor trained person to do them. Hence precise amounts of emissions are unknown! Appropriate regulations on industrial chemicals and discharges and emissions exist for water but not air under the Environment Act, as there is a requirement for licensing to discharge wastes. Here companies are required to provide information on such discharges but it seems usually it is not (comprehensively anyway) enforced. There is no legal mechanism for or obligation on industry to maintain records of precise amounts emitted let alone to reduce those emissions; or even to provide DEC with what chemicals they import for their processes, except for pesticides and water discharges.

2.6 Discussion and Conclusions

On Chemical Production, Import, Export and Use.
Data on chemical import and export are available, but the information is very general with chemical groups being lumped according to the Harmonized System. Except for petroleum products no available data exists for production in PNG. Little data exists on actual use of chemicals in PNG. Generally it is assumed that import data for most chemicals infers / reflects use. However there are strange variations in data. Accurate summaries on all chemical data needs to be produced and made available.

On Chemicals Used by Categories
The classification / categorisation used by IRC / Customs for chemicals and pesticides in particular as required by international agreement makes interpretation of data difficult. Data also needs to be summarized and presented in trade statistics format easily understandable by the public. This issue needs to be addressed. The only available information on chemicals by category outside IRC exists for agricultural chemicals and petroleum products, but records differ between departments / databases and / or are not up to date / and their accuracy can not be verified. Inventories of hazardous chemicals are crucial if we are to manage chemicals. This is an important area to act on.

On Chemical Wastes and Emissions
Very little meaningful data exists. We can conclude from the survey done many years ago that industries need to establish systems of best practice, a system of regular environmental accounting and environmental auditing and need to provide such information as required by law to government. Government needs to establish workable procedures to obtain information on chemical wastes and emissions and establish a comprehensive database to record such information. This involves developing in - country an enhanced capacity for chemical analysis. If PNG is to adopt the "polluter pays principle" the amounts of pollutants in discharges and emissions must be known. Companies then should be required to internalise such costs into their production procedures. It is recognised that this will take time and a change in the attitude by both government and industry. This mechanism both needs to protect confidentiality of data for trade reasons but also makes available to the public crucial health and environmental information

2.7 Recommendations

DEC, DTI, DOH and DAL working together with IRC / Customs and with the private sector need to establish and maintain a national chemical database which records quantity and the value of chemical production, import, export and use in Papua New Guinea. This database should be computerised and easily accessible by government, the private sector, and the public. Government departments and trade and private sector organisations should take responsibility for making such data easily available. The database could be based / located with the Registrar of environmental contaminants / Environmental Protection Branch of DEC.

DEC and Customs/IRC need to work more closely so that specific chemicals can be better controlled at port of entry and the quantities imported accurately monitored The Harmonized Commodity Description and Coding System (HS) could be amended so to reflect specific chemical groups more accurately eg pesticides such as DDT or paraquat and chemicals such as PCBs or specified hazardous chemicals can be given subcategories. DEC needs to inform Customs on those chemicals with either a 'prohibited' or 'restricted' status. Import control needs to be reviewed.

Records are needed for POPs (Stockholm) , PIC (Rotterdam) chemicals and other PTSs and or specified chemicals covered under the Waigani and Basel Conventions or regarded to be hazardous under PNG conditions of use, as may be specified under regulations under the Environment Act or the other acts covering health and environment aspects of chemical management. Detailed records need to be kept (and be readily available and up to date) for all of agricultural chemicals (pesticides and fertilisers), petroleum products, industrial chemicals, and consumer chemicals. The last category needs to be defined.

DEC needs to develop a mechanism for companies to accurately record data on emissions and discharges and for making that information available to government. This is necessary if the government can enforce the "polluter pays principle" and to ensure better chemical management. DEC needs to develop a mechanism for companies to accurately record data on emissions and discharges and for making that information available to government. This is necessary if the government can enforce the "polluter pays principle" and to ensure better chemical management.

Government needs to work with industry to establish workable procedures to obtain such information on chemical wastes and emissions and establish a comprehensive database to record such information on wastes and emissions. Industries need to establish systems of regular environmental accounting and environmental auditing and need to provide such information as required by law to government. This also involves developing in - country an enhanced capacity for chemical analysis**.** Such information should be entered into a national pollution inventory, which is available both to the public and to chemical managers.

Chapter 3: Priority Concerns Related to Chemical Production, Import and Use

This chapter provides an overview of the nature of problems associated with chemicals used in PNG. It suggests those chemicals or categories of chemicals or general pollutants causing the highest concerns.

This chapter remains little altered from the first PNG National Profile of Chemical management (Mowbray, 2000) as the situation with chemicals management generally has little changed in the last few years. Two new introductory sections are added. Small alterations have been made, eg leaded petrol is no longer sold in PNG.

3.1 Important environmental issues in PNG

Papua New Guinea is often described as a country endowed with vast natural wealth both in terms of its natural resources and its large number of rich ecosystems containing considerable biological diversity.

In the last 10 years the PNG environment has suffered serious impacts and environmental degradation. This is due to pressures from a growing population with expectations of modernisation and a better quality of life. It is also due to demands by government and business for fast tracking economic growth and small scale industrialisation. These impacts and the degradation has occurred as a result of current patterns of development, habitat destruction, unsustainable resource use practices, environmental pollution, poverty, population growth, and poor environmental governance.

People use their environment for food, housing, fuel, medicines and growing cash crops. Government and developers want the land for minerals, for timber and for modern agriculture, roads and infrastructure developments. With increasing urbanisation land is also needed for housing, roads and for industry and business activities. The coastal areas and rivers are impacted as we exploit them for their fisheries and use them to dump our wastes. These demands now manifest themselves in:

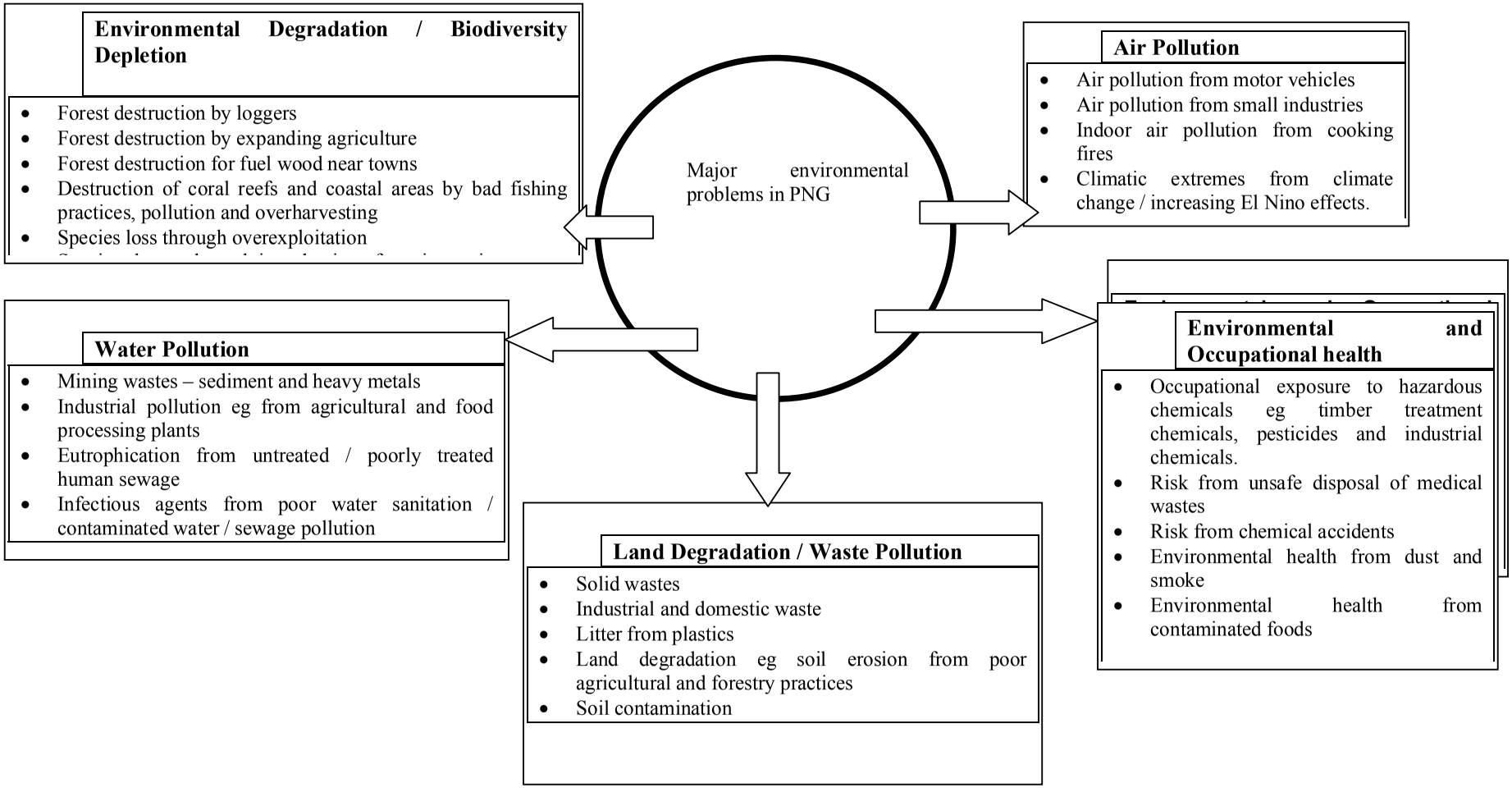
- A variety of unacceptable environmental impacts and increased risks
- Habitat loss and destruction or degradation or fragmentation or conversion to other uses
- Rapid loss in biological diversity
- Pollution of the soil, water, atmosphere, habitats
- Over exploitation and unsustainable use of natural resources
- Introduction of exotic and non-native species
- Modern agricultural methods which ignore traditional knowledge and practices

Students studying Environmental Science at UPNG in 2003 were asked what they considered to be the major environmental problems facing PNG today. Figure 3.1 illustrates their response. All boxes within Figure 3.1 include chemicals as causers of degradation, pollution and risk.

Unfortunately chemicals are often by their nature insidious in how they cause their effects. Their effects are long term and often very difficult to prove. But in other countries their effects are often well documented. Consequently most people are unaware of the dangers that inappropriate use and disposal of chemicals can cause.

Chemicals, chemical risk and pollution need be considered in this context.

Figure 3.1 Environmental Degradation and Pollution Problems in PNG



3.2 Chemical Risk and Natural Disasters

In October 2004 the National Disaster Centre in PNG published data on major disasters in PNG. The data are summarized in Table 3.1. Chemicals are clearly ranked low on the scale of importance as measured by the estimated cost for humanitarian response and rehabilitation, though lives were lost due to a kerosene explosion in a village. However compared to lives lost from the tsunami and landslides the numbers are insignificant.

Again, in perspective related to disasters, chemicals concerns are not given high priority in PNG. Again the insidious nature of chemical effects on human health and the environment is not considered. The real costs from both occupational and environmental exposure to chemicals has never been seriously considered in PNG. Indeed to determine the real cost of chemicals to both human health and the environment in PNG would be very difficult to determine / quantify , especially if it were to be expressed in economic terms.

Table 3.1 Major Disasters in Papua New Guinea (1997-2002)

Number / Rank	**Disaster**	**No of Occurrence**	**Population Affected**	**Lives Lost**	**Estimated Cost in Kina for Humanitarian Response and Rehabilitation**
1	Drought and Frost	1	2,236,830		29,073.496
2	Earthquakes	4	221,282	2	18,674,000
3	Floods	22	480,517		13,709,423
4	Tsunami	1	12,427	2,227	6,008,100
5	Cyclone	1	158,780		4,960,760
6	Volcanic Activities	4	46,358		4,058,870
7	Landslides	22	19,707	128	1,090,000
8	Sea level rise	1	3,227		620,000
9	Hailstorm	3	2,259		250,000
10	Famine	1	2,000		200,000
11	Chemical spill	1	750		46,000
12	Kerosene Explosion	1	39	5	35,826
13	Disease Outbreak	2	196	11	?
	TOTAL	**63**	**3,274,375**	**2,373**	**78,728,475**

Article / insert in Newspaper , 13th October 2004 in *Post Courier; also available from PNG National Disaster Centre,, at* www.pngndc.gov.pg

3.3 Priority Concerns Related to Chemical Import, Production and Use

(modified from first PNG National Profile of Chemical Management (Mowbray, 2000)

As noted in Chapter 2 there is little actual production of chemicals in PNG other than petroleum. However there is processing, formulation and use of chemicals nearly all of which are imported. Rubber and plastics are exported and compared to other groups of chemicals provides a significant income. Extraction of minerals occurs with some very large mines throughout the country.

Concerns on use of pesticides and heavy metals and other chemicals have been variously mentioned in publications over the years (Hicks 1989; Hicks & Mowbray 1991; Mowbray 1986a; Mowbray 1986b; Mowbray 1986c; Mowbray 1988; Mowbray, Grant & Windridge 1996; Singh 1996; Watts 1993) . Not included in this list is the plethora of publications on mining impacts in PNG. The main mining companies such as Ok Tedi Mining Ltd, Porgera Joint Venture, Misima Mines (now ceased operation) and Lihir Gold, and Kutubu Oil, have produced many publications including environmental plans, environmental management and monitoring reports, public environmental reports, sustainability reports etc.. over the years. Two publications that could be mentioned, though now dated, as further sources of information include (Mowbray 1986d; Pernetta 1988) .

The substance of this chapter is the concerns shared by the authors and key officers in the DEC. A meeting was held between the authors and key officers involved in chemical management in DEC and a 'brain storming' session was held. Tables 3.2 and 3.3 were compiled/ collated at this joint meeting. Table 3.2 has been slightly modified to include problems related to environmental governance, information availability technical capacity and general awareness on chemicals. It represents our attempt to note what we regard as the major pollution and chemical management issues in PNG, and our ranking of their importance. It mirrors somewhat what students perceive as the problems as given in Figure 3.1.

Table 3.2 provides an overview and description of pollution and related problem areas resulting from chemical processing and use in PNG. Management of all these problems have remained poor in PNG over the years. Table 3.3 gives a ranking of problem areas. Over the last decade too little has been achieved in chemical management and so the problems remain.

3.4 Analysis of Problems and Conclusions

Analysis of Table 3.3 reveal:

- Scales of problems vary from local to national. Table 3.2 shows whether problems are believed to be mainly rural or urban.
- Expressed concern of effects (perceived risk) is highest for pollution of waterways especially by mining and agriculture, contamination of drinking water, hazardous waste treatment and disposal, chemical accidents in small operations, import of unknown chemicals, storage and disposal of obsolete chemicals and waste disposal.
- Areas of concern (perceived risk) due to a low ability to control include air pollution, ground water pollution, soil contamination, chemical residues in food, occupational health in agriculture and forestry, and small industries, chemical accidents in small industries and small transporters, import of unknown chemicals, storage and disposal of obsolete chemicals, chemical poisoning and wastes from households.
- There is virtually no available statistical data on pollution by chemicals and effects of human health in PNG (other than from mining environmental plans, environmental management and monitoring documents and associated reports which are beyond the scope of this report). There is a real lack of systematically collected data and any adequate databases in the country related to pollution and chemicals.

Table 3.2 Description of Problem Areas

Nature of Problem	Problem Area	Problem (City/Region)	Brief Description of Problem	Chemical(s)/ Pollutants
Waste management and disposal	Mine wastes	Water pollution (rural -rivers/sea): mine, industrial,	Disposal and leaching both of overburden and tailings / no environmental acceptable disposal methods	Sediments, heavy metals (Cu, Hg) and CN
	Sewage, agro-industrial & animal wastes	Water pollution (rural -rivers/sea)	Often inadequate treatment & unacceptable disposal	Organic wastes & bacteria
	Industrial discharges & emissions	Air & water pollution (urban)	Dirty production technologies; inadequate disposal/ treatment methods; not sure of nature of wastes	Many hazardous chemicals: wide range: both inorganic and organic wastes
	Motor vehicle exhausts	Air pollution, mainly city (Urban)	Poor car maintenance/ lack of government enforcement.	Many hazardous chemicals: car exhaust emissions, noise
	Litter / Solid Wastes	Air, water & land/solid pollution	Lack of adequate solid waste management strategies/lack of proper sifting of landfills/ non-availability of suitable sites/ lack of sanitary landfills & lack of high temperature incinerators	Range of municipal wastes including non-combustibles and industrial household chemicals
	Hospital & Medical Wastes	Poisoning / diseases & pollution	One proper functioning medical waste incinerator in country; generally low temperature incinerators and/or non-functional broken down incinerators, operators not trained to run incinerators / no proper disposal sites - no segregation of hospital wastes	Range of medical wastes
Unsafe use / occupational health & safety	Pesticide use	Poisoning & pollution (rural/urban)	Lack of awareness/ information / inadequate training in safe use of hazardous chemicals; inadequate protection and personal hygiene by urban pest control operators, agricultural workers and timber treatment operators;	Pesticides,
	Use of timber treatment chemicals (TTC)	Poisoning & pollution (rural/urban)		CCA and BFCA
	Use of hazardous chemicals in work place	Poisoning (mainly Urban)	Lack of safe use / lack of industrial hygiene	Range of hazardous chemicals

Nature of Problem	Problem Area	Problem (City/Region)	Brief Description of Problem	Chemical(s)/ Pollutants
Illegal Use of Chemicals	Pesticides	Poisoning & pollution (mainly rural)	Lack of controls / enforcement; illegal use probably of old stocks -"illegal trade in DDT" ; .	DDT, paraquat, others often sold in small unlabeled packs; Use of old stocks of DDT from malaria control for use on food crops. Use of arsenic trioxide by pest control operators for termite control; and use of sodium arsenate in oil palm industry
	Hazardous Pesticides	Poisoning (mainly rural)	Intentional / suicides (in past); lack of awareness where use pesticides for killing lice in hair / killing mosquitoes / contaminating food	Paraquat (pesticide) and aerosol insecticides
	Hazardous Consumer Chemicals illegally used eg Alcohol	Poisoning (urban or rural)	Mass drinking	Methanol / other alcohols other than ethanol
Storage, obsolete chemicals / stocks	Old Pesticides / TTC	Pollution & contamination; poor storage & lack of suitable storage & disposal (mainly rural)	Inadequate storage and disposal of old containers / old stocks and wastes; illegal use.	Pesticides eg. DDT, HCH; and timber treatment chemicals eg BFCA, CCA.
Controls on hazardous chemicals / and enforcement	Inadequate controls on all chemicals and poor practices	Urban and rural	Lack of regulations / capacity to enforce laws or to ensure best practice; insufficient resources	All hazardous chemicals
Recording / databases and information	Inadequate information and recording	Urban and rural	Lack of record keeping; often not know what using or discharging	All hazardous chemicals
Food and environmental monitoring / chemical analyses	Inadequate laboratory facilities	Urban and rural	Insufficient resources	Most hazardous chemicals and wastes / pollutants
Unsafe use of chemicals in community	Inadequate understanding of chemicals and risk	Urban and rural	Poor education, training and awareness	All chemicals

Table 3.3 Priority Concerns Related to Chemicals

Nature of problem	Scale of Problem [1]	Level of Concern [2]	Ability to control Problem	Availability of statistical data [3]	Specific chemicals creating concerns	Priority ranking 0; 1-5 [4]
Air pollution	local	medium	low	insufficient/little	Air pollutants - vehicles and boilers, furnaces & incinerators in agro-industries	2- Port Moresby 4 - other towns 5 - Rural areas
Pollution of Inland Waterways	regional/ catchment	Mining - high Agriculture - high Other - medium	medium	insufficient/large	sediments, heavy metals, organic wastes	1
Marine pollution	local	medium	medium	insufficient/little	sediments, heavy metals, organic wastes & oil from ships	2
Ground-water pollution	local	low	low	no data		5
Soil Contamination	local	low	low	no data		5
Chemical Residues in food	local export	low medium	low medium	no data no data		5 2
Drinking water contamination	local	high - medium in populated areas	medium	insufficient/little	sediments, heavy metals, coliform bacteria & typhoid disease bacteria	2
Chemical & Hazardous waste treatment / disposal [5]	national	high	low- medium	insufficient/little	wide range which includes hospital wastes + others unspecified	2
Occupational Health: Agriculture & Forestry	national	medium	low	insufficient/little	pesticides, TTC	2
Occupational Health: Industrial	national	low - small industry. high - large industry.	low - small industry high - large industry	insufficient/little	wide range of inflammatory, corrosive, toxic chemicals	2
Public health	national	low	medium	insufficient/ medium	using pesticide stocks on Agriculture and fishing purposes + dynamite + cyanide in fishing	2
Chemical Accidents: Industrial	local	medium- small industry low- big industry	low - small industry high - big industry	-insufficient /little -sufficient	-hazard -chemicals	1 0

Nature of problem	Scale of Problem [1]	Level of Concern [2]	Ability to control Problem	Availability of statistical data [3]	Specific chemicals creating concerns	Priority ranking 0; 1-5 [4]
Chemical Accidents: Transports [6]	local	high -small operations medium-big operations	low-small operations high- big operations	insufficient/little	hazard chemicals	0
Unknown Chemical Imports	national	high	low	insufficient/little	pesticides, TTC, much unknown	1
Storage / Disposal of Obsolete Chemicals	national	high	low	insufficient/ medium	pesticides, TTC, battery chemicals transformer (PCB)/ hospital medicines/ chemicals	2
Chemical Poisoning / suicides	national	previously high now low	low	insufficient/ medium	anti-malarials in past paraquat	4
Persistent Organic Pollutants	national	low	medium	no data	include organochlorine pesticides/ eg DDT + PCBs	3
Industrial Use, Waste & Disposal	national	high	low-medium	insufficient/large	wide range - unspecified	1
Agricultural Industry / Forestry Waste Disposal	regional	high	low - medium	insufficient/little	organic wastes, pesticides, TTC.	1
Solid Waste Disposal	national	high	medium - low	insufficient/large	litter, plastic, heavy metal, battery wastes	1
Household Waste disposal (detergents, cleaners etc.)	national	low	low	insufficient/large		3

1.
   local = site specific or occurs in localised areas
   regional = covers region of country or large catchment
   national = country wide
2. level of concern: = "as perceived by authors and DEC officers"
3. Very little statistical data available. Most data are qualitative and often difficult to interpret.
4. priority ranking: 0 = adequate control; 1 highest concern .... 5 lowest concern.
5. Radioactive wastes are meant to be returned to supplier of radioactive materials usually in Australia through arrangement made in purchasing agreement. Only (certainly most) use of radioactive materials are by hospitals / medical use and for research purposes (Universities and Research organisations)
6. Transport accidents: Most problems and concerns relate to small companies and individuals that take few if any safety precautions in transporting hazardous chemicals. However some transport accidents have occurred involving mining companies involving spillages of dangerous chemicals including cyanide. See note 2 under Table 3.4 and see Box 3.1.

- Chemicals known / believed to cause most problems include heavy metals, organic wastes, hazardous chemicals and pesticides and timber treatment chemicals and those in air pollutants. These are the main chemicals and pollutants listed in Table 3.2. As noted in Table 3.2 occasionally poisoning occur in communities due to illegal consumption of low grade and toxic alcohols, and spillages occur in transport accidents, eg cyanide spills.

- Areas ranked with highest priority for action needed are listed in Table 3.4. These are generally those where the level of concern is high or medium and the present ability to control the problem is low. These may represent real problems (eg pollution of inland waters, waste disposal) or perceived problems (chemical accidents, import of unknown chemicals into PNG).

Table 3.4 Ranking of Priorities for Action Related to Chemicals and Pollution in Papua New Guinea.

Priority Ranking	**Problem**
1 (highest concern)	Pollution of inland waterways Chemical accidents in small industries Unknown chemicals being imported into PNG Industrial/ agricultural/ forestry waste disposal Solid waste disposal,
2	Air pollution in Port Moresby Marine pollution Chemical residues in food for export * Drinking water contamination Hazardous chemical treatment and disposal Occupational health in industry, agriculture and forestry Public health from incorrect/illegal use of pesticides / chemicals Storage and disposal of obsolete chemicals
3	Persistent organic pollutants (POPs) Disposal of household wastes
4	Air pollution in other towns in PNG Chemicals used in suicides/poisoning
5 (lowest concern)	Ground water pollution Soil contamination Chemical residues in food for local consumption Air pollution in rural areas
0 (adequate control at present) **	Industrial accidents in big industries Accidents from transport of chemicals

Note

* Probably a perceived problem. Few non-processed foods are exported from PNG. The author is unaware of any foods exported which have been found to contain unacceptable levels of (pesticides / other chemical) residues.

** A devastating explosion in 1995 in the explosives plant killed eleven workers at the Porgera mine
A truck carrying flotation chemicals to the Porgera Mine from Lae in 199x ran off the road in Ku Village in Simbu, leading to a compensation claim by the village people. This ranking of '0" is questionable. A barge carrying 2700 60 litre drums of sodium cyanide to Ok Tedi mine capsized at the mouth of the Fly River in Feb 1984, disrupting peoples way of life for weeks/ possibly months due to peoples' perception of the risk. A helicopter carrying 1 tonne of sodium cyanide to Tolukuma mine dropped its load on 22nd March 2000 spilling the cyanide and causing public concern and much media attention. See Box 3.1 outlining chronicle of events, as reported in PNG newspapers. Box 3.1 highlights confusion both about public perception of risks from cyanide and government's responsibilities toward transportation of dangerous materials. It also highlights the need for PNG to have trained persons and laboratory capabilities to respond quickly to emergencies like this.

The above information was assembled and evaluated by only the authors and representatives of DEC. The tables were given to persons from various other government departments, an NGO and trade / commercial organisations for their scrutiny, opinion and comment. However it would seem that none of these persons either disagreed with the contents of Tables or ever checked them. Few (and only minor) responses were forthcoming. The two meetings held for comment only attracted few participants. Invitations to submit comments also received only minor suggestions. It should be noted that key Government departments

(other than DEC) gave little priority to the exercise. One could assume that if departments and trade / commercial organisations had given the study a priority a different set of priorities may have been chosen reflecting more the experiences and concerns of different sectors and not those of academics and environment officers.

It would seem that a more practical way of getting a group / overall consensus on the contents of both tables and priorities for action would involve the organisation of an official workshop or seminar, sanctioned by Government, industry organisations and community groups. This may well be what is needed. UNITAR has provided guidance notes on running such workshops for developing integrated chemical management strategy. For example the following information can be obtained from http:///www.unitar.org/cwm/publications/index.htm (Organising a National Workshop on Chemicals Management; Safety and Developing and Sustaining an Integrated National Program for the Sound Management of Chemicals).

However given the absence of more substantive information, it is would be expedient for the Government to use the information above either as the basis on which to develop a more detailed study or (at present) as the basis to establish immediate priorities in chemical management in PNG. In establishing a further study or in setting those priorities it is important that an interdepartmental committee be formed / activated and that it be made a priority.

It is worth noting in Table 3.4 that POPs chemicals are ranked as "priority 3". This ranking was done in 1997 and published in the first National Chemical Profile (Mowbray, 200). POPs chemicals however have become high 'priority' because of PNG's ratification of the Stockholm Convention and the availability of funding through the GEF. However the PNG POPs project, as outlined in Chapter 4 the introductory chapter has encompassed much more than just the POPs chemicals, covering indeed all aspects of chemical management in PNG.

One group of chemicals which are not included that the authors feel ought be considered a high priority in PNG is that of **asbestos**. Different forms of asbestos are included under the Rotterdam Convention, as listed in Chapter 4. Given the problems to human health to those exposed to asbestos fibres, and given that many buildings in PNG have probably been built using fibro containing asbestos, a detailed investigation ought be considered a priority.

3.5 Recommendations

- Priorities areas to focus on in pollution and chemical management include as top priority protection of waterways especially from mining and agricultural wastes, chemical accidents in small operations, import of unknown chemicals, industrial/agricultural/forestry and solid waste disposal; as secondary priorities air pollution from motor vehicles in Port Moresby, marine pollution, contamination of drinking water, hazardous waste treatment and disposal, hazardous chemicals and pesticides use in industry, agriculture and forestry including use of timber treatment chemicals ,health effects from illegal use of chemicals, and storage, disposal and destruction of obsolete chemicals.

- Areas where more government control / intervention is required also include ground water pollution, soil contamination, occupational health in agriculture and forestry, and small industries, accidents in small scale transport of hazardous chemicals, and chemical poisoning and wastes from households.

- A reliable data recording system must be established for pollution, waste and chemical management matters. Until then priorities will continue to be determined based on professional experience, perceptions and ad hoc information (and possibly political demands).

- An official workshop or seminar, sanctioned by Government, industry organisations and community groups ought to be organised to evaluate priority concerns in the areas of Pollution and Chemical management in PNG. (Such a workshop may build upon materials / information in this Report).

- Government should use the information here as a basis for a more detailed study or (at present) as the basis to establish immediate priorities in chemical management in PNG; and that an interdepartmental committee be formed / activated to do this job.

Box 3.1 Cyanide Spill at Tolukuma mine, Central Province, March-April 2000: what was reported…..

Cyanide Spill on Tuesday 21st March 2000

Post Courier 22nd March 2000
Warning out on cyanide spill
A drum of sodium cyanide, weighing a tonne, was dropped accidentally from a helicopter [yesterday] ..15km south of Tolukuma mine…said managing director of Pacific Dome Resources. Villages warned to stay away.
Professor warns Tolukuma villagers to avoid contact
Sodium cyanide is a poisonous chemical….that can harm aquatic life and people.

Post Courier 23rd March 2000
Cyanide pellets located south of Tolukuma mine
..nearest village was 12km upstream from where pellets fell. …ferrous sulphate was to be flown in …company was communicating and working closely with relevant PNG Government agencies such as Department of Mines, Environment and Conservation and National Disaster and Emergency Services…technical experts being flown in. Every effort was being made to attend to the spill quickly and effectively. Environment and Conservation minister requests urgent meeting with mine management.

National 23rd March 2000
Major cyanide disaster averted, says Dome
The accident prompted an alert by the National Disaster and Emergency service, which issued a warning to local villages not to drink from nearby rivers or creeks. A team from the mine found the pellets about 500m from where the company had set up a base camp… and was not close to any areas of habitation, gardens or village water sources…..and a specialist recovery team had been airlifted in to decontaminate the area
"Its no excuse, but we have probably flown in almost 1000 tonnes of chemicals and this is the first time we have had this sort of an accident", said managing director of Dome Resources

National 24th March 2000
Company irresponsible: Landowners
Landowners living in the vicinity of the cyanide spill area of Dilava and Ialoge in the Goilala district of Central Province are claiming irresponsibility on the part of Tolukuma for the accident. Landowners Association chairman says that safety standards in airlifting such dangerous materials must be investigated as "this is not the first time this has happened".

National 27th March 2000
Agiwa: Don't drink from the Yaloga
Minister for Environment and Conservation has warned villagers living downstream of the Yaloga River ..not to drink the water from the river although they could use it for 'recreational purposes Water sample tests had found some sodium cyanide well below PNG regulatory levels.'.

National 29th March 2000
Greenpeace, Dome clash over clean-up
Dome Resources accused Greenpeace of preventing cyanide testing , ..while activists argued the company was playing down environmental damage. Greenpeace said it was testing soil and water samples around the site and interviewing villagers along the Yaloga River.
Exercise caution when carrying dangerous goods
The Executive Director of the Consumer Affairs Council said that corporate entities should exercise caution when conducting their business in the country ..[urging] that villagers near the mine must be made aware of the consequences and effects of the [cyanide] spill.
Supplies to cyanide spill area adequate: Agiwa
Adequate food and water supplies are being provided to people living near the area where cyanide was spilled.,…while tests are being carried out. Most of the cyanide pellets have been recovered ..but OEC officials are conducting tests to ascertain the level of contamination caused by the accident.

Independent, 30th March 2000
Cyanide transporting may have breached order
The transporting of a load of sodium cyanide may have breached a Civil Aviation Safety Order, which is enforced in Papua New Guinea and governs the transporting of dangerous goods [and] specifies the conditions under which dangerous chemicals can be carried by aircraft…said Air Niugini Managing Director. This revelation was in response and contrary to assertions by the Minister for Environment and Conservation who [stated] that the operator of Tolukuma Gold Mine was governed under the environmental agreement and that there were no laws in PNG governing the transportation of dangerous chemicals.
[Air Nuigini Managing Director] said regulations do exist. Civil Aviation Safety Order 33.1 governs the consignment of dangerous goods, while Civil Aviation Order 33.2 specifies the condition under which dangerous goods can be carried on an aircraft. These Civil Aviation Orders and International Air Transport Association (IATA) regulations prohibits the carriage of more than 50kg of sodium cyanide by cargo aircraft unless special exemption and permission has been granted by the director of the Office of Civil Aviation.

Watchdog finds toxic metals in Tolukuma waters
Toxic waste with levels of metals well in excess of Australian standards are being discharged into the Auga River at Tolukuma…says Sydney based mining watchdog Mineral Resource Institute. "The company is clearly engaging in unacceptable practices in dumping both its waste into the river and in its lack of precautions in transporting highly toxic material: the institute said. …..Water samples have been sent to a lab in Australia and to the University of Technology lab [in Lae] for testing.

Post Courier, 5th April 2000
Tolukuma mine will pay compo to landowners
Tolukuma mine will compensate landowners where the sodium cyanide spilled [said Tolukuma mine manager].

National, 4th April 2000
Tolukuma Mine's production drops after cyanide spill
Tolukuma Mine's monthly production drops following cyanide spill. Investigation by air safety division of Civil Aviation has been completed….all sling loading operations to and from the mine has been suspended until the outcome of its investigations. [An] Australian toxicologist has been engaged by Dome to assess the impact of the cyanide spill and to verify the level of sodium cyanide in the tributaries and the main Yaloga River, supported by UPNG Chemistry professor. Senior officers of DEC also left to assess the situation and compile a report for Cabinet.

National, 7th April 2000
No compensation planned after PNG cyanide spill
Dome Resources was not planning to compensate local landowners. Compensation would be paid for trees and shrubs cleared from the immediate spill site to enable helicopters to land and for crews to decontaminate and remove soil. We will pay for that (tree) damage. We don't see that there has been any other damage done, except at the site. Local creeks and rivers were clear of cyanide and local villages and water and animal life had not been endangered.

National, 10th April 2000
Mine operators say cyanide scare is over
Tolukuma mine operations manager [said] the water is "quite safe" by drinking and washing in it [as did the Minister Agiwa]. [Yet] Minister Agiwa said "How much cyanide has gone downstream we are not sure We cannot assure the people living downstream to drink the water until we have some confirmation from the tests conducted that the water is safe"….About 25 tonnes of decontaminated soil had been removed. 50 kg of the cyanide pellets out of the 950kg had spilled into the forest and creek….

National, 11th April 2000
Tolukuma villages warned not to use river
Environment and Conservation Minister told people downstream of the Tolukuma mine that the water in the river was not fit for drinking. He said it would take three weeks for experts and government officials to complete tests on the river, and only then would they be told if they could drink from it or not. [He] had asked Tolukuma mine to provide water to villages in the interim. [which it said it had with food].[However people distrusted the government and company officials and one said they had sighted dead animals… some were psychologically affected by the reports…]

National 13th April 2000
Tolukuma landowners want road constructed
The risk of dangerous chemicals falling off and being spilled while being airlifted would be minimised if a road is built…[and so] avoid such problems as the recent cyanide spill.

National, 17th April 2000
No cyanide threat, but clean up incomplete: Greenpeace.
Greenpeace's tests have revealed there is no immediate threat to communities living downstream from the accident site, but also that the clean up effort by the company is incomplete… that Greenpeace will be meeting Dome Resources to discuss their sample results…

Items selected / extracted from PNG newspapers over period 22nd March to 20th April 2000 by author.

Chapter 4: Review of Information and Data on POPs in Papua New Guinea

This chapter summarises what is known about POPs chemicals in Papua New Guinea. It includes summaries and a brief assessment of information and data collected in 2004 on POPs in Papua New Guinea.

4.1 Background

The last few decades have seen a dramatic growth in chemical manufacturing that has resulted in the release of toxic chemicals into the environment. Many of these chemicals are essential to human society but can also pose a serious threat to human health and the environment. An example of a group of such environmental pollutants that have caused such world wide concern are 'persistent organic pollutants' (POPs).

These highly stable compounds are used as pesticides and in industry. They are also produced unintentionally as the byproducts of combustion and industrial processes.

POPs are specifically a problem because they:

- Cause a wide range of toxic effects poisoning humans and wildlife ***(are toxic)***
- Persist in the environment for a long time before they break down (***are persistent)***
- Travel for long distances to all parts of the Earth, even remote areas thousands of kilometers from the nearest POPs source ***(are mobile)***
- Accumulate in tissues of most living organisms, which absorb POPs when they eat food, drink water or breath air ***(bioaccumulate, may biomagnify)***

As a result, POPs are everywhere. They tend to concentrate in the fatty tissues of humans and animals that are high on the food chain, reaching up to 70,000 times the background levels. Over the long term this could have profound implications for all of us. For wildlife the effects of POPs exposure is well documented. They include birth defects, cancers and dysfunctional immune and reproductive systems. Marine mammals such as some species of seals, porpoises, dolphins and whales and some species of birds such as some eagles and hawks (at the top of the foodchain) have suffered large population declines after been exposed to POPs. DDT causes eggshell thinning in birds. For humans the weight of evidence suggests that some POPs may have serious health effects. These may include cancers, birth defects, fertility problems, a greater susceptibility to disease and even a diminishing of intelligence. Especially vulnerable are foetuses and infants, which are exposed to POPs via the placenta, breast feeding and other pathways during the critical early years of human development.

Such is the international concern that there is now a global convention on them, specifically aimed at phasing out totally their use. It is called the Stockholm Convention. (www.pops.int.). PNG is a signatory to this convention. An associated convention that covers a wider range of chemicals which also provide risk to human health and the environment is the Rotterdam Convention (www.pic.int). The chemicals listed under these two conventions are given in Box 4.1 below:

The Stockholm Convention on Persistent Organic Pollutants (POPs) which entered into force on 17 May 2004 calls for each of its Parties (includes Papua New Guinea) to develop/update their National Implementation Plans (NIPs) on the management and disposal of POPs. PNG is in the process of developing its NIP under a twelve-country project funded by the Global Environment Facility with the United Nations Environment Programme being the implementing agency.

When the PNG POPs project was initiated it was agreed that priority for management need to be given both to POPS chemicals used or likely to exist in PNG, and a range of other chemicals which are likely to cause health and environmental problems in PNG. Agreement was reached at a workshop in September 2003 in Lae that the chemicals that need to be considered as high priority chemicals for management in PNG would include:

- Persistent Organic Pollutants. (POPs), as covered under the Stockholm Convention.
- POPs – like chemicals: those containing some of the properties of being persistent, toxic, mobile, biologically accumulate and so are high risk to the environment and to human health through environmental and occupational exposure.

- Persistent Toxic Substances or PTSs, as included in the studies published by UNEP Chemicals and Funded by GEF which included both the Pacific Islands and South East Asia and South Pacific regional reports (UNEP, 2003a,b).
- Hazardous Chemicals or environmental contaminants, as originally defined under the PNG Environmental Contaminants Act, now the Environment Act.
- Chemicals, as included, as appropriate, under the UNITAR guidance documents for producing / updating the National Profile.
- Chemicals included under the Rotterdam Convention of "Prior Informed Consent", and the Basel and Waigani Conventions..

Thus a wide range of possibly hazardous chemicals are included.

Those attending the Lae workshop and the PNG POPs National Co-ordinating Committee decided to gather information compiling an inventory and assessment for PNG in the following areas. These were decided to be the priority areas:

POPs Chemicals

- DDT – officially used in malaria control in specific areas in the country.
- PCBs - used or contaminants of oils in transformers and capacitors in the electricity sector
- Dioxins and furans – unintentional by-products of incomplete combustion – little is known about these in PNG

Other areas

- POPs and POP's like chemicals used in industry and forestry for timber treatment / an inventory of possible hazardous used in industry in the country
- POPs and POP's like chemicals used in agriculture / an inventory of pesticides used in the country
- Evaluation and Assessment of the chemical regulatory and institutional framework for chemicals in PNG.
- Evaluation and assessment of education, training, research and awareness raising on chemical and chemical management in the country.

Examples of POPs that are currently used or thought to be produced in PNG include:

Pesticides	DDT
Industrial chemicals	PCBs (polychlorinated biphenyls)
Unintended byproducts	dioxins and furans

A number of other chemicals included under the Rotterdam Convention were used in PNG in past years. The project intended to determine if these are still used in PNG.

The POPs project in Papua New Guinea has through 2004 collected information on POPS and POPs -like chemicals. These studies were initiated in earlier to mid 2004. Summaries of the results of the studies are included in this chapter. The chapter is divided into sections each dealing with the main chemical or groups of chemicals or the activity that were the focus of each task team and consultancy activity. For each a summary of key findings and the key issues identified are given. The detailed reports are cited.

4.2 Inventory and assessment of DDT used in the health sector

DDT was first used in PNG in the Second World War for mosquito control. The use of DDT was again used in the 1950s and 1960s to control vector borne diseases. Other organochlorines were introduced and in most cases pesticides were applied indiscriminately in the various sectors such as the agriculture, health, forestry and building and construction industries.

Box 4.1 Chemicals under Stockholm and Rotterdam Conventions, September 2004

Stockholm Convention	Rotterdam Convention
Annex A • aldrin • chlordane • dieldrin • endrin • heptachlor • hexachlorobenzene • mirex • toxaphene • polychlorinated biphenyls (PCB)	Pesticides • 2,4,5-T • aldrin • captafol • chlordane • chlordimeform • chlorobenzilate • DDT • dieldrin • dinoseb and dinoseb salts • 1,2-dibromoethane (EDB) • fluroacetamide • HCH (mixed isomers) • heptachlor • hexachlorobenzene • lindane • certain mercury compounds • pentachlorophenol certain hazardous pesticide formulations of • methamidophos • methyl-parathion • monocrotophos • phosphamidon • parathion Industrial chemicals • • asbestos (crocidolite) • polybrominated biphenyls (PBBs) • polychlorinated byphenyls (PCBs) • polychlorinated terphenyls (PCTs) • tris (2,3-dibromopropyl) phosphate recently added include pesticides • binapacryl • toxaphene • ethylene dichloride • ethylene oxide • DNOC and its salts • All formulations of monocrotophos and parathion • Certain formulations of benomyl, carbofuran and thiram industrial chemicals • asbestos (actinolite,anthophyllite, amosite, tremolite) • Tetraethyl and tetramethyl lead
Annex B • DDT	
Annex C • polychlorinated dibenzo-p-dioxins and dibenzofurans (PCDD/PCDF) • hexachlorobenzene (HCB) • polychlorinated biphenyls (PCB)	

In the late 1980s, a ban was imposed on the use of DDT and other organochlorine chemicals in agriculture. Heptachlor and chlordane was exempted for use in the treatment of subterranean termites in the building/construction industry. Lindane could only be used if recommended by the Department of Agriculture while DDT was exempted for use in the health sector for the control of vector borne diseases such as malaria. DDT is used as an indoor residual spray.

The departments responsible for the management of DDT are the Departments of Health and Environment & Conservation. Customs (IRC) also have a role to play during the importation of the chemicals while the Departments of Transport and Labour and Industrial Relations have responsibilities relating to the transport and handling and occupational health and safety aspects, respectively. Proper control mechanisms need to be in place to minimise or avoid exposure of humans and the environment during the life cycle of DDT in the country and during disposal operations for obsolete stockpiles.

The use and misuse of DDT in the agriculture sector is a concern, which needs to be addressed and the full cooperation of all concerned organizations and individuals would be required to achieve this.

The majority of people in PNG have little or no knowledge of chemicals risks and in the quest to increase yields for example by small farmers to meet the ever-increasing costs of living many have turned to the use of pesticides and illegal use of banned substances with little or no knowledge of their risks and hazards. DDT is known to be used illegally in agriculture. The general lack of awareness and education of the public is a factor that could lead to unwanted exposure or emission of chemicals such as DDT and their wastes.

To address some of these issues and to review the present situation, and as part of the PNG POPs project , Wossa and Sinikupa (2005) compiled an inventory on DDT stocks and use in PNG. Their report was titled: “The National Profile of DDT in Papua New Guinea”.

Wossa and Sinikupa’s main findings are as follows:

1. Malaria continues to be a major disease in PNG, both in coastal areas and the highlands. It is the second major cause of death (behind pneumonia).
2. DDT continues to be used in highlands areas for malarial vector control.
3. 20 tonnes of DDT were imported by the Health Department in 2000. Old stocks are also used.
4. WHO (2000) reported that 63.7 tonnes of DDT was stockpiled in 13 storage sites around PNG. Wossa and Sinikupa estimated that in excess of 43.6 tonnes of DDT are stockpiled mainly in the highlands provinces, in Rabaul or scattered around Milne Bay Province. Poor conditions of storage sheds and burial of some stockpiles ensure high risk of environmental contamination. They identified some contaminated sites.
5. Over 123 tonnes of DDT have been used in the last 20 years for malarial control.
6. The main alternative to DDT use is insecticide impregnated mosquito bed nets. However more research is needed to check its efficacy and its effectiveness in reducing malaria. Malaria vaccines are being researched and antimalarial drugs remain important. However effective vector control and management regimes remain important.
7. Illegal use of DDT, probably stolen or sold illegally from old DDT stocks is common in the highlands.

They made the following recommendations on what they see is needed to manage old DDT stockpiles and to phase out its use:

1. Redo the inventory of old DDT stockpiles and contaminated sites and repackage and secure stocks. Means of decontamination and alternative means of disposal of the DDT should be investigated with full costings.
2. Establish an effective and well coordinated and integrated malaria control program including alternative control methods to using DDT. This includes researching and establishing the best methods of distribution and re-treatment of insecticide treated nets.
3. Establish a monitoring programme to test and assess the level of DDT and its breakdown products and other organochlorine residues in both the environmental and human subjects to measure the impact of past use.
4. Launch a major awareness program on DDT and malaria control, plus dangers of misuse of DDT by use in agriculture and fishing ; and its effects on human health and the environment. This should be done through the print media, TV and radio.

Wossa and Sinikupa concluded by identifying priority concerns on DDT and proposed an action plan to be incorporated into the POPs NIP process.

4.3 Inventory and assessment of PCB containing equipment and waste oils

Little is known about PCBs in Papua New Guinea. In the 1980s small amounts were detected in oyster tissues in organochlorine residue studies done at UPNG. We also know that PCBs are present in PNG due to their use in transformers and other electrical equipment.

The use of transformers containing polychlorinated biphenyls (PCB) commenced when the power generation started in the early colonial days. To-date while many of the transformers installed in the late 1970s are still in use, others especially the earlier (redundant) transformers still lie in the waste yards. Most of the transformers are owned by the PNG Power Ltd, the main producer of electricity in the country. However, major mines such as the Ok Tedi and Bougainville Mines do have some obsolete stockpiles.

The lack of knowledge and hazards posed by PCB has resulted in human exposure during service and maintenance of the transformers and capacitors and the lack of care for the obsolete transformers, many of which are leaking PCB oil into the environment due to the unacceptable conditions they are stored under. Some contaminated parts are reused for servicing of other transformers. Transformer oils, possibly containing PCB have been drained. However, it is not clear whether these have been burnt off or are being stored. Hence, the management of waste transformer oils need to be assessed as well.

Tolimanaram (2005) as part of the Persistent Organic Pollutant (POPs project) produced a summary report on PCB in Papua New Guinea. He surveyed 80% of the country and found the following:

1. Half of the transformers assessed were manufactured before and up to 1986 and are likely to be PCB contaminated. He adds that tests are still needed to verify PCB contamination .
2. Most of capacitor banks owned by PNG Power are PCB free.
3. More than 68.7 tons of waste oils assessed are stored in steel drums tanks and in obsolete equipment. These are spread over all centers assessed.
4. Identified three contaminated sites being in Lae, Wewak and Port Moresby.
5. In all centres noted that the storage of obsolete equipment and waste oils is improper and do not meet the requirements of the Stockholm Convention
6. There were no proper records of transformers that have gone through retrofilling in all centres assessed.
7. In all centres noted numbers of leaking transformers in service or obsolete.
8. A general lack of knowledge and capacity and skills to manage PCBs

He also noted that the lack of knowledge and hazards posed by PCBs has resulted in human exposure and symptoms of ill effects during servicing and maintenance of especially transformers. He also observed obsolete equipment leaking PCBs into the environment due to the unacceptable conditions they are stored under. Transformer oils possibly containing PCBs have been drained and used as chainsaw lubricants, marking of playing fields or stored somewhere. Some is sold illegally as engine oil. Hence the need to assess waste management is also critical for inclusion into the POPs NIP process.

Ok Tedi Mining Townships (Tabubil) also determined PCB concentrations in 42 samples of oils from transformers analyzed for areas around Kiunga and Tabubil . The average total PCBs mg/kg = 82.27 mg/kg ; with PCBs ranging from 2.6 mg/kg to 263.6 mg/kg. Three different isomers of Aroclor were identified in the samples.

Tolimanaram states that assessments still need to be carried out on other potentially PCB containing materials inclusive of lubricants, heat transfer fluids, hydraulic fluids, vacuum pumps, liquid filled cables, household appliances like light ballast and capacitors, surface coatings, adhesives, plasticizers and inks ; an enormous task.

Tolimanaram recommended that all likely transformers and equpment need to be tested using the PCB test kits. He also identified important data gaps where additional and new data is required to provide a comprehensive coverage of PCBs, being

- **PCB emissions (close and open applications)**
- **environmental assessment of the discharge of PCBs from storage sites.**
- **assessment of likely toxic effects of PCBs toxic in ecosystems in PNG.**
- **assessment of effects of PCBs on human health in PNG**
- **environment monitoring to determine PCB levels in the environment**
- **inventory / data on other potentially PCB containing material**

He noted his concern about total lack of information of PCBs in PNG. PCBs are not controlled He noted that no regulations as yet exist covering PCBs to ban imports, marketing and reuse of PCBs and PCB containing equipment, and to ensure proper labeling and packaging of existing identified PCB equipment.

Tolimanaram recommends steps for capacity building to manage PCBs and to successfully phase out their use and safe disposal. Given the lack of knowledge about PCBs amongst the community and also amongst PNG Power workers, he suggests a need to promote training and awareness on PCBs and the environment more generally. Tolimanaram concluded by identifying priority concerns on PCBs and proposed an action plan to be incorporated into the POPs NIP process.

4.4 The inventory of source categories and assessment of unintentionally produced POPs

Up to recently nothing has been known about dioxins and furans in PNG. Dioxins and furans ares new to the majority of Papua New Guineans. They are produced unintentionally and are unwanted byproducts of many chemical industrial processes and of all combustion processes both from natural sources like forest fires and from man-made sources like power plants, backyard burning and incineration.

Currently, there is no national policy or regulatory tool in place for controlling industrial air emissions and contamination of soils and water from by-products of industrial processes and combustion. It is even more difficult to regulate the activities of society where the cooking, heating, lighting, processing of foods, agricultural practices, transport system and waste disposal practices are

key to the survival of societies, yet these are the very activities that contribute to these unwanted byproducts.

There is, at present no proper inventories and information on the unintentionally produced POPs and other hazardous substances in the country. Neither are there any proper regulatory or non-regulatory tools and capacity to effectively monitor, regulate or control the emission of these substances into the environment. There are no laboratory facilities and capacity for sampling and analysing of these parameters, let alone the skills and manpower to carry out these tasks. The cost for sampling and analysis is far reaching and beyond our capability in PNG. The use of the toolkit for dioxins and furans developed by the United Nations Environment Programme is the cheapest and the best non-laboratory tool for estimating the emissions at this stage.

Petsul and Totome (2005) used this toolkit to determine a preliminary inventory of releases of dioxins and furans in PNG. They determined the most important sources likely to be those listed in Table 4.1. They then tried to make estimates from these.

Table 4.1: Most important sources of dioxin and furan

Waste incineration:	*Includes hospital waste, incineration of quarantine solid waste, hazardous animal carcasses.*
Metal production and recycling:	*Primary and secondary plants for the production of gold, silver, copper, aluminum, zinc, lead, copper wire reclamation*
Power generation and industrial fuel burning:	*Power boilers (plant) fuelled with diesel, gas, crude oil, wood, and industrial heating for heaters and dryers fuelled with biomass for use on-site (e.g. copra dryer) and flaring*
Mineral production:	*Production of lime, brick, and asphalt mixing, etc*
Transport and fixed engines:	*Passenger cars, buses, trucks, tractors run on unleaded petrol or diesel, motor bikes, ships, boats and outboard motors including chainsaws and lawnmowers*
Uncontrolled combustions	*Biomass burning, waste burning and cooking for household, schools, office, industry, wastes burning from dumpsites/landfills, backyard, construction and demolition, and building and vehicle fires*
Miscellaneous:	*Wood chips and sawdust, plastic for cooking, accidental fires, prescribed burnings, contaminated sites and crematoria.*

They estimated dioxin and furan emissions mainly into air (and as residues) but found no emissions to water and land. They determined the current background of major emissions of dioxins and furans into the environment from combustion processes, as summarized in Table 4.2.

They identified the major sources of dioxins and furans were uncontrolled waste burning in dumpsites and backyard burning. Others identified were power generation and industrial burning, hospital waste incineration, and transport and fixed engines as the main emitters in PNG. Other potential sources could not be quantified.

Theirs is the first attempt at developing an inventory of dioxins and furans in PNG. The present survey on the existing inventory only addresses dioxin and furan emissions to air. There may be some amounts of dioxins and furans being produced in agriculture, PCP used for wood treatment and PCBs used in transformers and capacitors. Other reservoirs include landfill/dump sites, contaminated soils, and sediments.

The inventory on emission factors generated in PNG is difficult to quantify as for some sources identified, there are no emission factors determined., eg biomass burning / bush fires, etc..

Table 4.2: Estimated releases of Dioxin and Furan into air (g 1-TEQ/a)1; reference year 2003/4.

Cat No.	*Main categories & subcategories*	*Air*	*Water*	*Land*	*Residue*
1	*Waste Incineration*	*0.910*	*0.000*	*0.000*	*0.000*
2	*Metal production & Recycling*	*0.000*	*0.000*	*0.000*	*0.000*
3	*Power generation & Industrial fuel burning*	*1.017*	*0.000*	*0.000*	*0.000*
4	*Mineral production*	*0.000*	*0.000*	*0.000*	*0.000*
5	*Transport & Fixed engines*	*0.019*	*0.000*	*0.000*	*0.000*
6	*Uncontrolled combustion processes*	*10.612*	*0.000*	*0.000*	*6.725*
7	*Miscellaneous*	*0.098*	*0.000*	*0.000*	*0.000*

1. 1-TEQ/a = toxic equivalents

Total emissions from known sources = 12.657 g 1-TEQ/a. **This is low by world standards!?**

Petsul and Totome draw the following conclusions:

- Amongst the main source sectors, the best coverage exists for hospital waste incineration, transport and fixed engines, and power generation and industrial fuel burning. As these sectors undergo the dramatic changes in technology, emission factors and dioxin and furan emissions may change rapidly. As a consequence, good effective awareness, education, research and rigid legislation needs to be established.

- There is only limited data and information available from the metal production and recycling and the mineral production sectors. This sector is not a "hot spot" but reliable data will be required in future.

- There is absolutely no data available on dioxin and furan emissions to water and land but from observation it can be concluded that emissions to water may only be attributed to PCP and PCBs being leached by storm waters.

- Presently there exist no harmonized methods on generating and evaluating data for the dioxin and furan inventory. The only available harmonization of data acquisition and evaluation is the UNEP Chemicals Standardized Toolkit used in comparing dioxin and furan inventory in PNG thus;

- PNG requires a harmonization of protocols for sampling stack emissions, water, soil, etc and to present accurate releases, analyses using proper instrumentation and other simple methods are highly recommended.

Petsul and Totome see their study as a preliminary shot on dioxin and furans emissions and estimates of total releases of these compounds into the environment. The major sectors of dioxin and furan releases into the air established in industrialized countries cannot be assumed to be representative for industries in PNG.

The data collected so far indicates the coverage is not sufficient to estimate real emissions of dioxins and furans. Nevertheless, the present inventory will need to be updated in future, as it is obvious that dioxins and furans are a real problem and will only get worst if measures are not taken by appropriate state bodies to reduce their emissions into the environment.

Petsul and Totome (2005) identify priority issues and propose an action plan to be incorporated into the POPs NIP process.

Awareness raising and education of the public is a big challenge for the country in this effort to prevent or minimize unwanted emissions and exposure through changes in attitudes, behaviour and practices at all levels of community.

4.5 Inventory and assessment of POPs AND POPs-like chemicals used in industrial processes and forestry and building.

Some of the major users of chemicals are in the manufacturing/processing industry and the forestry sector which includes the building industry. Yet the management of chemicals, particularly those in these industries, has not been effectively regulated at the national level. Although some industries may have their own policies in place, the national legal framework has not been fully developed to allow for a comprehensive mechanism that would ensure proper management of chemicals and their wastes at the national level. This has led to chemicals entering the country without proper and well informed clearance procedures, hazardous wastes and obsolete stockpiles of hazardous chemicals being dumped without proper "duty of care" and with no monitoring of such activities by any regulating body. In addition, the absence of a proper inventory or database of hazardous chemicals in the country makes their management an almost impossible task. PNG needs to implement stricter regulation of industrial and other chemicals used in manufacturing, mining , petroleum and forestry sectors. It has the laws and is signatory to conventions which will enable it to do so.

As part of the Persistent Organic Pollutant (POPs) Pilot Project, Nakmai (2005) compiled a report entitled: “POPs and POPs-like Chemicals in Industrial Processes and the Forestry Sector in PNG”

Nakmai initiated compilation of an inventory of chemicals used in the industrial processing and in the forestry sector in PNG. She gathered data and information on industrial chemicals and those that are used in forestry for timber treatment. Companies provided a list of the chemicals they use and their products. For many products the chemical constituents are unknown. From the inventory little can be ascertained / concluded. It would seem that companies are reluctant to say what their products contain, or do not know. Included though are the following: laboratory chemicals, solvents, detergents, cleaning agents, pigments, paints, and bleaches – chemicals used generally. She found unregistered pesticides. Mercury is also sold to small scale miners.

The inventory is incomplete. It needs to be more detailed and to include active ingredient or main constituent for each trade product. The chemicals needs some “hazard rating” ie some information given on risk. Other information needed includes what the chemical or product is used for. Quantities and values of stocks would also be useful information (if the companies are prepared to provide it).

Nakmai in her survey identified no POPs and PTS chemicals used in PNG other than CCA and BFCA, though some may be present in PNG. Missing from her list are important chemicals listed under the Montreal and Rotterdam Convention which may be currently used or present in PNG. These include fumigants (methyl bromide), asbestos (in any one of a number of forms, as actinolite, amosite, anthrophyllite, crocidolite, tremolite), PBBs, PCTs, and tris (2,3-dibromopropyl) phosphate, and tetraethyl and tetramethyl lead. Little is known on their presence in PNG. But this needs to be ascertained.

Methyl bromide is still used in fumigation. Many of the old government buildings – hospitals, schools and houses are made from fibro-cement and were built in the 1950s to 1970s. This is the era when asbestos was used a lot. Now many of these buildings are deteriorating and need repair or are being demolished and replaced. Some of these buildings may also have insulation consisting of asbestos. This needs to be checked out, just as transformers have been checked out for PCBs. Use of lead compounds need also to be checked.

Nakmai recognizes the problem of compiling an inventory and keeping it up to date. She also recognizes the difficulty of keeping track of chemicals through their life cycle eg from importer to distributor to user to waste disposal. She suggests a tracking system for use by those companies importing, distributing and selling chemicals. She also recommends that for all those industries that undergo environmental impact assessments and are seeking permits to discharge wastes into the environment, that DEC must ensure that a condition for this is for them to keep an inventory of all hazardous chemicals and the volumes imported and used in their processes be kept and reported as per the reporting requirements set.

A suggestion (by the author) is that the priority should be at compiling an inventory of hazardous chemicals that need to be regulated and managed under a clearly stated chemical management strategy. These would include chemicals covered under:
Hazardous Chemicals Regulations (draft) for old Environmental Contaminants Act (already done)
Stockholm Convention and Rotterdam Convention (see Table 4.1)
Annexes to Basel and Waigani Conventions (refer to SPREP Waigani Handbook – interlinkages among Chemicals and hazardous Waste related Conventions)

The task then is to determine which of these chemicals are imported or used or produced in PNG and in what quantities and under what conditions. It is therefore important that all companies know what chemicals they use or produce or store or dispose of / emit. They need to also keep an inventory of these and provide a summary of such information on a regular basis (eg annually) to DEC.

Nakmai also assessed the legal/institutional framework for the management of hazardous chemicals in the industrial sector and the capacity available for implementing national and international obligations. She also reviewed the various conventions. These were also done by Yaru (2005) and are also covered in Chapter 6.

It is often stated in PNG that because government regulations are often not enforced industries have adopted self regulation. What is debatable in PNG is whether this “self-regulation” actually leads to better environmental practices and improved occupational health and safety. These non-regulatory mechanisms need also be assessed in the PNG context. A more detailed study is needed on which ones are actually used in PNG and how effective are they at ensuring better practices. A further study is needed to determine which ones could be applied in PNG and when and how. Here the private sector needs to sit down with government (and NGOs and community leaders) to determine what can be done.

Nakmai has served for many years as the main officer within the environmental protection branch of DEC responsible for chemical management . She notes some very important issues that need to be considered and acted upon.

1. Lack of regulatory capacity within government.
2. Most people are unfamiliar with the acts.
3. Most people either do not keep their own inventory of hazardous chemicals.
4. No data / information exists on emissions, discharges and wastes.
5. Customs officers are not trained on chemicals.
6. Few industrials / manufacturers produce / have available MSDS.
7. No training / certification of pest control and timber treatment operators
8. Obsolete Stocks and Contaminated Sites
9. Poisonous Information Centre.
10. Need for Environmentally Friendly Industries and Cleaner Production

Many of the issues are similar to those for pesticides but some differ. It is important that such an evaluation be done for industrial chemicals in PNG.

Nakmai, from her long experience as the principle officer responsible for chemical management includes in her recommendations / discussion mention of

the need for government to establish cooperative working relationship with chemical industries;
encourage industries to develop environment friendly products and support these by appropriate incentives such as reducing customs tariffs as costs added to consumer products and on raw materials and machinery imported in to manufacture these products.
awards to industries who are taking steps to reduce their wastes through the use and installation of cleaner production / cleaner technology

Nakmai , provides the following as critical issues that need to be addressed, with priorities and recommendations and has incorporate these into her action plan with time frames and costings:

Key issues include:

legislation and controls registry; inventory of stocks held; development of chemical clearance procedures for customs officers; development of a pollutant release and transfer register ; emissions of PTS and POPs; develop policies on cleaner production and promoting environmental friendly products ; action on obsolete stocks and contaminated sites.

4.6 Inventory and assessment of POPs and Pops-like pesticides used in Agriculture

The agriculture sector is an important importer and user of pesticides. Efforts were made 10-20 years ago to better inform sellers and users about safer use of pesticides (Chapter 6). Much effort was given to provide training in safe and efficient use of pesticides, and safe handling and management of pesticides.. The Pesticide Regulations stipulate the sellers and buyers of pesticides ought be aware of the FAO Code of Conduct on the Distribution and Use of Pesticides. Posters and leaflets on poisoning and treatment were distributed to all major hospitals. The situation in that period and what was done are reported in various publications, principally in Hicks (1989), Hicks and Mowbray (1991), Mowbray (1988), Mowbray (2000) and Watts (1993). It seems that most of this has had little effect. The situation seems to remain little changed. Few improvements are apparent in safe use of pesticides. Storage of chemicals, use of safety equipment and protective gear, much use of empty containers, management of wastes, lack of training, lack of adequate health monitoring of workers all remain important issues that need to be now readdressed. These are all activities that need to be built into the action plan and NIP process. Large projects and the vast majority of smallholders and farmers have yet to realize the cumulative impacts of these chemicals on their health and the environment.

There is a environmental regulatory framework and registration system for pesticides (covered in Chapter 6) but it is not working as it should. Some large plantations may have their own policies and good practices in place, however, the national framework has not been fully developed to allow for proper management of pesticides at each stage of their life-cycle and ensure the best practice. All including the smaller operators and village farmers need proper training and guidance on the safe and efficient use of pesticides. The lack of proper policing has led to chemicals entering the country without proper and informed clearance procedures and wastes and obsolete stockpiles being disposed without proper "duty of care" and with no monitoring of such activities. In addition, there is, at present no proper inventory of pesticides and lack of information on their distribution and the fate of obsolete stockpiles and wastes in the country. This makes the task of management of these pesticides in the country a very difficult task.

The majority of people in PNG have little or no knowledge of pesticides and so many use pesticides with no proper education and training on chemicals. The general lack of awareness and education of the public is another factor that leads to unwanted exposure to pesticides and their wastes into the environment.

As part of the Persistent Organic Pollutant (POPs) Pilot Project Kuman (2005) compiled a thoroughly documented report entitled: "Inventory and Assessment of POPs and POPs like Chemicals Used in the Agriculture and Livestock Sector of PNG".

A summary of what Kuman found is given in the following section, with some comments.

1. Inventory of POPs and POP-like chemicals presently used in PNG

Kuman compiled an inventory of pesticides from surveys and checks in selected provinces in the country where most agricultural activities are based. He listed 106 products and 57 active ingredients. Some were unregistered, in addition to some found by Nakmai (2005). Also but not included is DDT which is illegally being used in agriculture. POPs and PIC pesticides used are:

POPs pesticides	DDT
PIC pesticides	benomyl, carbofuran , methamidophos , thiram

He noted that heptachlor (a POP) was used up to 2003 by pest control companies. Some old stocks were dumped in a mine trench at Lihir in 2003.

2. Status of Obsolete Stocks

Most users reported that most old stocks of pesticides have been used, have been burned and / or buried, or have been placed in a store or in a container awaiting advice on how to dispose. This includes benomyl and old timber treatment chemicals (CCA) leaking from storage at a forestry station. A list of contaminated sites and sites where obsolete pesticides are stored still needs to be compiled and to be included in the action plan / NIP process.

3. *Pesticide Suppliers, Dealers and Users*

The number of major suppliers of agricultural chemicals is small, being Chemica, Farmset, AgMark and Brian Bell. Smaller retailers tend to buy from these suppliers. Some large plantations / farms may import their own as do some urban pesticide control companies. The number of suppliers have decreased over recent years as compared to 15 years ago. He also noted the illegal sale of DDT and other pesticides especially in the Highlands. DDT is obtained from stored or old stocks belonging to the Health Department and sold to village farmers. Other people buy pesticides from retailers, then resell them in the street and in villages in smaller containers or packets but without labeling.

4. *Chemical Storage Facilities*

The survey showed that the condition of stores of pesticides throughout the country vary enormously. Some, but not all larger plantations and some companies tend to have: locked store, sufficient ventilation, concrete floor, available running water and electricity and lighting. A common problem is that many store their pesticides in old shipping containers. These lack ventilation, get very hot and lead to crowding of chemicals. Many places have old stores which are in poor condition often dilapidated. Small farmers and villagers store their chemicals in their houses which is a safety concern.

5. *Use of Empty Pesticide Containers*

Use of empty pesticide containers as water containers is widespread, and thoroughly documented. This is a nationwide problem of great concern. Two oil palm companies which have ISO14001/ ISO9000 accreditation do not control / manage disposal of empty containers. Often people are informed to wash "thoroughly" such containers before use.

6. *Chemical Applications and Use*

Most pesticides are used by the larger plantations, eg coffee and oil palm. In the highlands possibly a million kina is spent on pesticides and fertilisers In the islands oil palm possibly uses more than 2.5 million kina's worth. In both New Guinea coastal and in the southern part of country less is spent. It is difficult to determine how much pesticide is used as some major users regard it as confidential information. IRC gives the value of pesticide imports as collected revenue in 2003 as K7.2 million and fertilizers as K41 million (Table 2.7). Most users, big and small, use less pesticides than in the past, principally because of the cost. This corroborates the IRC data .

Most of the pesticide in terms of quantity and value seems to be the herbicides glyphosate and paraquat - possibly up to 90% though this is not reflected in IRC data (Chapter 2). The main insecticide is possibly acephate (Orthene) and a commonly used fungicide is metalaxyl (Ridomil). Most small farmers can not afford pesticides.

Most small farmers only buy pesticides when needed. What they buy is from their own experience, and what is recommended by friends. It is only in the New Guinea's area that extension services provide adequate help in making recommendations. Little experimentation or field trials are conducted though NARI and OPRA do some.

7. *Protection / Protective Gear*

The survey reaffirmed that there is little awareness, understanding and appreciation of the nature of and risk from pesticides. Moreover little information is available to users. Many of the users are neither literate in English nor Tok Pisin. Hence they can not read the labels. Sellers and government extension services provide little help. Accordingly they receive little advice on safety issues. Larger companies do provide protective clothing and gears. Often though protective gear is incomplete. Often workers fail to wear it when they should.. Generally workers formulate and use pesticides with little protection.

Two large oil palm companies are accredited with ISO14001 / ISO 9000 and so try to address safety, health and environment issues. They are also aware of the NISIT Standards for using hazardous chemicals: PNG 1516-Part1-1991 and Part 2-1992.

8. *Management of Wastes*

Little consideration is given to disposing of leftover pesticides and wastes and avoiding pollution into streams or soil and ground water contamination. Except for large companies few people are familiar with environmental regulations on chemicals and wastes.

9. *Training*

Throughout the country training in use of pesticides is inadequate. Some large research and training organisatiosn (eg NARI, CCI and University of Vudal), plantations and farms, some of the major suppliers and pest control companies do run in-service training courses on safe and efficient use of pesticides and in handling and managing chemicals. Some do training and extension with farmers. More than not, managers and supervisors provide the adhoc training. Some companies provide no training, often relying on employees' past work experience and training. Some sellers do provide advice.

NISIT does have a standard or guidelines on health, safety and well-being in the workplace (NISIT National Health and Safety Standard PNGS 1082-1991). It appears few organizations are aware of it.

10. *Medical Services, Health and Safety*

No one, including hospitals are prepared for poisoning Most do not know what to do. A few instances of poisoning due to persons drinking paraquat were mentioned, resulting in deaths; two were deliberate, another was associated with a drinking binge – where 16 persons were claimed to have died. One company says instances of poisoning have decreased with stricter controls on distributing chemicals to small holders. One large farm can do blood acetyl cholinerase tests but no information is available on whether they do such tests and the results.

Most management and workers say they can discuss safety issues. The management of most large plantations and farms and companies say they are committed to worker safety. But working conditions on many are very poor and there is little appreciation and understanding on chemical safety issues.

11. *Alternatives*
There is inadequate research on biological control methods and IPM. The trend is towards increased manual labour and cultural methods to replace use of pesticides because of the cost of the chemicals. Use of grown cover to prevent weed growth, hand removing pests and diseased plants/plant parts are examples. One large coffee and tea grower claims using ground cover has reduced herbicide use by 60%.

12. *Pesticide Research and Development*
There is little active research on either pesticide use and application under PNG conditions, nor on alternatives. Some exceptions are at CRI (Coffee Research Institute), OPRA (Oil Palm Research Association) and NARI. Some companies do field trials with NARI. Most rely on overseas field trials and recommendations on labels or from overseas recommendations.

Kuman has identified key issues and developed an action plan to be incorporated into the POPs NIP process. What also remains to be done and emphasized in the action plan and NIP process, include

1. The PNG Pesticide Registration system must be revamped and the Pesticide Registrar must be more proactive in ensuring that importers, sellers and users comply both with the law and with best practice.
2. More information needs to be made available on safe and efficient use of pesticides. The issue of labeling needs to be readdressed , both focusing on recommendations for use and risk communication addressing all aspects of chemical risks both to humans and the environment.
3. Identification of alternatives to present pesticides used in agriculture including less hazardous chemicals, and integrated pest management (IPM) techniques and of problems that hinder the use of alternatives and application of the IPM techniques.

4.7 Further POPs reports

Three other reports, the first two with action plans, were prepared for the POPs Project. These were

- Yaru (2005) Evaluation and Assessment of the chemical regulatory and institutional framework for chemicals in PNG.
  Some important issues and points highlighted in Yaru's report is provided in Chapter 6 (section 6.6 in Box 6.1)
- Ila'ava (2005) Evaluation and assessment of education, training, research and awareness raising on chemical and chemical management in the country.
  Important points on education, training and research are highlighted in Chapter 11 (section 11.4 in Box 11.1) and on education and awareness raising in Chapter 13 (section 13.3).
- Solien (2005) POPs Awareness report
  Important points and lessons learned on awareness raising in chemicals and POPs is also discussed with suggestions in Chapter 13 (section 13.3).

4.8 Recommendations

- Given its obligations under the Stockholm, Rotterdam, Basel and Waigani Conventions and others , and due to the insidious nature of POPs and POPs-like chemicals, higher priority must be given to their management.

- The priority issues identified and the action plans proposed for the PNG National Implementation Plan for POPs ought be endorsed by the PNG government and be given serious consideration by the Conference of Parties of the Stockholm Convention. Backgrounds to and justifications to actions proposed in the POPs NIP are contained in the reports cited.

Chapter 5: Review of Health and Environmental Effects of POPs and POPs-like Chemicals in Papua New Guinea

This chapter provides a brief summary on what is has been done and is known about the health and environmental effects of POPs and POPs like chemicals in Papua New Guinea. It includes a brief assessment of the information and data collected found in the literature. A more thorough literature review is required.

5.1 Background

Very few studies have been done in PNG on the health and environmental effects of chemicals, other than those associated with mining, agricultural and forestry companies. Many such studies have been done as part of the EIA process and environmental management and monitoring requirements. Such studies mainly focus on heavy metals, sediments and pollution. Most of the studies done on POPs and POPs like chemicals were done in the 1980s and many of these at UPNG as part of SPREP funded activities on pesticides and heavy metals. These studies are reported in Chapter 3 (section 3.3). Few such studies have been done in recent years.

What follows is a brief overview on what is known on residue work, poisoning studies and ecological assessments of POPs and POPs like chemicals in PNG. The POPs and POPs-like chemicals are mainly organochlorine pesticides and PCBs.

5.2 Residue Studies Done in PNG

Various studies were done in the 1970s, 1980s and early 1990s to determine DDT and other organochlorine residues in foodstuffs, breast milk, blood, fatty tissue and environmental samples.

Pesticide residues recorded in human tissues generally indicate relatively low levels, though some of the levels are high by world standards. (Table 5.1). Some of the concentrations in breast milk, fat and even blood are high. However all such studies reflect the situation 10-30 years ago. No recent data is available.

Both Bourke (1971) and studies done at UPNG by Mowbray et al, (1988) reported low cholinesterase levels in persons occupationally exposed to organophosphates and carbamate insecticides. Similarly, levels of organochlorine pesticides and PCBs are detectable in very low amounts in animal and foods in PNG (See Tables 5.2 – 5.6). Again nearly all data is dated.

Table 5.1 Chlorinated pesticides and PCBs in human samples (ng/g = ppb)

Tissue	HCB	HCH	aldrin	heptachlor	DDT-R	dieldrin	PCB	Source
breast milk			0-13.2		0-884			Hornabrook et al, 1971
fat	0-920	0-50	0-130		40-58,000	0-2,110		Siyali et al, 1973
breast milk					60-3000			Spicer & Kereru, 1993
blood (pesticide users)	1	1	2	3	55 (0-949)	1		Mowbray, Baria,Griffin & Kila, 1988
blood (unexposed)	1	0.1	1	1	30 (0-370)	1		Mowbray, Baria,Griffin &

								Kila, 1988

Sources UNEP 2002 – Pacific Islands Regional Report (UNEP 2002 a).
Mowbray's reports

Table 5.2 Chlorinated pesticides in animals and sediment (ng/g wet wt or ppb)

Food	No of samples	HCH	heptachlor	DDT-R	dieldrin	Source
sediment	2	1.35		0.39	0.01	Olafson and Mowbray 1980
clam	4	0.28	0.02	0.05		
prawns	3	0.22		0.12		
crabs	2	0.13-0.41		1.1-2.0	0-1.8	
threadfin	4	0.06-0.17		1.1-7.7		
barramundi	2	0.16-0.31		0-0.09		
freshwater crocodile	4	0.18-0.40		0.3-3.2		
saltwater crocodile	4	0.23-0.29		7.3-23.7		

Sources: Mowbray's notes

Table 5.3 Chlorinated pesticides and PCBs in marine samples (ug/kg or ppb)

	HCB	HCH	aldrin	heptachlor	chlordane	DDT-R	dieldrin	PCB	
Green mussels (wet wt)		0-0.19							Prudente et al. 1999
Fish Lipid=0.68% (wet wt)	0.57				0.37	0.43		7.5	Kannan et al. 1995
Oysters range of means for different methods	6-44	1-3	1-5	3-25		22-122 (7-200)	1-10		Mowbray, Baria, Kapush and Haei, 1986
Mud clams Range of means of sample for different times and different methods	0-0.01	0-7	0-5	0.3-12		0-15 (0-27)	0-1		Mowbray, Baria, Kapush and Haei, 1986
Oysters (wet wt) range of means for different areas	3-25	3-46	0-54	31-121		88-274	8-89	PCBs detected by not quantified	Mowbray, Griffin & Kila, 1988

Sources UNEP 2002 – South East Asia & South Pacific Regional Report (UNEP, 2002b).
Mowbray's reports

Table 5.4 Chlorinated pesticides and PCBs in food samples (ng/g or ppb)

	HCB	HCH	heptachlor	aldrin	chlordane	DDT-R	dieldrin	PCB	Source
Meat (?)	0.1	0.6-2.2	0.04-0.15	<0.1-1.0	0.3-0.7	4.4-130	2.9-3.0	5.2-17	Kannan et al, 1994
taro	4	4	13	4		33	6		Mowbray, Baria,Griffin & Kila, 1988

Sources UNEP 2002 – Pacific Islands Regional Report (UNEP, 2002a)
Mowbray's reports

Table 5.5 Chlorinated pesticides and PCBs in food samples (ug/kg wet wt or ppb)

Food	No of samples	HCB	HCH	heptachlor	aldrin	DDT-R	dieldrin	PCB	Source
cheese	1	0.43	1.1	1.4	<0.01	6.2	2.2	4.4	Kannan et al, 1994
pork fat	1	0.40	7.5	0.13	0.3	24	4.3	45	
chicken	1	0.2	9.8	0.31	<0.01	29	2.2	124	
Striped mullet	6	0.04	0.85	0.07	0.12	0.51	1.2	3.3	
Tilapia	3	0.01	0.47	0.09	<0.10	0.09	0.1	1.9	
Mud crab	3	0.03	0.64	0.26	0.45	0.79	0.32	8.6	
oyster	1	0.02	0.33	0.17	2.1	0.34	0.73	16	

Sources UNEP 2002 – South East Asia and South Pacific Regional Report (UNEP, 2003b).

These studies show the presence of organochlorines including POPs pesticides and PCB in human and environmental samples. Although some levels are high one can deduce very little, partly since in the work done, other than at UPNG, sample sizes are either very low or unknown and the circumstances when collected are not known. Moreover with two exceptions all studies are before 1990 and somewhat now out of date.

5.3 Chemical Poisoning Studies in PNG

Mowbray (1986) did the last review on chemical poisoning of humans in PNG. Such a review is timely again almost 20 years later.

In his review Mowbray noted that typical causes of chemical poisoning and some deaths included: kerosene, methyl alcohol (methanol) and isopropanol, paint, petrol, lead, carbon monoxide, hydrocarbons, bleach, dettol and battery acids. Other main causes include overdoses of drugs such as valium, codeine, aspirin, chloroquin, maloprim. Snake bites, and fish and food poisoning are also common causes of poisoning. Pesticide poisonings included acephate, arsenic, coumaphos, DDT, dichlorvos, mevinphos, methomyl, methyl bromide, monocrotophos, paraquat, parathion, propoxur, rotenone, sodium pentachlorophenate and trichlorfon. Many deaths have been documented from drinking both of methanol and of paraquat. Many persons died from accidentally or intentionally drinking paraquat in the 1980s.

Solien (2004) noted from Health Department statistics for 1998 instances of poisonings across the country but was not able to state the causes of the poisoning. Both morbidity and mortality are recorded. Such records need to be systematically collected and reviewed.

Mowbray (1986) reports that there are few documented cases of poisonings in other animals. He reported cats dying after DDT spraying for mosquitoes, dogs eating coumaphos impregnated soap, cattle dying from paraquat, dimethoate and diazinon from accidental poisoning or using old chemicals that had degraded into more toxic ones.

Surveys were done by Environmental Science students in 1996 and repeated in 2002 and 2003. The students sought to determine if people perceived health effects from air pollution, in particular motor vehicle exhaust fumes in Port Moresby. Students asked 338 people whether they thought automobile exhaust make people sick. 76% said yes. Of these 66% said they know people who suffer from asthma, bronchitis and breathing problems possibly from breathing automobile exhaust. Some doctors also asked verified that they believe this may be so. This small study merely indicates that people are aware that exhaust fumes may have bad effects. There are many constituents in motor vehicle exhaust , many known to cause health problems and probably include dioxins and furans. Proper studies need to be conducted.

5.4 Ecological Studies in PNG

There are no documented field studies on ecological effects of POPs and POPs –like chemicals in PNG.

There are many patrol reports in government archives which detail spraying programs where DDT was used. Some include reports of spray teams actually dumping the DDT in creeks or the sea and others tell of village resistance to spraying because they feared being poisoned. Others tell of villagers washing their houses after the spray teams left for fear of being poisoned, and the smell. (Mowbray, own readings and personal communication).

In the Sepik and Oro provinces roofs of houses deteriorated after DDT spraying since the DDT also killed the predator of the sago thatch caterpillar. Mowbray (1988, page 202) reported pest outbreaks after DDT spraying in parts of Oro Province in the 1970s. This occurred when the DDT killed the predator of the sago thatch moth caterpillar leading to a subsequent increase in the population of the caterpillars who then ate the roofs of the houses earlier sprayed. Village cats were also poisoned. These were reported to Mowbray by former staff in the old PNG Malaria control unit of the Health department. Mowbray saw the data. Unfortunately all the files and data were subsequently lost. Similar poisonings of cats and other animals were reported to Mowbray from DDT spraying in villages in Milne Bay in the 1960s and 1970s .

5.5 Assessment and Recommendation

Lack of recent data or any adequate residue or field studies make proper assessment of effects of POPs and POPs-like chemicals, such as DDT, on humans and the environment in PNG nigh impossible.

A thorough literature review and assessment should be made of all POPs and POPs-like chemicals and their effects on people and on the environment in Papua New Guinea. Such a study should review any studies done since 1990 and include an assessment of poisonings, residue studies and anecdotal information available from available sources.

Chapter 6: Legal Instruments and Non-Regulatory Mechanisms for Managing Chemicals

This chapter aims to provide an overview of existing legal instruments and non-regulatory mechanisms for managing chemicals, including their implementation and enforcement, and to identify relevant strengths, weaknesses and gaps.

6.1 Overview of National Legal Instruments Which Address the Management of Chemicals

Table 6.1 list general details on legislation in PNG that cover chemicals. They are scattered across a number of departments.

The Department of Environment and Conservation is the main department responsible for chemical management. Up to 2000 there were three existing major pieces of environmental legislation related to chemical management in PNG, all administered through DEC, being

- *Environmental Contaminants Act (Chapter 368) 1978*
- *Environmental Planning Act (Chapter 370) 1978*
- *Water Resources Act (Chapter 205) 1982.*

The first two together with *Conservation Areas Act (Chapter362) 1978* formed an interlocking group of legislation passed by parliament in 1978 aimed at ensuring delivery of effective environmental management in PNG. Unfortunately the *Conservation Areas Act* remained dormant for 25 years[12]. It lacked any regulations or procedures. The functions of the three environmental protection pieces of legislation were as outlined below :

Environmental Contaminants Act: Was the major act controlling chemical management in PNG. Covered the many areas of environmental pollution; it established a licensing procedure for water, air and land discharge of pollutants. It established a register of hazardous environmental contaminants which regulated their importation, manufacture, discharge and use. It issued permits to import, export, manufacture, distribute and sell hazardous contaminants. It was only operable for limited pollutants, including noise and litter, and for pesticides. Only regulations and guidelines on pesticides were issued and enforced. Regulations on other hazardous chemicals, waste discharges and pollutants were never gazetted. No regulations were gazetted for industrial and consumer chemicals; they remained in draft form only.

Environmental Planning Act: provided the mechanism for environmental planning processes (through EIA processes, in particular approval of environmental plans) when any proposal was likely to have significant environmental, economic and social impacts. The emphasis was on voluntary compliance, but the Minister had power of requisition under the Act. Mechanisms for public involvement were defined. The act applied particularly to mining and forestry projects and some agricultural and infrastructural projects.

Water Resources Act: provided for the control and management of water resources in PNG. This included rivers, streams, underground water, wells and coastal waters. Domestic water usage (customary, public and private) rights were safeguarded, but the unauthorised taking of water and pollution was an offence. Licenses were required for the construction of various water-related facilities and leases may have been granted for water usage by large-scale projects. Water use permits were issued for abstraction and discharge of waste water. Water control districts that have strict environmental safeguards may have been declared. It was enforced (in part).

[12] Two other important pieces of conservation were *Fauna (Protection and Control) Act, 1966* and *National Parks Act, 1982*. Other environment and related legislation are listed in Unisearch PNG (1992),pp 108-110.

It was recognised that the license issuing procedures for the three acts were cumbersome, there was an overlap of conditions imposed on licenses, permits and environmental plan approvals. Proponents had to submit three separate monitoring reports according to the requirements of respective approvals.

These acts are now superceded with one *Environment Act, 2000.* The new act combines these three acts to provide a more efficient assessment, approval and monitoring system by incorporating the responsibilities currently covered separately. The act aims to promote a co-operative approach with both the community and industry to ensure environmental protection and best practice.

The new regulatory framework is based on three different levels or streams of regulation dependent upon the magnitude and significance of the activity. These levels are:

Level 1 activities are those that require a minimum level of environmental protection. Regulation of such activities will be based on standards, codes and regulations that set benchmarks for environmentally acceptable activities. For example maximum discharge levels, ambient quality standards for receiving environment, codes of practice, guidelines for best/acceptable practice. In cases of non-compliance, environmental protection orders, clean-up orders and emergency directions may be issued. .

Level 2 activities are those that require a framework of environmental approvals allowing for water discharge permits, or licensing for importation, sale and use of environmental contaminants (hazardous chemicals) and for site-specific environmental conditions to be set for these activities which have more significant potential impacts. Level two activities will be regulated by means of conditions in environmental permits, environmental improvement plans and environmental management programs.

Level 3 activities cover those with the potential of major environmental impact and are projects of national significance or of large scale. Such activities will be subject to a process of public and detailed considerations of environmental implication through the EIA process.

Management of chemicals is through Level 1 and Level 2 activities, with hazardous environmental contaminants and important pollutants subject to Level 2 activity regulatory mechanisms. Various regulations covering the act were gazetted in 2002 (see Table 6.1), and it is now fully operational.

Various tools have been developed to assist implement the new *Environment Act* and the new environmental regulatory system / streams. Tools include environmental policies and regulations, environmental impact assessment, environmental permits, codes of practice, bonds, fees and levies, environmental improvement plans, cleanup orders, environmental protection order, auditing and monitoring. Persons and organisations are required to accept an " environmental duty [of care]" and to avoid causing environmental harm. Some of these are elaborated on in section 6.5.

However as in most countries due to the cross-sectoral nature of chemical management there are a multitude of parts of legislation and regulations in PNG, which address some aspect of chemical and environmental management. The most pertinent are compiled together by Kwa (1996). Some of these laws and regulations are very out-of-date and merely sit in the statutory books unused and unheeded. They are summarized in Table 6.1 which summarises in table form the most pertinent legal instruments covering chemical management in PNG.

From Table 6.1 it can be clearly deduced that

- The main chemicals (apart from medicines and pharmaceuticals) for which regulatory controls exist in PNG at present are pesticides and petroleum products. No regulations exist to control other chemicals eg industrial and consumer chemicals, except in specific instances where particular chemicals are named. For example there is a Health Act regulation on the herbicide paraquat and an industrial safety regulations on timber treatment chemicals, and the now unused insecticide called monocrotophos and methamidophos or chlorpyrifos.
- A range of mechanisms do exist within various legislation to control forms of pollution, but, except under *Environment Act,* procedures for these and types of pollutants covered are vague and untested with a few exceptions. Section 6.2 below will briefly review the procedures and controls for pesticides, and also mention requirements for pesticide labeling.

Some provincial and local governments also have laws on chemicals. What needs to be clarified is how these provincial and local level government laws interact with those in Table 6.1 under the organic law on local level and provincial government.

Table 6.1: References to Existing Legal Instruments which Address the Management of Chemicals

Legal Instrument (Type, Reference, Year)	**Responsible bodies**	**Chemical Use Categories Covered/ Areas**	**Objective of Legislation**	**Relevant Articles / Provisions**	**Resources Allocated**	**Enforcement Ranking**
Environment Act , 2000	DEC	all	To ensure safe use of chemicals at all stages of life cycle: covers import, production /manufacturing/ formulation, export & handling, disposal/waste management, sale, use and storage; and for wastes to develop pollution release and transfer registers	Environment Contaminants (Pesticides) Regulation 1998 Ozone Regulation Environment (Permits and Transitional) Regulations 2002 Environment (Prescribed Activities) Regulations 2002 Environment (Procedures) Regulation 2002 Environment (Water Quality Criteria) Regulation 2002 Environment (Fees and Charges) Regulation 2002 Oil Palm Processing Code of Practice Vehicle, machinery and fuel storage Code of Practice Landfill Code of Practice Requirement for Cleaner Production.	*Trained persons*: inadequate. *Funding:* inadequate	Varies – but generally low
Environmental Contaminants Act, 1978[1] (superceded by Environment Act, 2000)	DEC	Pesticides including wood preservatives/ timber treatment chemicals, and vector control/ public health chemicals	Control importation, manufacture, distribution and sale of pesticides to protect human health and environment from indiscriminate use of agrochemicals	Pesticides regulations ECA Pesticides Guidelines Guidelines for writing PNG pesticide labels Pesticide Registration Guidelines Customs (Prohibited Imports) Pesticides Regulations *(all still applicable)*	*Trained persons*: inadequate. *Funding:* inadequate	*imports* fair: *sale:* fair: *use*: weak
		Industrial; discharges and emissions	Control importation, manufacture and use of hazardous chemicals to protect human health and the environment	Hazardous Chemicals regulations (draft) General Pollution (no regulations drafted)	*Trained persons*: inadequate. *funding* :inadequate	Very weak / for most categories is non-existent.
Water Resources Act, 1982 (superceded by Environment Act, 2000)	DEC	water use & discharge (contaminants, discharges)	Manages water resources and water catchments, control use of water and discharges into water Not control chemicals, but only regulate discharge of waste (at end-of-pipe).		*trained persons*: inadequate. *funding* :inadequate	fair
Environmental Planning Act, 1978 (superceded by Environment Act, 2000)	DEC	Big industries eg mining, forestry, agriculture	Through environmental plans and related EIA . Tools ensure proper environmental management of larger scale projects in PNG	*O*nly regulates planning / monitoring. EIA sections refer to the *Environmental Contaminants Act* for chemical management aspects.	*trained persons*: inadequate. *funding* :inadequate	Varies from weak to fair to effective

Legal Instrument (Type, Reference, Year)	**Responsible bodies**	**Chemical Use Categories Covered/ Areas**	**Objective of Legislation**	**Relevant Articles / Provisions**	**Resources Allocated**	**Enforcement Ranking**
Industrial Safety Health & Welfare Act 1961 (Chapter 175)	Department of Labour & Industrial Relations	Occupational safety / Safety at work	Provisions for dangerous work, handling, disposal, waste management, storage, occupational health, safety, awareness, education training and research	Includes special orders / regulations covering chemical treatment of timber as per Industrial Safety (Chemical Treatment of Timber) Order 1975; and in cacao as per Industrial safety (Monocrotophos) Order 1971.	*inadequate*	Implementation ranges from good to very good, though monitoring of aspects of chemicals remains a problem.
Inflammable Liquids Act 1953 (Chapter 311)	Department of Labour & Industrial Relations	Inflammable materials	Controls / regulate storage, transport and packaging of dangerous goods, explosives, inflammable liquids through issuance of licences register all premises that store, transport and packageof flammable and dangerous chemicals			
Explosives Act 1953	Department of Labour and Industrial Relations	Explosives	.			
Poisons & Dangerous Substances , Act 1952 Consequential amendments made in the "Medicines and Cosmetics Act 1999."	Department of Health	Includes pesticides (but out of date)		Covers paraquat – additives, storage and , sale		fair in some areas. uncertain in others
Public Health Act Food Sanitation Act 1991 Drugs Act 1952	Department of Health			Includes "Public Health (Sanitation and General) Regulations 1973	*Inadequate* - Department of Health -delegated function to NCDC	fair
Dumping of Wastes at Sea Act 1979	Department of Transport and Civil Aviation, DEC	Discharge wastes (Sections 6&7)	Supplemented WRA regulations (section 28) to manage discharges		*inadequate*	*weak*

Legal Instrument (Type, Reference, Year)	**Responsible bodies**	**Chemical Use Categories Covered/ Areas**	**Objective of Legislation**	**Relevant Articles / Provisions**	**Resources Allocated**	**Enforcement Ranking**
Prevention of Pollution of the Sea Act 1979	Department of Transport and Civil Aviation, DEC				*inadequate*	*weak*
NISIT Act 1993	Department of Trade and Industry	Establish standards. for chemical and related fields and occupational health and safety	Safeguard PNG against unsafe and substandard products. Also established Health and Safety standards for chemical measurements		*inadequate*	na
NAQIA Act 1997 Quarantine Act 1953	NAQIA					
Mining (Safety Act) 1977, Chapter 195A Mining Act, 1992	Department of Mining [4]	Industrial	Ensues companies comply with safety practices. Regulations cover cyanide in gold mining, sulphides for copper mining and nitrates used in explosives, and precaution against fire, waste, inflammable materials, health and sanitation, drinking water , explosives		*Staff shortage*	*effective*
Mining (Ok Tedi Agreement Act),1976	DEC and Department of Mining	Mining	Water / tailing discharge and environmental protection matters related to Ok Tedi mine.	And subsequent Ok Tedi (Supplemental Agreement) Acts 1980-1995.		
Oil and Gas Act 1998 (as amended)	Department of Petroleum and Energy	Petroleum products	Covers disposal/ waste management, use, storage, emergency response, public health, occupational health and safety, pollutant release and transfer registers and awareness, education and training	Oil and Gas Regulation 1997, No 10 of 2002 Petroleum Policy Handbook Petroleum Policy (pipeline) Gas Policy 1995 (Policy / Guideline) Gas Agreement (Guideline) Standard Petroleum Agreement (Guideline) Pipeline Policy 1998		
Customs Act (1951). And Customs Tariff Act 1970	Customs (Internal Revenue Commission)	implementation of imports only. Pesticides including wood preservatives/ timber treatment chemicals, and vector control/ public health chemicals		Customs Prohibited Regulation (Imports and Exports) including eg Customs (Prohibited Imports) Pesticides Regulations (1993) Customs (Ad Volorem Duties) Regulations	Inadequately trained staff and funds	Weak

Legal Instrument (Type, Reference, Year)	**Responsible bodies**	**Chemical Use Categories Covered/ Areas**	**Objective of Legislation**	**Relevant Articles / Provisions**	**Resources Allocated**	**Enforcement Ranking**
Civil Aviation Safety Orders Under Civil Aviation Act ?	Transport and Civil Aviation		transport of dangerous goods in aircraft			

6.2 Summary of Description of Key Legal Instruments and Procedures Relating to Pesticides

The importation, manufacture, distribution and sale of pesticides are controlled under regulations under the new *Environment Act, 2000* formerly under the *Environmental Contaminants Act (1978) Chapter 368*. Pesticides are controlled through the operation of *the Environmental Contaminants (Pesticides) Regulation 1988,* and its associated guidelines. DEC has the responsibility to enforce the Act. Two sets of guidelines have been produced. These are *Pesticide Guidelines (1988), Guidelines for Writing PNG Pesticide Labels.* More guidelines are needed eg concerning formulation, storage/warehousing, transport, packaging, personal protection, disposal of pesticides and containers, emergency measures. A supporting regulation gazetted in 1993 was the *Customs Import (Pesticides) Prohibition Regulations*, gazetted in 1993.

Most pesticides must be registered for importation and use in PNG. Household aerosols, a few other types of household pesticides, and pesticides used on ectoparasites of pets are presently exempted. The Registrar maintains a register.

The applicant to register a pesticide must provide the Registrar with specified basic data and verification of registration in Australia, New Zealand, Malaysia etc. or submit more detailed data as appropriate.

The Pesticide Registrar through the Pesticide Officer or the Pesticide Working Party determines the conditions under which pesticides are registered, ie how they may be used, and by whom. He/ she approves labels and monitors pesticide use. The Pesticide Working Party has not functioned for many years and definitely needs to be revitalized!

Permits are presently issued (a) to import, (b) to import/distribute (including repackaging) and (c) to manufacture/formulate. Importers and distributors need a permit. Some permits may include restrictions on use. Under (a) and (b) these permits have to be presented together with the approved label stamped by the Registrar to the customs officer to enable the release of the goods at the port of entry. Enforcement officers conduct post-registration surveillance. This is the legal requirement by law.

In 2004 195 products were registered covering 69 active ingredients with 21 companies having permits to import pesticides into PNG (refer to Table 2.14 in Chapter 2). However the register is out of date and contains errors. An effort must be made to ensure register / database is up to date and contains required and correct data / information.

The Registrar made it clear that no pesticides can now be (legally) imported into PNG unless they are registered, or exempted from the registration process. DEC officers should be given copies of any decisions on banned chemicals, and a list of registered pesticides as well; so should customs officers.

The Pesticides Guidelines clearly state that those importing pesticides for sale and use must be familiar with and accept as a standard of good agricultural practice the *International Code of Conduct on the Distribution and Use of Pesticides, commonly known as "FAO Code*" FAO, 2002[13]. This international code of conduct outlines responsibilities.. In the guidelines section 7.0 states:

> All applicants for permits to import, manufacture, distribute, and sell pesticides must be familiar with and accept the FAO Code... as "a standard of good and acceptable practice".

The WHO Recommended Classification of Pesticide by Hazard (IPCS 2002) [14] is used as the basis on which pesticides are classified. In schedule 1 it states that when application is made for a permit the

[13] Available on Internet at http://www.fao.org/waicent/FaoInfo/Agricult/AGP/AGPP/Pesticid/Code/PM_Code.htm

[14] Latest edition is Classification of Pesticides by Hazard and Guidelines to Classification 2000-2002 (WHO / IPCS Document available at www.inchem.org/pages/pds.html

WHO classification of the pesticide must be stated. The WHO classification is set out in Section 7.7 in guidelines. WHO class 1A pesticides (by formulation) are banned in PNG, and the "PNG label" requires colour coding according to the WHO classification or "HAZ category".

Back in 1993 PNG agree to participate in the *Prior Informed Consent Procedure,* known *as PIC* [15].

The list of banned and severely restricted chemicals in PNG is derived both from the *WHO Classification* and the *PIC* list, as shown in Table 6.2. This list still applies in 2004.

Table 6.2 Banned or Severely Restricted Chemicals

Name of chemical	**Level of Restriction (ban or severe restriction)**	**Details of Restriction (eg. Reason for control action, remaining allowed uses….)**
Pesticides	WHO Class 1A • all banned except: • severe restrictions on arsenic compounds so only used in TTCs eg CCA & BFCA	environmental & human health
Pesticides	Organochlorines all banned except: Severe restrictions for • DDT used in vector control • lindane if DAL OK • heptachlor or chlordane for subterranean termites	environmental & human health
PIC Chemicals	all banned unless allowed above with severe restrictions	environmental & human health

Pesticide Management in PNG needs enforcement. It is important that inspectors gazetted under the Pesticides Regulations understand their role in the context of chemical management. It is important that DEC is given the capacity and develops the infrastructure for enforcement. It is important that inspectors take responsibility to enforce the act and its regulations. It is important that Customs Officers be trained in the procedures for dealing with pesticide imports.

It is imperative that inspectors understand the jargon / language and limited technical information concerning pesticides. It is important for inspectors to know what pesticides can be legally used in PNG, how they can be used etc., safely and that acceptable standards of behaviour are applied to all life stages in a pesticides life history. Here inspectors can spread the essence of the FAO code. Of great importance is to ensure that labels, packaging and storage are acceptable. It is important to ensure pesticides are used safely. These are important practical jobs for inspectors. Much still needs to be done to ensure that human health and our environment are not put at unacceptable risk.

One important area that PNG has acted on to ensure safer use of pesticides is trying to improve labeling. This has met mixed success. The government requires chemical companies to label their products so all users can be aware of risks and learn from the label how to reduce risk and deal with emergencies. For example, PNG chemical labels have colour coding and warning signs appropriate to the culture. Some are likely to be used by villagers and home gardeners eg. Gramoxone labels are also required to be, in part, in Tok Pisin language.

Under Section 7.11.4 of the Pesticide Guidelines, when the applicant submits an application to register a pesticide a copy of the intended label must also be submitted for approval. A copy of the approved label is signed by the Registrar and attached to the permit. Under the pesticide guidelines (Section 9) labels must comply with FAO Guidelines. Labels on most products imported from Australia, New Zealand, UK, USA and Malaysia in general meet FAO guidelines and are acceptable in PNG. Certain

[15] Information on PIC procedure available at http://www.pic.int/ or at http://www.chem.unep.ch/pic/

affixtures may be required especially for WHO class Ib and II pesticides, and where intended use directions differ.

For pesticides for which PNG labels have been produced and where PNG labels are required, the label must conform to our own label-guidelines and our model label. At present some pesticides have been registered with an approved PNG label which does not conform to the PNG guidelines. However one of the conditions of registration was that the distributor must within a specified time (by end of the year) produce labels which do conform. However this has never been enforced. Old labels persist still today ten years later.

Guidelines for writing PNG labels and a model label have been produced and distributed to all potential importers, distributors and some of the users. In PNG there are hundreds of languages. The three official languages are English, Tok Pisin and Motu. All PNG labels must be in English. All paraquat labels must also be in Tok Pisin because of its widespread use particularly by village farmers. Some other pesticides must have labels or affixtures with warning and cautionary statements and first aid instructions in Tok Pisin. Some suppliers have also included directions for use in Tok Pisin. The problem is that many PNG'ians speak but do not read in either English and/or Tok Pisin. Accordingly hazard symbols and wordings must be included in PNG labels. However pictograms are presently optional. To date few companies have included pictograms on their labels.

Many companies still ignore the PNG laws on labeling. The main problems with pesticide labeling in PNG are three fold:

1. The principal problem is the cost of producing PNG labels for a small market. Hence most pesticide labels are oversea's labels. Despite this, in the past some distributors have been prepared to bear the cost and have reproduced excellent PNG labels. An associated problem is getting the correct pantone colour on the bottom strip of the label.
2. A second problem is that overseas labels which are generally acceptable may contain irrelevant or even incorrect "use directions" for the PNG situation / environment. In the case of some South East Asian country labels (eg Malaysian) the English section on the label is insufficient.
3. The third problem is the language problem. Many PNG'ians do not read English. Many neither read English nor Tok Pisin. Most labels are in English. The only requirements for Tok Pisin labels are for those pesticides commonly used by small holders, village farmers and home gardeners which are in the higher WHO classes, and in particular paraquat which is so widely used. For persons who do not read pictograms may prove valuable, but these are not obligatory on PNG labels.

6.3 Summary Description of Management Procedures for Control of Petroleum Chemicals

Table 6.3 provides an overview of who is responsible for petroleum chemicals through its life cycle. The Department of Petroleum and Energy (DPE) and DEC have split responsibilities, together with other departments and bodies eg IRC / Customs, Department of Transport, Department of Trade and Industry, and ICCC. This is an example of where a department other than DEC has clearly delineated its responsibilities. Other departments should do likewise. All the following acts and regulations apply:

1. The Environment Act 2000
2. The Oil and Gas Act (Consolidated No. 21) Oil and Gas Regulation No 10 of 2002
3. Harbours Board (Inflammable Liquid and Dangerous Goods) By- Laws (Chapter 240)
4. Inflammable Liquid Act (Chapter 311) (Consolidated No 15 of 2002) and Regulation
5. Customs Act (Chapter 101) (Consolidated No. 13 of 2001)
6. Independent Consumer and Competition Commission (Oil Refinery State Agreement Exception) Regulation 2003
7. Protection of the Sea (Shipping Levy) Act 2003

The responsibilities of the Department of Petroleum and Energy are given below. What the Department of Environment and Conservation is responsible for is noted also.

1. Grants Licences for Exploration and Development of Oil and Gas Resources

2. Regulates and monitors the activities of licenses to ensure, they comply with all of PNG's relevant legislations including international and industry best-practices
3. Does not approve Environmental Plans but provides comments and liaise with DEC. EP approvals are done by DEC
4. Does not approve permits for water use, and permits for use of hazardous/toxic substances/ waste generation, disposal etc. Done by DEC
5. Does its own Health, Safety and Environmental Inspections, but liaises closely with DEC on critical environmental issues pertinent to the industry
6. Regulates most of the operational aspects of the industry. (i.e. exploration, production, processing, community affairs, safety, engineering etc)
7. All Environmental Compliance and Monitoring are reported to DEC. DPE is notified through the Monthly Technical Reports.

6.4 Existing Legislation by Use Category Addressing Various Stages of Chemicals from Production or Import through Disposal

Table 6.4 provides a brief profile of whether legal instruments regulate the different stages of chemical groups in PNG, from import and/ or production/formulation to disposal. The authors and officers of DEC constructed this table (from first PNG National Profile on Chemical Management (Mowbray, 2000) These instruments are contained in the various acts listed in Table 6.1. A detailed analysis of what acts cover items in Table 6.4 is needed. The example is only given for petroleum chemicals in Table 6.3.

Legal instruments do exist covering all aspects of pesticides under the Environment Act. All aspects of industrial chemicals and disposal of petroleum products and chemical wastes are also covered under the Environment Act but lack regulations and enforcement. Petroleum products are also covered under legislation the responsibility of the Department of Petroleum and Energy, as discussed in section 6.3. It appears that use of fertilisers and consumer products are not covered under existing legislation.

A review on legislation covering POPs is given by Yaru (2005). Much of what it covers is discussed above. POPs and POP-like chemicals are covered in part as DDT is covered under pesticides and PCBs under industrial chemicals, though the latter needs regulations. Dioxins and furans are in theory also covered under industrial chemicals but in practice so little is known about them (and the nature of most chemical wastes in PNG) that they effectively are not covered.

Table 6.3 Overview of Legal Instruments to Manage Petroleum Chemicals by use categories

(DEC through Environment Act)

Category of Chemical	Import	Production/Formulation	Storage	Transport	Distribution/Marketing	Use Handling	Labeling	Disposal
Petroleum Products	IRC/Customs Act	DPE (Oil and Gas Act and Regulations)	DPE (Oil and Gas Regulations) DOT Harbours Board Act	DOT- Shipping Levy Act Harbours Board Act Inflammable Liquid Act	Inflammable Liquid Act ICCC Regulations	DPE (Oil and Gas Regulations) Harbours Board Act Inflammable Liquid Act	DPE (Oil and Gas Regulations) Harbours Board Act Inflammable Liquid Act	DEC DPE- Oil and Gas Regulations

Table 6.4 Overview of Legal Instruments to Manage Chemicals by Use Category

(x means legal instruments exist; 0 means no existing legal instruments)

Category of Chemical	Import	Production/ Formulation	Storage	Transport	Distribution / marketing	Use / Handling	Labeling	Disposal
Pesticides [1] (agricultural, wood preservatives/ timber treatment, public health and consumer use)	x	x	x	x	x	x	x	x
Fertilisers	x	o	o	o	o	o	?	-
Industrial. Chemicals [2] (used in manufacturing / processing facilities)	x	x	x	x	x	x	x	x
Petroleum Products [3]	x	x	x Transport	x	x	x	x	x DEC
Consumer Chemicals [4]	o	o	o	o	o	o	o	o
Chemical wastes	x	-	x	x	-	x	o	x

1. Pesticides: Have regulations. Have Guidelines on Registration and Labeling. Compliance to FAO Code "obligatory". Further guidelines needed. Further general awareness needed. Down line it is difficult to control misuse - and hard to determine who is responsible for misuse. Lack of clarity exists here between responsibilities of DEC and those of Department of Agriculture and Livestock. Too few gazetted environmental officers (EO). Uncertain whether EOs carry out responsibilities??
2. Industrial Chemicals: Only draft regulations on Hazardous Chemicals - hence never enforced except through general provisions of old Environmental Contaminants Act..
3. Petroleum Products: Responsibilities here are shared mainly between DEC and DPE. See Table 6.3 and accompanying text in section 6.3.
4. Consumer Chemicals: Need clear definition of what are and are not included under definition of Consumer Chemicals…..hence chemicals that may fall under this category are "loosely" if at all controlled in PNG.

PNG certainly needs the establishment of regulations to cover all chemicals other than pesticides and petroleum products. Useful information and procedures are available from UNEP Chemicals (IRPTC). Information is available on the internet concerning Pollutant Release and Transfer Registers (http://www.chem.unep.ch/prtr) ; on Prior Informed Consent (http://www.pic.int or http://www.chem.unep.ch/pic); on Persistent Organic Pollutants (http://www.pops.int or http://www.chem.unep.ch/pops) ; and on the Code of Ethics on the International Trade in Chemicals (http://www.chem.unep.ch/ethics/english/CODEEN.html). This code is somewhat equivalent to the FAO Code on Pesticides. General information on UNEP Chemicals can be found at their website: http://www.chem.unep.ch/ and available as html or pdf files or as a hard copy.

6.5 Summary Description of Management Procedures for Control of Chemicals

To date a chemical management strategy in Papua New Guinea only operates with pesticides. No real chemical management strategy yet operates for industrial and consumer chemicals.

A brief profile of the present chemical management situation in Papua New Guinea is as follows:

Table 6.5 Components of Chemical Management Strategy in PNG.

Component of Chemical Management Strategy	**Pesticides**	**Industrial and Consumer Chemicals**
Risk Assessment	partial / use secondary information	none / limited
Legislation and Regulations	Cover registration and labeling	none; "draft only"
Infrastructure and Enforcement	import and registration process; otherwise limited	none; developing
Education , Training and Awareness Raising	limited	none / beginning / POPs only
Monitoring and Review	partial	none / beginning

This is expanded as follows:

Risk assessment for pesticides is made using secondary information, that is provided either by the importer, by the overseas supplier (usually a multinational chemical company) or from data and information provided by an overseas government or a UN agency, either FAO or UNEP Chemicals (formerly IRPTC). It was expected that computerised databases created by University of Queensland at Gatten would be used eg Peskem (Australia), but this no longer exists. However there are a number of NGO websites that are useful. PAN North America has the website (http://www.pesticideinfo.org) and the Australian National Toxics network has one at website http://www.oztoxics.org . The Australian National Registration Authority for Agricultural and Veterinary Chemicals has a website that includes an inventory of all pesticide products registered in Australia (http://www.apvma.gov.au/pubcris/subpage_pubcris.shtml . Details on these data bases are given in Table 10.5 in Chapter 10.

Pesticide regulations and guidelines for implementing the legislation and for labeling exist. Supplementary Customs regulations exist to control the importation of pesticides. Staff within the Environment Protection Section of the Department of Environment and Conservation (DEC) are responsible for registration and ensuring compliance and enforcement. Consequently now fewer pesticides enter PNG without prior approval. However some general household pesticides not exempt from registration still appear in trade stores and some pesticides still enter imported without being registered, some for aid projects and some others with the knowledge of government authorities. Some old stocks are still being sold and/or used. Some timber treatment chemicals are imported as industrial chemicals and some brought in without approval. Such loopholes need to be closed for agrochemicals. DEC needs to clarify with all importers

which pesticides require legislation and which are exempt, such as many of the household aerosols and mosquitocoils. Education and training occurs in agricultural training institutions and in-service courses are given, and several aid projects have focused in part on training. However environmental safety is probably not covered adequately in any of these courses. Consequently much needs to be done to train both sellers and users better.

Thorough reviews and monitoring of pesticide use in PNG, and compliance both to PNG regulations and guidelines and compliance with the FAO code were conducted through the late 1980s and early 1990. These are variously presented as reports to SPREP (Mowbray (1988)), SPC (Hicks (1989; Hicks & Mowbray (1991)) and to Greenpeace Pacific (Watts (1993)). However since then insufficient attention has been on most aspects of pesticide use, in particular including transport, storage and disposal, education and training. Little has been done in recent years. Much needs to be done to ensure full compliance, and to build an infrastructure to enable good practices and ensure enforcement; and to be able to monitor and review.

Risk from other chemicals that can cause environmental or health problems in PNG has never been adequately evaluated. These include industrial and consumer chemicals. Draft regulations and guidelines covering industrial chemicals (Hazardous Substances regulations) have been in the drafting phase for many years. (over ten years). In the late 1990s , under an AusAID Strengthening Project both legislative procedures were reviewed and standards being developed for a wide range of environmental and health related contaminants / chemicals. This in part resulted in the new Environment Act. What is required now are the drafting of more specific regulations to cover all major aspects of chemical management, including controls of pesticides, industrial chemicals, consumer chemicals, POPs and pollution. It would be beneficial to initiate projects in the near future to also establish a better pesticide registration database, to access the various chemical databases available internationally, to consolidate the work done on developing national pollution inventories (through the PRTR process), to possibly develop a PNG database on hazardous chemicals and to establish a mechanism to regularly review the National Profile of Chemicals Management.

6.6 Legal Instruments for Managing POPs Chemicals

Yaru (2005) provides a general review on what laws cover POPs and include those specifically for POPs - and what amendments are needed in key legislation and other actions necessary.

These include key legislation

- derived from national obligations under the Stockholm Convention…
- related to hazardous waste management related to hazardous waste management and contaminated sites / stockpiles
- related to PCBs
- related to sources that generate and release dioxins and furans

Key legal instruments covering all stages of the life cycle of POPs – include DDT, PCBs and dioxins / furans need to be determined.

6.7 Non-Regulatory and other Mechanisms for Managing Chemicals

There are many non-regulatory instruments for managing chemicals. They are termed environmental management tools. Many are now being used in PNG. Examples are given in Figure 6.1 below. Those highlighted are use in PNG. However who uses what needs to be determined.

Economic Instruments

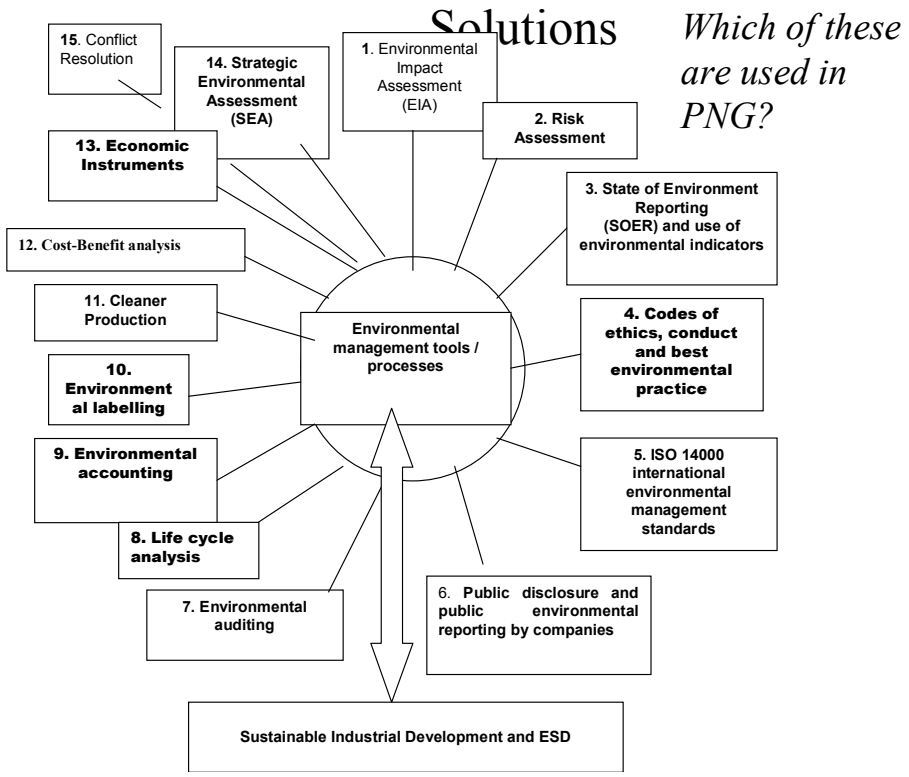
DEC is looking at means of encouraging the use of economic instruments[16] in its approach to its environmental regulatory framework. However very little seems to have been done in this regard over the last 10 years. DEC accepts the "polluter pay principle" through imposition of fees. Which economic instruments are the most appropriate still need to be determined. The DEC discussion paper published in 1996 states that

> A fundamental principle of modern environmental management is that the costs of environmental degradation should be borne by those responsible, and not by the community generally. Through the self-regulation approach, the costs of impact assessment, monitoring and auditing performance should lie predominantly with the developer, rather than the Government"

The same document identifies economic instruments as an important component of the new regulatory framework.

One senior officer involved in the Environmental Protection Division says that his section is moving toward preventative and pro-active methods of managing chemicals. They aim to work with companies encouraging them to adopt "environmental best practice", comply with "guidelines" and also adopt "environmental management systems".

Figure 6.1 Environmental Management Tools



Standards, Codes and Guidelines

DEC is progressively developing standards, codes of best practice and guidelines including in areas of ambient quality standards (air, water), in handling and disposal of wastes and hazardous substances, and in industrial discharge standards and codes of practice. It is intended that these mechanisms be used to control level 1 activities. It is also intended that responsibilities for these activities be with provincial governments.

[16] Two useful books on economic instruments in environmental management are James (1997; Panayotou (1998).

However much work needs to be done to ensure that standards, codes and guidelines are developed, that they are implemented, and that procedures for compliance monitoring are put in place. Much liaison, education and training programs need be done at the provincial government level and manpower needs need be identified and made available.

Examples of standards, codes and guidelines produced and/or adopted to date are:

Examples of Standards already used or being developed / already developed by NISIT, and / or adopted by DEC as on December 2005 were:

PNG 1050 capillary and brazing filling of Copper Alloy; and Copper and Copper Alloy fittings for use in water supply and hot water services.
PNG 1338 British Pharmacopoeia
Health and Safety at Work-Principles and Practices (As 1470-1986)
Chemical Aspects (As 2243.2-1990)
Measurement of Occupational Health and safety Performance
Safety Storage and Handling Information card for Hazardous materials
Packaging and dangerous Goods (As 2400.21-1986)
The Storage and handling of Agricultural and Veterinary Chemicals (As 2507-1998)
Packaging of Dangerous Goods (As 2400.21-1986)
Protection Against General or Specific Chemicals (As 3765.1-1996)
NISIT National Health and Safety Standard PNGS 1082-1991)
NISIT Standards for Using hazardous Chemicals PNG 1516-art 1-1991 and part 2-1992).

Yaru (2005) list further examples of chemical standards in PNG.

Examples of Codes of Practice already used or being developed / already developed by DEC as on December 1997 were:

FAO Pesticide Code: International Code of Conduct on the Distribution and Use of Pesticides (adopted for pesticides)
Environmental Code of Practice: Oil Palm Processing / PNG Oil Palm Processing Industry
Environmental Code of Practice: Vehicle, Machinery and Fuel Storage Code of Practice / PNG Vehicle and Machinery Workshops,- Petroleum Storage, Resale and Usage Sites.
Environmental Code: Landfill Code of Practice
Environmental Code: Sewage Disposal (in preparation - ?)

Examples of Guidelines of Practice already used or being developed / already developed by DEC as on December 1997 were:

- Pesticide Registration Guidelines
- Pesticide Labeling Guidelines
- Recommended Ambient Water Quality Standards for Papua New Guinea
- Guidelines on Environmental Impact of Forestry
- Guidelines on Environmental Impact of Agro-Industries.
- Guidelines on Infrastructure Development

A number of the mining and oil companies and some large agricultural companies involved in the oil palm industry have been accredited with ISO14000 and ISO9000 certification. This compels these companies to adopt best practice. Others are commencing the certification process.

Much still needs to be done to make effective use of economic instruments in PNG. To enable implementation of the new Environment Act much also still needs to be done to ensure adoption of standards and codes of practice and to ensure compliance to guidelines and best practice. These include both adoption of PNG standards and codes, and also accreditation by companies to the ISO 14000 and 9000 series.

6.8 Comment / Analysis

Chemical legislation in PNG is inadequately coordinated and enforced. However it has been agreed in PNG that DEC retains responsibility for chemicals and pollution management under their mission of environmental protection. However this is complicated by the intention to decentralise some of DEC's present functions to the provinces under the Provincial and Local Level Government reforms. Accordingly with the various legislation given in Table 6.1 and with such reforms, responsibilities under the various legislation need be clearly defined, particularly and aptly now with the advent of the new *Environment Act, 2000*. Manpower and resources, considered by many as insufficient, need also be reviewed.

Under the old legislation there were too many ministerial discretionary powers. To avoid unnecessary use of such discretionary powers under the new legislation further regulations and guidelines need be gazetted covering the most important / high-risk consumer and industrial chemicals. Standards are being developed but need be established quickly for use and for discharges / emissions, and written into guidelines. Safety standards need to be established for exposure. Existing codes of conduct / practice should be written into the law (as for pesticides) and the law need require, as mandatory, environmental monitoring and auditing. Further codes of practice need be established. ISO certification by large agriculture and other concerns using chemicals need to be encouraged. Analytical facilities for basic testing of hazardous chemicals need be established in PNG. This is a real obstacle to enforcement of standards. Legislation need be enforced; compliance needs to be more rigorously and frequently checked. Economic instruments need be made effective and enacted. Strategies for ensuring industries do cooperate, adopt cleaner production and for environmental auditing need be developed, be they legal, economic, technical, voluntary or otherwise. Ratification of international mechanisms (treaties, conventions and protocols) need be done and written into our local laws. General education and awareness raising of the public and industry, and a "political will" for effective chemical management are all necessary prerequisites.

Still much work needs to be done on streamlining the environmental legislation (ie the new *Environment Act*) and making it both workable and more effective. There is a general recognition of the need for a coordinated approach to chemical management; an approach that involves not just DEC but includes the many arms of government, including provincial government and also industry, NGOs and community groups all working together.

6.9 Recommendations

Given the *Environment Act 2000* and given that much work has gone on into developing regulations, guidelines and codes, priority must now be given to

- **Enforcement of legislation**. Implement immediately legal instruments in the form of regulations, guidelines, standards, capacity to prosecute.
- **Make more effective use of economic instruments**.
- **Encouraging industry to adopt cleaner production, best practice and voluntary practices to ensure better chemical management**
- **A system of regular environmental accounting and environmental auditing** is also need to provide such information as required by law to government.

- **Strengthen the institutional framework**; and ensure coordination between government bodies to ensure the best use of limited resources of trained personnel and limited financial back up; Ensure the continuing development of a chemical management infrastructure and capacity building.
- **Strengthening information access and ability to utilise such information.** We must improve the capacity to obtain / have access to information and process such information that we can from within PNG. Furthermore since PNG will continue to lack the required "in-country" analytical capacity and be unable to generate much independent "in-country" data, we need to develop a capacity to evaluate the risk of chemicals under the probable conditions of use in PNG before they are allowed to be imported and used in the country, where possible.

An effort be made to ensure all persons in government departments are better aware of their existing legislation to ensure that all departments are better acquainted with their own responsibilities for managing chemicals.

Chapter 7 Departments, Agencies and Other Institutions Managing Chemicals

This chapter lists the "perceived" responsibilities of different departments, agencies and other government institutions responsible for and concerned with, various aspects of chemical management. It gives a little detail on the mandates and responsibility of DEC as the primary department responsible for chemical management.

7.1 Responsibilities of Different Government Departments, Agencies and other Institutions

Table 7.1 provides a general overview of departmental responsibilities and activities related to chemical management for each stage of the life cycle from importation through to disposal. DEC has the major responsibility due to the Environment Act. Except for DEC most have a restricted role. Responsibilities as listed are due to mandated responsibilities due to their acts. Others are perceived responsibilities, often vague, where appropriate legislation / regulations needs to be clarified.

Pesticides

Clearly most responsibility lies with DEC through the Pesticides Regulations under the Environment Act, with lesser responsibilities shared between Departments of Health and Agriculture and Livestock. Smaller responsibilities also rest with IRC (Customs), Labour and Industrial Relations, with Trade and Industry, Transport and Civil Aviation, ICCC and with provincial governments. It would seem though that with some exceptions in Health, Agriculture and Livestock and Trade and Industry, few departments partake actively in activities in chemical management. Little cross-department communication seems to exist. Most of the departments are represented on the Pesticide Working Party, but this advisory committee has not met since 1994 NISIT has some responsibility in ensuring quality standards are met, but thy have not been involved with pesticides as such. No production of pesticides occurs in PNG.

Petroleum Chemicals

Most responsibility here seems to lie with the Department of Petroleum and Energy. Clearly DEC also has responsibilities, as does Transport and Civil Aviation. Lesser responsibilities also are shared between Departments of Health, Labour and Industrial Relations, Trade and Industry, IRC (Customs), ICCC and with provincial governments. NISIT has some responsibility in ensuring quality standards are met. It would appear that officers within DEC see petroleum products to be the responsibility of the Department of Petroleum and Energy, except with regard to disposal of petroleum products and their wastes. Here they clearly recognise their responsibilities.

Industrial Chemicals

Most responsibility here again lies with DEC, with responsibilities shared with the Department of Health. For aspects of chemical used in mining, eg explosives and processing chemicals some responsibilities lie with the Department of Mining. Similar responsibilities are shared by Petroleum and Energy. Smaller responsibilities also rest with Customs, Labour and Industrial Relations, with Trade and Industry, Transport and Civil Aviation, ICCC and with provincial governments. NISIT has some responsibility in ensuring quality standards are meet. Unfortunately to date few departments have exercised their responsibilities in the areas of industrial chemicals. The exceptions include some actions in areas of occupational and environmental health, and in cases of accidents and blatant pollution. See Box 3.1 on the recent cyanide spill in Chapter 3. Here the Department of Transport and Civil Aviation only acted after the cyanide spill had occurred falling from a helicopter.

Consumer Chemicals

The problem is that in PNG no precise, let alone legal, definition of “Consumer Chemicals” exists . For the purpose of this review I have defined them as *‘chemicals used in household and consumer products or for personal use in the home and office’*. They do not include food additives or chemicals used in industrial processes. Neither the old Consumer Affairs Council nor the now Independent Consumer and Competition Commission (ICCC) has considered chemicals as part of its responsibilities. However, as shown in Table 7.1 the authors and DEC officers believe that most responsibilities for "consumer chemicals" should rest with the Department of Health. NISIT would have some responsibility in ensuring quality standards are met. Lesser

responsibilities also rest with Customs, DEC, Labour and Industrial Relations, with Trade and Industry, Transport and Civil Aviation, and provincial governments. ICCC should play a major role in coordinating and ensuring effective management of such products, and in particular their sale, labeling, distribution and marketing.

In all of the above the Department of Foreign Affairs would have responsibility where international treaties covering particular types of chemicals are involved, so possibly restricted import or phasing out use of products that contain these chemicals

7.2 Description of Department Authorities and Mandates

DEC is organised under three divisions, these are Nature Conservation, Environment and Corporate Services. The Environment Division has four sections or subdivisions: EIA, Environmental Protection; Water Resource Management and Environmental Compliance and Enforcement. The structure of DEC is drawn below in Figure 7.1. Four publications were published in 1996 that reflect the change in focus and direction of DEC and spell out its new strategic directions. These were *Proposed Environmental Regulation Framework A Discussion Paper* (DEC ,1996c)*Managing Papua New Guinea's Unique Environment Strategic Directions 1996-1998* (DEC ,1996a), *Strategic Planning Manual (*DEC ,1996d), *and Managing Papua New Guinea's Unique Environment. Management Plan* 1996 (DEC ,1996b).

The DEC Corporate Plan for 2004-2008 published in September 2003 spells out its responsibilities. In 2004, the department has two core functions: environmental management and protection, and nature conservation and development. There are three main divisions, the Environment Division , the Conservation Division and Corporate Services. The Environment Division has the responsibility for establishing and implementing an effective environmental regulatory system and developing and implementing environmental management strategies on chemical management, waste management, water resource assessment and management, environmental enforcement and compliance and on climate change management.

Most responsibilities for chemical management fall under the Environmental Protection Branch within the Environment division. Its objective is to develop and maintain a regulatory framework to safeguard the air, water, land, wildlife and marine environment by ensuring effective management of industrial and domestic wastes, hazardous chemicals and unsustainable use of (water) resources. The Environment Protection Section will provide standards and guidelines for preventing and minimising wastes and pollution, controlling hazardous substances (including pesticides) and regulating the use of water within the legal and policy jurisdiction of national and international standards. Persons directly involved in chemical management in 2004 numbered four with two (?) support staff. These staff between them covered all aspects of chemical management for the whole country. Presumably the Environmental Compliance and Enforcement Branch also plays a major role.

Figure 7.1 Structure of the Department of Environment and Conservation

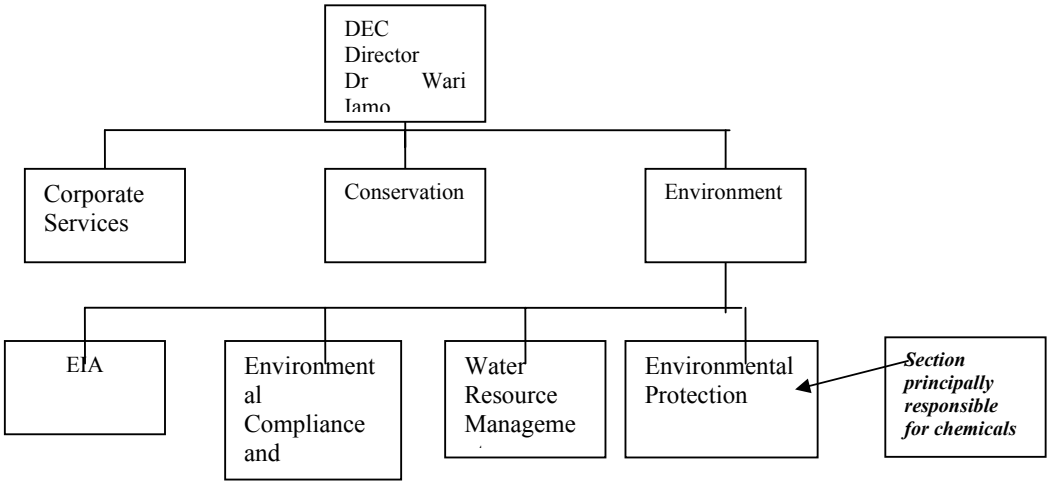


Table 7.1 Responsibilities of Government Departments / Ministries, Agencies and other Institutions for Chemicals

(where all = all; pes = pesticides; pet = petroleum chemicals; inc = industrial chemicals; cch = consumer chemicals)

Stage of Life-cycle / Dept or Ministry Concerned	Importation	Formulation	Storage	Transport	Labeling	Distribution or Marketing	Use / Handling	Disposal
Environment & Conservation	all	pes, inc, pet	pes, inc, pet	pes, inc, pet	all	pes, inc	pes, inc, pet	all
Health	inc, cch	inc, cch	inc, cch	cch	all	all	all	cch
Agriculture & Livestock			pes	pes	pes		pes	pes
Mining	inc	inc	inc	inc			inc	inc
Petroleum & Energy	pet		inc	inc	inc		inc	inc
Labour and Industrial Relations		pet			inc		pes, inc, cch	
Trade and Industry; includes IPA	inc, cch	all				all	all	
Transport and Civil Aviation	pet		pet	all	pet, inc	pet	pes, pet, inc	pet, inc
Provincial and Local Level Government					cch			pes, pet, inc
IRC (Customs)	pes, pet, cch	inc			pet, inc	pet		
Foreign Affairs	pes, inc, cch							
ICCC					pes, inc, cch	all		
NISIT	cch	pet, inc, cch	pet, inc, cch	pet, inc, cch	pet, inc, cch		pet, inc, cch	pet, inc, cch

Special Projects related to chemical management directly listed within the Environment Division include the Persistent Organic Pollutants Project (POPs), Amendments to the Basel Convention on Transboundary Movements of Hazardous Wastes, NEC Submission on the Rotterdam Convention on Prior Informed Consent (PIC) for PNG and the Development and Implementation of a National Programme on Persistent Toxic Substances. The review and update of the PNG Chemical Management Profile is part of the POPs project.

Little is known about the structure and mandates of other departments involved in chemical management.

With the Provincial and Local Level Government reforms and with the new Environment Act, much responsibility for implementation and enforcement of level 1 and level 2 activities, often involving chemical management, will lie at the provincial government level. Responsibilities in chemical management at this level need to be ascertained, must be clearly stated and mandated.

7.3 Key Contacts for POPs and POPs like Chemicals in Government

Management of POPs and POPs-like chemicals lie partly within the responsibility of DEC, but also with other departments or authorities. These include usage of DDT with the Department of Health and PCBs with PNG Power itself. No one in government except those in the POPs project know anything about dioxins and furans. Table 7.2 lists key contacts within the PNG Government for POPs and POPs-like chemicals.

Table 7.2 Key Contacts for POPs and POPs-like chemicals in PNG

	POPs /POP-like group	**Department / Organisation**	**Key Person**	**Contact**
	all	POPS project, DEC	Ms Katrina Solien, National Co-ordinator GEF Pilot Project on POPs	phone: 3233910 fax: 3236037 email: popspom@datec.net.pg
	Pesticides, including DDT	DEC DAL UPNG	Ms Lois Nakmai, First Assistant Secretary Environment Protection Mr Ian Onaga A/D Field & Technical Services Assoc Prof David Mowbray Environmental Science, UPNG	phone: 3250914 email: enpchemmgt@datec.net.pg phone: 3211046 phone: 3267413 fax: 3260369 email: david.mowbray@upng.ac.pg
	Industrial and Forestry Chemicals	DEC	Ms Lois Nakmai, First Assistant Secretary Environment Protection	as above
	PCBs	DEC PNG Power	Ms Lois Nakmai, First Assistant Secretary Environment Protection Mr Ben Tolimanaram / Mr Kellis Willie PNG Power	as above phone: 3262439/2394 / phone: 3243339
	Dioxins and furans	University of PNG	Dr Peter Petsul, Lecturer Chemistry, UPNG Mr Robin Totome, Lecturer	phone: 3267xxx fax: 3260369 email: P.Petsul@upng.ac.pg phone: 3267xxx

			Biology UPNG	fax: 3260369 email: R.Totome@upng.ac.pg

7.4 Comments / Conclusions

DEC is the main department responsible for chemical management in PNG. But many other departments are also involved for specific groups of chemicals or for different stages in the life cycle of such chemicals. The only groups of chemicals for which a regulatory process seems to exist in detail and are implemented are pesticides and petroleum chemicals. Presently an environmental regulatory framework is being developed, and much is been produced/ developed on measures to control and prevent pollution especially through the development of codes and standards. Little has been done to date on industrial or consumer chemicals. The Department of Petroleum and Energy's responsibilities are spelt out in Chapter 6 in section 6.3. Industry also plays a key role here (self-regulation) working together with government.

Despite the new environmental regulatory framework and the Environment Act 2000, much remains to strengthen chemical management in PNG. The POPs project is part of that process.

In compiling this report the authors came to realise the poor communication and co-ordination between departments in chemical management. Although persons / sections in various departments could be named who had "interests" in various aspects of chemical management, it seemed very little was being done, except in DEC. In DEC the section dealing with chemicals is poorly staffed and poorly funded, hence there are many constraints on what it can do. The few staff have too many responsibilities, which seems to effect their ability to do any one thing, as they would like. Moreover DEC definitely needs to further strengthen their links and communication with other departments involved in chemical management. (This will be further elaborated on in Chapter 9.)

The POPs project has successfully involved persons from many departments, and the unions and university. It is one process that hopefully will ensure better communication and co-ordination of between those involved in chemical management in future years.

7.5 Recommendations

What is needed for each of the departments other than DEC, is to list areas of chemical management for which they have responsibilities, and which sections of each of these departments have these responsibilities, as is done by Department of Petroleum and Energy for petroleum products. Also needed are the missions and mandates of the departments, the relevant legislation and regulations which cover these chemicals, and the regulatory processes involved, and how their activities might be better coordinated with the other different government departments and private and community groups. This report has been unable to compile this important information adequately.

Responsibilities of provincial governments in chemical management must be clearly stated and mandated, and appropriate strategies be developed, and links with DEC quickly established.

Of value as well would be for an independent group to continue the activities of the POPs project. Of value would be an audit of the chemical management regulatory and administrative procedures in each department concerned to determine their effectiveness. An audit should be also done in DEC to ascertain how effectively the new framework and procedures are achieving their intended objectives, and give suggested improvements. Again this POPs project can assist in part to do this.

Chapter 8 Relevant Activities of Industry, Public Interest Groups and the Research Sector

This chapter describes and reviews activities of some non-governmental bodies and entities, which would be expected to support national efforts to manage chemicals

8.1 Summary of Expertise Available Outside of Government (within PNG)

Various organisations outside Government have been identified as stakeholders on aspects of chemical management in PNG. These groups include:

- Port Moresby Chamber of Commerce and Industry
- PNG Chamber of Mines and Petroleum
- Manufacturer's Council of PNG
- Institute of Engineers PNG Inc.
- PNG Trade Union Congress
- Centre for Environment Research and Development
- Chemistry Discipline and Environmental Science Discipline[17] , University of Papua New Guinea

With the exceptions of the PNG Trade Union Congress and UPNG none of the above have contributed to this report. However the following groups have also been involved in the POPs project

- persons from research organizations such as PNGIMR, Goroka; Coffee Industries Corporation, Aiyura; PNG Oil Palm Research Association (OPRA)-WNB.
- private industry persons from chemical, pest control and agricultural industries

Tables 8.1 provides a summary of expertise in research organisations, universities, industry and NGOs that may support national programs and policies related to chemical management. These tables were compiled from discussion between the authors and the officers from DEC, and from questionnaires and interviews with various persons involved with chemicals.. Information on petroleum products was provided by Gedisa Kone of Department of Petroleum and Energy. Expertise on petroleum products and on chemicals used in mining would reside in the companies themselves. Virtually no expertise would exist in the country for chemicals used in consumer products, hence this group was not included in the table. University staff and a few government and industry based personnel may provide some information if requested, but assistance from overseas would be often required.

Pesticides

Information on pesticides is available from staff within Environmental Sciences at UPNG. UPNG Chemistry and Biology departments used to run a small Pesticide laboratory but this was closed down in the late 1980's. Some information would be available from the National Analytical Laboratory at the University of Technology in Lae, or the National Agricultural Laboratory of NARI. Some information would also be available from individual companies in industry. There used to be a PNG Agricultural Chemicals Association, but this is now defunct. This organisation did (in practice) encourage its members to become familiar with the FAO Code of Conduct, though the author doubts that many did. Expertise and Information on POPs and POPs-like pesticides is confined to those involved in the POPs project only.

Petroleum Chemicals

Research institutions and laboratories such as the NAL at University of Technology and Chemistry Discipline at UPNG may have some information on testing chemicals eg level of hydrocarbons contaminants in soil / water, or total petroleum hydrocarbon (TPH). The petroleum industries may have information on the alternatives to petroleum chemicals eg biofuels as alternatives for diesel / petroleum chemicals eg Oil Search and InterOil.

[17] Main author/DLM is Associate Professor in Environmental Science from 1990-1997,2002-2005.

Petroleum industries all have policies on chemicals usage, handling, storage, transport and disposal. Policy analysis and review is vital in the petroleum industry. Expertise on petroleum products resides with the companies only. Persons in the petroleum industry indicate very little knowledge of dioxins and furans and POPs byproducts of incomplete combustion.

Industrial Chemicals

Information on industrial chemicals is available from staff at UPNG, from both the Chemistry Discipline and Environmental Sciences. UPNG Chemistry and Biology departments often used to do small consultancies on water quality for government or industry. Much more was done by the National Analytical Laboratory at the University of Technology. Information would be available from individual companies within industry. From the author's experience smaller companies know little about what they use , nor are they aware of health and safety issues. In addition they indicate no knowledge of the properties or amounts of wastes that they produce. Larger companies do keep records on most chemicals they use and their wastes. Many have adequate information on occupational health and safety aspects of the chemicals they use, although may not make this information available to the public. They generally will make information available to government upon request. They may require that such information be kept confidential. In the 1990s two professional organisations have run conferences and/or discussed how their professional organisations could contribute to improve occupational health and safety and pollution/ chemical management in PNG. These are the Association of Professional and Health Engineers (?) and Institute of Engineers PNG Inc (IEPNG) . Trade unions have in the past involved themselves sporadically in matters related to occupational health and safety, but in general little has happened in this area in recent years. Knowledge of dioxins and furans and POPs byproducts of incomplete combustion is very poor among personal within industry. Through association with the POPs project some individuals within PNG Power are now familiarizing themselves with PCBs.

Consumer Chemicals

Information in PNG about consumer chemicals is difficult to obtain. Some information may be obtained from staff at the University of Papua New Guinea or can be accessed from the library at the two universities.

Stakeholder Participation

It is worth noting from our surveys that neither the Trade Union groups nor NGOs have any real information or expertise on chemicals in PNG. NGO activity is generally focused on the issues of mining, forestry, conservation, environment/development issues and general education and awareness raising. Some groups are sporadically active on chemicals and monitor activities of government and industry in areas of chemical use. Greenpeace took action after the March 2000 cyanide spill near Tolukuma mine. (See Box 3.1 in Chapter 3).

Under the *Environment Act*, an Environmental Protection Consultancy Group will be established which would include representatives from the industry sector and from the NGO community. Section 26 of the *Environment Act* refers to regulations to prescribe the composition of the proposed group. However as yet the group has yet to be formed.

Access to Information

The new Environment Act, as did the old act (ECA), has provisions for government releasing information on chemicals, particularly those relating to with health and environmental matters. In practice confidentiality of trade information is respected by the PNG Government and as such this information may not be made available. The author (DLM) has never had problems in obtaining from DEC information on health and environmental matters. Such information is usually made available upon request although the information may take time to locate. Information on those pesticides which are registered in PNG is freely available, except for the confidential commercial and trade information.

Information from other departments on other environmental matters has not always been made available when requested. For example in the past the Department of Mining and Petroleum (now Department of Mining) were reluctant to release information on mining matters particularly those relating to river monitoring, tailings discharges and effects on river systems. Ironically often some of that information was made available by the company concerned. Often the information released by the company may be delayed and therefore outdated at the time of release. This time lag, in making available data on pollution matters, is a matter of concern.

8.2 Conclusions

Expertise and information on chemical management outside of government only resides predominantly in industry itself and amongst a few academics and professional staff at both the University of PNG and the

University of Technology. Trade organisations, trade unions and non-government groups are at present not active in these areas, and to date have little involvement in chemical management issues , except recently in the POPs project (and except when it involved matters related to mining). Few persons or organizations, except those involved in the POPs project know anything about POPs chemicals.

8.3 Recommendations

It would be valuable if the government encouraged industrial and trade organisations, trade unions and NGOs to be more proactive in the areas of chemical management.

Governments should be encouraged to make information more easily available to private and community groups, and indeed to share more information in both the public and private domain. It should be obligatory that information on health and environmental matters be made readily available to the public. Encouraging groups to learn more about POPs and POPs-like chemicals could be a start.

Industry and professional organisations in PNG should be encouraged to be more proactive and develop their own guidelines and codes of practice, and in particular benchmarks and "best practice". Such organisations need to encourage and assist smaller companies adopting best practice, including by sharing information.

Non-government groups should be encouraged to diversify their interests to include both occupational health and environmental pollution / chemical management matters.

Table 8.1 Summary of Expertise on pesticides, petroleum products and industrial chemicals Available outside of Government sector
(x = some information; blank = no information, Pes = Pesticides, Pet = Petroleum, InC = Industrial chemicals)

	Research Institutes			Universities			Industry			Environmental/Consumer groups[1]			Labour Union			Professional Groups[1]			Other/Specify		
Field of Expertise	Pes	Pet	InC	Pes	Pet	InC	Pes	Pet	InC	Pes	Pet	InC	Pes	Pet	InC	Pes	Pet	InC	Pes	Pet	InC
Data Collection	x			x		x	x	x	x												
Testing	x	x		#	x	x	x	x	x												
Risk assessment				x		x	x	x	x												
Risk Reduction				x		x	x	x	x												
Policy Analysis				x				x													
Training and Education	x			x		x	x	x	x												
Research on Alternatives	x			x			x	x													
Monitoring				x				x	x												
Enforcement							x	x	x												
Information to workers				x			x	x	x							x		x			
Information to Public				x		x	x	x	x			x				x					
Other/ Specify																					

[1]. Information is available from Professional Organisations and NGOs from overseas.

Chapter 9 Inter-Department Committees and Coordinating Mechanisms

A brief review is made of the inter-departmental committees on chemical management. Such committees or mechanisms facilitate co-ordination and co-operation among departments, agencies and other relevant governmental and non-governmental bodies in areas of chemical management

9.1 Inter-Departmental Committees and Coordinating Mechanisms

The two preceding chapters show that many departments and other institutions / organizations are involved in chemical management. *Table 9.1* provides an updated overview of relevant mechanisms for coordinating activities among the relevant institutions. These are probably not exclusive , but are the interdepartmental committees known to the authors.

9.2 Comment on Inter-Departmental Committees and Coordinating Mechanisms on Chemical Management

The authors were unable to determine very much about any of the inter-department committees, except for the Pesticide Working Party, the POPs National Coordinating Committee and the NISIT Chemical Standards Committee. The only information obtained is that given in Table 9.1. It seems that most of these committees exist in name, but not in practice. What does happen is that members of such departments do from time to time discuss overlapping responsibilities and common interests but in an informal and ad hoc manner. They also do share information and comment and advise each other on chemical management matters.

Pesticide Working Party

The Pesticide Working Party did meet a number of times but many years ago. It was a body established under the Environmental Contaminants (Pesticide Regulations) 1988. Under section 3.0 of the Pesticide Regulations the functions and powers of the Pesticide Working Party were stated as

- To promote the prudent, effective and safe use of pesticides in PNG.
- To consider and determine applications made for the issuing of permits
- To promote and undertake research or experimental work designed to test or improve the efficacy of any pesticide
- To promote and organise the dissemination of information relating to the safe and efficient use of pesticides
- To make recommendations to the Minister relating to the use of pesticides

The Minister could delegate his powers relating to the issuance and revocation of permits to the Chairman of the Working Party who would act in accordance with the decisions of the Pesticide Working party.

The committee included representatives of both rural industries (Growers Association), the then existing PNG Agricultural and Veterinary Chemical Association, an academic and a medical doctor. It considered policy matters, reviewed the Pesticide Labeling Guidelines and discussed which pesticides should be banned and highly restricted, and discussed some applications for registration. Its recommendations were in part implemented / incorporated into the pesticide guidelines. It appears now to be defunct.

POPs National Co-ordinating Committee

A good example of an interdepartmental / broad membership committee that now exists is that coordinating the POPs project. The composition of the National Coordinating Committee of POPs project is given in Table 9.2.

Table 9.1 Overview of Inter-departmental Commissions and Coordinating Mechanisms

Name of Mechanism	Responsibilities.	Secretariat	Members	Legislative Mandate / Objective	Effectiveness
Port Moresby Waste Management Coordinating Committee	Discuss (?) waste related issues for Port Moresby	Department of Health Or NCDC?	DEC, DOH, Works and Implementation, NCDC, UPNG, Water Board Eda Ranu	None..... adhoc - Co-ordinate	rarely meets "defunct ?"
Pesticides Working Party	Policy and recommendations for pesticides	DEC / Environmental Protection	DEC, DOH,UPNG,DAL, Industry, Rural Producers,	none ... advise Registrar	no meetings for 10 years
NISIT - Chemical Standards Committee	Establish standards	NISIT	NISIT,UOT,UPNG,NARI Industry	Establish standards	3 meetings (?) per year
Hospital Waste Management	unknown	Department of Health	DOH, DEC, Labour and Employment, Works and Implementation, NISIT	none -	meetings ???
Occupational Health &Safety	unknown	Employers Federation	DIR, DEC,DOH, Unions, DAL, NISIT, Industry	??	
Mine /Petroleum Monitoring Quarterly Reviews???	Review		DEC,DMP PNG Forest Authority (as appropriate) Industry		meet quarterly
National Marine Oil Spillage Committee	Oil Spillage Management Responses	Dept. of Transport (Maritime Division)	DEC, DTCA, DPE, NDEO	None??	Meets twice yearly
National Coordinating Committee, POPS Project	Management of POPS Chemicals	DEC/ Environmental Protection	DEC, DAL, DLE, DJAG, DPALLGC, PM& NEC, IRC, union and universities		Meets regularly - see text
Biotech & Biosafety	Food Security Policy	Department of Agriculture & Livestock	DAL, DEC, DOH, DNP & Cord, DPALLGC, NARI, NAQIA, DPE, NCDC,UPNG	Food Security Policy	Occasionally meets
Environmental Steering Committee	Environmental Management Policy	DEC & Manufacturers Council of PNG	NCDC, DEC, DOH, Industries, Manufacturers Council of PNG	Littering Policy	Occasionally meets

Table 9.2 Representation on the national POPs Coordinating Committee

		Who involved?
	National Government	Department of Environment and Conservation Department of Agriculture and Livestock Department of Prime Minister and NEC Department of Justice and Attorney General Department of Health Department of Trade and Industry Department of Labour and Employment Department of Provincial Affairs Department of National Planning and Rural Development Internal Revenue Commission / Customs
	Union	PNG Trade Union Congress
	Private Sector	Oil Palm Research Association, PNG Power
	NGO	NGO Environmental Watch Group
	Universities	University of Papua New Guinea

Unfortunately the NGO and private sector representatives have been unable to attend regularly the coordinating meetings and other workshops, but many departmental people do.

The various tasks teams set up under the POPs project have involved persons from the above, and also (not inclusive)

- **provincial and city administrations** (Eastern Highlands Provincial Administration, National Capital District Commission, Gulf Provincial Administration, Morobe Provincial Administration, Western Highlands Provincial Administration, Sandaun Administration, Lae City, NCDC, Lorengau Local Level Government
- **other departments** (Department of Petroleum and Energy, Department of Mining, NISIT, NARI)
- **other members of the private sector** involved with chemicals and pest control, and organizations such as Coffee Industries Corporation
- **other universities and research institutions** (University of Goroka, University of Technology, Institute of Medical Research, NARI)

Lessons need to be learned so that the POPS National Coordinating Committee can be transformed into a more general Chemical Management Coordinating Committee whose life might continue beyond the life of the POPs project and so to ensure effective chemical management in PNG.

Other Committees

NISIT has a Chemical Standards Committee and many other committees that set or recommend PNG standards. Its present influence on chemical management in PNG seems minimal. The National Marine Oil Spillage Committee is an active committee that meets regularly (twice a year). With an increase in petroleum extraction activities this committee, headed by the Maritime Division of the Department of Transport has developed strategies to respond to possible oil spillages and resultant problems. The Environmental Steering Committee is headed by the Manufacturer's Council of PNG , and includes DEC membership. It focuses on promoting awareness on a healthy environment. This committee has focused on litter issues and how best industries can develop alternatives to plastics which are not biodegradable. It seems that this committee has achieved very little. Recently DEC has proposed a ban on the production and sale of plastic shopping bags to come into effect in early 2005. There is a mixed response and its seems the Manufacturer's Council is opposed to the ban and is working on an alternative strategy.

9.3 Description of Mechanisms for Obtaining Input from Non-Government Bodies

In theory the old *Environmental Contaminants Act* did include provision for non-government persons on its Environmental Contaminants Advisory Council, including academics from each of the two main universities, and a representative from the private sector. Unfortunately such a Council was never established. Similarly under regulations advisory committees and working parties could be established with non-Government representation, but only one on Pesticides was established. Under the new *Environment Act*, the Minister can appoint non-government persons to be members of the Environment Council. Similar non-government persons can be appointed to Working Committees and to the Environmental Protection Consultative Group.

However no non-government organisation in PNG is active in the area of chemical management, except to do with mining, as noted in Chapter 8.

The author (an academic from Biology / Environmental Science, UPNG) has acted as an adviser to the DEC for the last 24 years (1982- 2005) on matters related to pesticides in particular and chemical management in general. The professor of Chemistry and staff within both the Biology and Chemistry departments have also provided assistance and advice over many years (and still do), including membership of various NISIT committees, as have some staff from the University of Technology and the private sector, either formally or informally.

From the author's experience there is limited input from the private sector in chemical management Some committees do include such members eg Pesticide Working Party, NISIT Chemical Standards Committee and the Environmental Steering Committee. The POPs project had industry representatives involved early on but they have dropped out. Industry must get more involved in working with government in chemical management if it is going to improve.

Advice and input from University staff and others outside government has often been sought by Government in relation to chemical management, but such advice has not always been forthcoming, nor sometimes appropriate, or when given necessarily heeded.

9.4 Comment

The importance of interdepartmental co-ordination and the involvement in non-government organizations and the private sector is recognized in PNG.

However existing coordinating mechanisms between government departments do not seem to work as effectively as they should. According to twenty questionnaires sent to different government departments / institutions, 18 mentioned that there is a lack of communication between government departments.

Persons within the different departments do communicate with each other when they feel it appropriate or necessary. However it seems that meetings of coordinating committees are few and infrequent, and often the key persons do not come. Often it would appear that these committees have not met for years. In recent years few such meetings have occurred concerning co-ordination at a national level of use of agricultural chemicals. The Pesticide Working Party has not meet for more than ten years.

Participation by non-government persons in such committees also seem to be fragmented and infrequent. Ways of broadening NGO representation and participation may be beneficial. Outside organisations whether private or community need to involve themselves more with working with the government departments involved. Existing legislation does provide for such private and public participation.

Inclusion of NGOs and the private sector will become more possible with increased awareness and dissemination of information on chemical management. This is further discussed in chapter 13.

The lack of adequate co-ordination and inter-department co-operation on chemical management matters is well illustrated by the limited contributions / participation / priority given by some departments to the POPs project and virtually no responses to requests over the last two years for comments and improvements to the first '*National Profile of Chemical Management', with the exception of those directly involved in the POPs project.*

An audit of existing committees is needed to determine

- Are existing mechanisms working? What can be done to improve them? Are solutions – technological (phone/faxes/emails)? Are organizational solutions required? Is communication/ more frequent communication needed eg newsletter? Need there be higher political support?
- Are all parties / departments able to contribute effectively?
- Do mechanisms cover important aspects of chemical which require co-ordination and cooperation?
- Are existing mechanisms linked with others or separate?
- Are parties from outside government involved?
- Are others involved for specific issues?
- Is information (as per chapter 10) shared across agencies / departments charged with chemical management?

The POPs project is one intergovernmental activity that has successfully gained participation by members of many government departments. Further more it has met regularly over the last two years (perhaps driven by strict time lines determined by funding). It is hoped that such activity can be sustained for chemical management over the next few years.

9.5 Recommendations

It is recommended that a review be made of all such interdepartmental and coordinating committees in the areas of chemical management, their objectives be reviewed, their composition be reviewed and broadened, and better mechanisms be established to render them more effective.

A "lessons learned" review should be made of the POPs project to establish what are the factors that constrain and what assist improved inter-departmental co-ordinating mechanisms.

Such a review must be initiated either by DEC or by DEC working with the Department of National Planning and Rural Development, preferably both since this would probably facilitate greater cross department commitment and activity.

Chapter 10 Data Access and Use

In this chapter an overview is given of the availability of information and data relevant for chemical management in PNG and the related infrastructure. Analysis is made on how the information and data are used for chemical management. Internet web addresses (or other contact addresses) are provided on international or other government and non-government bodies and agencies which have information / information sources and databases which may assist decision-makers / decision-making in chemical management in PNG. The databases may be directly available on the internet or may be provided at a cost or may be free upon request. Some such databases can be directly downloaded. Others are available on diskettes and on CD ROMs.

10.1 Availability of Information and Data for National Chemical Management

There is a scarcity of available and up to date information on chemicals within Papua New Guinea. Data on pesticide imports and use in PNG were collected over 15 years up to 1990 by the author at the University of Papua New Guinea and have been published in various reports (Mowbray (1986; Mowbray (1988) and in both the Pacific Agro-Pesticide Indices – both the 1990 edition (ARSAP/CIRAD/SPC/SPREP (1990) and the 1994 edition (ARSAP/CIRAD/SPC (1994)). These two last books were compiled through the ARSAP/ CIRAD project as part of their international Iphytrop project. The author was a major contributor / author for the 1990 edition and a major contributor to the 1994 edition. They contain detailed information on all pesticides used in PNG (and the rest of the Pacific) over the period 1980 – 1994.

The author also assisted in the compilation of a list of hazardous chemicals used in the early 1990s at the University of PNG in the science and medical faculties. This was extended to include some industrial chemicals through surveys and questionnaires sent to companies throughout PNG (Gabut (1991)). The intention then was to initiate / compile a National Register of Potentially Toxic Chemicals (a PNG National IRPTC) using the IRPTC PC- database (see section 10.5). However this project was terminated. This information was maintained in a database by the author at UPNG, but is now out dated.

There is an abundance of general information in some areas, for example on pesticides and for some industrial chemicals from overseas sources, particularly on health and environmental effects. However information from within PNG and from overseas for specific chemicals as pertinent to the PNG situation is generally insufficient or lacking. Information on chemical wastes in PNG is generally inadequate; a little is known for projects requiring an EIA. Information on actual effects in PNG is lacking. Table 10.1 overviews the situation as perceived by the author and the DEC officers. The situation on petroleum products was provided by Mr Gedisa Kone of the Department of Petroleum and Energy. Information available for decision making and reviewing is ranked according to whether it is considered sufficient, or in part useful but generally insufficient, or none is available.

Table 10.1 provides an overview of whether data are available for different decision-making activities required under existing legal instruments By referring to Table 10.1 one can gather the situation on some POPs and POPs like chemicals. DDT would be as per pesticides, and PCB as per industrial chemicals. The first information on dioxins and furans is that reported in Chapter 4 derived from the POPs project, and reported in Petsul and Totome (2005).

Table 10.1 Quality and Quantity of Available Information

Data needed for / to	Pesticides (agricultural, public health and consumer use)	Petroleum Products	Industrial Chemicals	Consumer Chemicals	Chemical Wastes
Decision on use under PNG condition	x	+	+	o	+
Assess chemicals impact under local conditions	+	+	o	o	+
Risk Assessment (environment / health)	x	x	+	o	+
Classification / labeling	x	x	x	x	+
Registration	x	x	o	-	-
Licensing	x	x	o	-	+
Permitting	x	x	o	-	+
Risk Reduction Decisions	x	x	+	o	+
Accident Preparedness/ Response	x	x	+	+	+
Poisoning Control	x	x	+	+	+
Emissions Inventories	o	+	+	-	+
Inspections & Audits (environment / health)	o	x	+	-	+
Information to workers	+	x	+	-	-
Information to the public	+	+	+	+	+

Key: x =much / sufficient; + = only sufficient in part / insufficient; o = none; - = not appropriate

10.2 Location of National Data

Information on chemicals is very difficult to access / locate in PNG. Mention is made above of data collections and publications with data on pesticides and hazardous chemicals at the University of Papua New Guinea. Data from the National Statistics Office (NSO) are available but at a cost. The Internal Revenue Commission (IRC or Customs) has much raw data. Some is summarized in chapter 2. Its data base contains information of quantities of materials/ chemicals imported and the moneys collected from such imports. DEC has some information on pesticides and industrial chemicals and emissions and discharges (as discussed in Chapter 2). Such information must be submitted to DEC, for example when pesticides are imported, but the accuracy of completeness of the information provided to DEC is unknown. Some of the information is also confidential. However the author presumes that much information exists in files within government departments or in databases within computers which are not always accessible. Information from private companies is usually more difficult to obtain, companies often claiming confidentiality.

Many government departments and have websites (see table 11.2), but half of them either do not work or are infrequently updated. For example The National Statistics Office's direct website does not work. It also has a website based at Pacific Community or SPC , but this seems to contain out of date information and data.

Information on PNG generally (for Chapter 1) and on chemicals generally (chapter 2) were obtained from a number of sources. The principle ones included from within PNG were: National Statistics Office, Internal Revenue Commission / Customs, Bank of PNG (BPNG), Department of Trade and Industry Statistical Digest, Department of Environment and Conservation (files / database), Department of Agriculture and Livestock Rural Statistical Section / Publications. Further information on POPs is presented in Chapter 4 based on data and information collected in this POPs project.

Information on PNG is also available from sources outside PNG and are made available from various reports / books produced by United Nations Agencies, eg Human Development Report, Asian Development Bank Pacific Strategy 2005-2009 and others; but these international publications contain little information on chemicals.

Table 10.2 indicates the nature of the national data related to chemical management, which is available and provides practical information on how to gain access to such information. It shows that data are kept within Government Departments, within other institutions, within non-Government bodies (University and the private sector) and with some private doctors.

Table 10.2 Location of National Data

Type of Data	Location(s) /Data Source [1]	Who has access?	How to gain access	Format
Production Statistics	NSO, IRC / Customs, BPNG, DAL-Rural Statistics	all / some pay	on request	computer database bulletins , statistical handbooks
Import and Export Statistics	IRC / Customs, NSO, BPNG, DAL-Rural Statistics	all	on request	computer database bulletins statistical handbooks
Chemical use Statistics	NSO ?; DEC-EP	all (by group), restricted	on request	computer database database files hardcopies
Oil and Gas Production and Export Statistics	DPE	all	on request	computer database
Petroleum Industry Chemicals	DPE	all	on request	Computer database hard copy files
Industrial Accident Reports	Department of Labour and Industrial Relations, DEC, Department of Trade and Industry, Companies, National Disaster Surveillance & Emergency Services			files
Transport Accident Reports	Department of Transport and MVIL, RPNGC, Civil Aviation, DEC			files
Occupational Health Data (agricultural)	DOH ??,hospitals, private doctors	general only		files ??? (DOH)
Occupational Health Data (industrial)	Department of Trade and Industry, Department of Labour and Industrial Relations, companies, private doctors	general only		files
Poisoning Statistics	DOH ??, hospitals ?,private doctors	general		files
Pollutant Release and Transfer Register	DEC-EP	part restricted		files
Register of pesticides	DEC-EP~ register compiled with help of author at ES-UPNG.	all (except confidential information)	on request	computer database
Database on pesticides	Environmental Science-UPNG and available in book form	all	On request	computer database; also in book form – see 1990 and 1994 editions of Pacific Regional Agro-Pesticide Index.
Inventory of toxic/ hazardous chemicals	DEC-EP – provisional database was compiled by author at ES UPNG / outdated	all	on request	files, computer database
Inventory of existing chemicals	None ;in part DEC-EP	all	on request	Files, computer database
Inventory of hazardous sites	Department of Trade and Industry,		on request	Files database?
Register of imports	IRC/Customs, NSO, Department of Trade & Industry, DEC	all	on request	computer database bulletins statistical handbooks

Type of Data	Location(s) /Data Source [1]	Who has access?	How to gain access	Format
Register of Producers	IPA, Department of Trade and Industry, DEC-EP; also POM Chamber of Commerce & Industry, PNG Chamber of Mines & Petroleum, Manufacturers Council of PNG	all	on request	computer database bulletins statistical handbooks
PIC /POP Decisions	DEC-EP	all	on request	computer database files UNEP/FAO releases

1 NSO = National Statistical Office; BPNG = Bank of PNG; DAL-Rural Statistics Section, Department of Agriculture and Livestock.; DEC-EP= Department of Environment & Conservation Environmental Protection Division; DOH = Department of Health; ES-UPNG = Environmental Science , University of Papua New Guinea; IPA = Investment Promotion Authority; IRC / Customs = Internal Revenue Commission / Customs Division.; MVIL=Motor vehicles Insurance Limited;; RPNGC = Police.

Six important points need be considered when inspecting this table; these being:

1. By law importers and users of chemicals must provide information to government. In practice many do not do this. This was illustrated in section 2.5 in the discussion on emissions and discharges. The Pesticides Regulations require all permit holders to annually supply the Registrar with details of the pesticide products imported, manufactured, distributed or sold. The information that is submitted is often incomplete.
2. Information is difficult to obtain. To get the information you must find the right person or find where they store their information. Often data and information are incomplete. Often files are not accessible (people do not know where keys are). Computers are often “down”, programmes such as databases have crashed or not working. Information lacks harmonisation of format. Data / chemicals are grouped under inappropriate categories. The actual reliability and accuracy of information may be questionable. Often the information and data are out of date.
3. There appears in many areas to be no systematic collection of data, for example for data on accidents, occupational health data, and poisons statistics. The Health Department and the Medical Faculty staff at UPNG were intending to develop a Poisons Information Centre and to collect data on poisoning in PNG, but this has not eventuated.
4. The way data are collected or the format in which they are stored often means that information is hard to interpret or meaningless. For example IRC/ Customs use the Harmonised System of classification for use categories where imported chemicals are lumped into groups or broad categories. Hence specific information required on specific chemicals can not be obtained. You can not determine how much of a particular chemical is imported; only the total amount within the category in which it falls. However upon request IRC could determine specific categories for specific chemical subgroups or specific chemicals, but this has not been requested.
5. Confidential information (particularly if of commercial significance) is not available from government departments, or not given to government departments. However most environmental and health information is available on request, though the process of obtaining it may be time consuming and tedious. Government departments also now often charge a fee for information, so often information can not be obtained by some.
6. Individual companies keep records but are reluctant to make it available, even sometimes to government, for reasons of confidentiality. Obtaining information from private industry may be particularly difficult for these reasons

10.3 Availability of International Literature

Many international literature and databases are available for use in the country. Those, at least in part, known to be available in PNG and useful in chemical management are listed in *Tables 10.3 and 10.4.* These include hard copies (monographs, booklets) in libraries or on shelves in department offices. However often these sets of documents are scattered around departments with many missing copies. Fortunately much of this information and the databases are now available on the internet and can be quickly downloaded or got through requests via email. Often you can contact the organisation who will immediately forward you a copy of the requested information, at no or some given cost. Internet sites where the literature and databases can be obtained are also given in Tables 10.3 and 10.4. Further internet sites where much information can be obtained are also given in Tables 12.1 to 12.4 where international organizations and agreements and regional organisations and agreements are listed.

An example of easily accessible information is that on the POPs website where guidance documents can be easily downloaded at http://www.pops.int/documents/guidance/
These include

- Standardized Toolkit for Identification and Quantification of Dioxin and Furan Releases
- Guidelines for the Identification of PCBs and Materials Containing PCBs
- PCB Transformers and Capacitors – From Management to Reclassification and Disposal
- Reducing and Eliminating the use of POPs; guidance for alternative strategies for sustainable pest and vector management.

10.4 Availability of International Databases and Access to Internet.

It is only in the past few years that most government departments and universities have had access to the Internet. In Port Moresby this is often prevented by regular power cuts or by lack of telephone lines available to the departments and/or by phone lines being cut off due to nonpayment by departments of their phone charges. Hence access to the Internet by government departments is problematic. Thus access to important and useful international databases is denied.

As part of the DEC Institutional Strengthening Project in the late 1990s a computer based Library Management System was installed. This included a CD ROM facility. Hence DEC ought be able to use large computer databases available on the internet or on CD ROMs.

Listed above in Table 10.3 are the website addresses for much international literature on chemical management. Table 10.4 below lists further website addresses for accessing / finding information and sources of information on chemical management. Table 10.5 provides contact points and notes on international and some country databases on chemicals on the internet. It is possible through the internet to gain access to many websites to do with chemicals; as listed in Tables 10.3 – 10.5. In addition to these tables in this chapter, it worth looking at those tables mentioned above in Chapter 12 (Tables 12.1 to 12.4). For example Table 12.1 lists important websites providing useful information and procedures available from UNEP Chemicals (IRPTC). Information is available on the internet concerning Pollutant Release and Transfer Registers (http://www.chem.unep.ch/prtr/) ; on Prior Informed Consent (http://www.chem.unep.ch/pic/ or www.pic.int); on Persistant Organic Pollutants (http://www.chem.unep.ch/pops or http://www.pops.int) ; and on the Code of Ethics on the International Trade in Chemicals (UNEP, 1994; at http://www.chem.unep.ch/ethics or at http://www.chem.unep.ch/ethics/english/CODEEN.html) . This code is somewhat equivalent to the FAO Code on Pesticides. General information on UNEP Chemicals can be got at their website: http://www.chem.unep.ch/

These are just some websites known to the authors. However how many of these websites are used to access information by persons involved in chemical management at present in PNG is unknown to the author.

The author is only aware of a few databases used / available for use in PNG on chemical management. These are included in the list in Table 10.5.How many of these are actually used is also unknown; probably very few!!

Table 10.3 Availability of International Literature

Literature	Location(s) in PNG	Who has access?	How to gain access	Internet site for literature
Chemical Abstracts Service (CAS)	DEC All?			http://www.cas.org (large database of chemical information)
Concise International Chemical Assessment Documents (CICADs) (WHO/IPCS)	DEC			http://www.who.int/ipcs/publications/en/ go to Concise International Chemical Assessment Documents or directly at http://www.who.int/ipcs/publications/cicad/en
Decision Guidance Documents for PIC Chemicals (FAO/UNEP)	DEC-EP	all	on request	http://www.pic.int/en/ follow through English and Documents and click on DGDs.
Documents from FAO/WHO Joint Expert Committee on Food Additives (JECFA)	DEC-EP DAL-NARI/PP			http://www.who.int/ipcs/food/jecta/en/ or directly at http://www.who.int/entity/ipcs/publications/jecta/en/
Documents from the FAO/WHO Joint Meeting on Pesticide Residue (JMPR)	DEC-EP DAL-NARI/PP	all	on request	http://www.who.int/ipcs/food/jmpr/en/ or directly at http://www.who.int/entity/ipcs/publications/jmpr/en/
Environmental Health Criteria Documents (WHO/IPCS)	DOH -EH WHO office DEC-EP, NISIT, UPNG -Medical Library	all	on request	http://www.who.int/ipcs/publications/ehc/en/ or http://www.inchem.org/pages/ehc.html or http://www.who.int/dsa/cat97/zehc.htm or at http://bookorders.who.int/bookorders/index.htm or general publications on protection of human health at http://www.who.int/publications/en/ or http://www.who.int/pcs/pubs/pub_ehc.htm (provides full list/ summaries provided for some)
FAO/WHO Pesticides Safety Data Sheets	DEC-EP DAL-NARI/PP	all	on request	http://www.who.int/ipcs/publications/pds/en/ (provides full list) or directly at http://www.inchem.org/pages/pds.html (also provides latest WHO Classification by Hazard 2000-2002)
Good Manufacturing Practice Principles	DTI ,Dept of Commerce DAL, DEC			http://www.tga.gov.au/manuf/ - go to chemicals
Health and Safety Guides (WHO/IPCS)	DOH -EH WHO office, NISIT, DEC-EP UPNG -Medical Library DLIR/OHS	all	on request	http://www.who.int/pcs/pubs/pub_hsg.htm (provides full list) or http://www.who.int/ipcs/en - go to publications or http://www.who.int/ipcs/publications/en/ go to Health and Safety Guides.
IATA (International Air Transport Association) Dangerous Goods	Department of Transport and Civil Aviation ?			http://www.iata.org/dangerousgoods/index (useful website on dangerous goods)
IMO International Maritime Dangerous Goods Code (IMDG)	Department of Transport and Civil Aviation / Maritime	all	On request	http://hazmat.dot.gov/imdg.htm and

Literature	Location(s) in PNG	Who has access?	How to gain access	Internet site for literature
	Division?			http://www.hazmateam.com/transportation/IMDG.html and http://www.imo.org/safety/mainframe.asp?topic_id=158 and http://www.oceansatlas.org/ then do Search for Dangerous goods. (covers transport of hazardous materials by sea)
International Chemical Safety Cards (IPCS/ICSCs)	DLIR/OHS Department of Transport and Civil Aviation	all	on request	http://www.who.int/ipcs/publications/icsc/en/ or direct at http://www.cdc.gov/niosh/ipcs/icstart.html (provides full data cards directly)
Material Safety Data Sheets (industry)	DLIR/OHS Department of Transport and Civil Aviation, NISIT	all	on request	Three good sources are: http://www.ilpi.com/msds/index.html (where to find MSDS on internet) http://www.ehs.cornell.edu/lrs/internetMSDS.htm (also gives internet sites for MSDS / (Cornell University site) http://www.inchem.org/pages/icsc.html gives IPCS's international chemical safety cards
OECD Good Laboratory Practice Principles	NISIT, NARI-NAgL UOT-NAL	all		http://www.oecd.org/env/glp - go to Good laboratory Practice
OECD Guidelines for the Testing of Chemicals	DEC-EP	all		http://www.oecd.org/env/glp - go to Chemical Testing Guidelines
POPs Information	DEC / others involved in POPs project or using POPs.	all	download	http://www.pops.int go to guidance or direct at http://www.pops.int/documents/guidance or at http://www.chem.unep.ch/newlayout/infpopschem.htm
UNITAR Training documents	DEC / others	all	download	http://www.unitar.org/cwm/publications/index.htm includes many publication including those referred to elsewhere in this profile
WHO/UNEP Global Environment Library Network	All – (via Internet)			http://www.earthwatch.unep.net/ Put in Search for GELNET (Global Health and Environment Library Network (GELNET) Or http:// www.earthwatch.unep.net/about/docs/contrib.htm

DOH-EH = Department of Health - Environmental Health;
NISIT= National Institute of Standards and Industrial Technology
NARI/PP = National Agricultural Research Institute Plant Protection,
NARI/National Agricultural Laboratory (formerly DAL = Department of Agriculture and Livestock/ National Chemistry Laboratory;
DEC-EP= Department of Environment & Conservation Environmental Protection Division;
UPNG = University of Papua New Guinea;
UOT-NAL= University of Technology / National Analytical Laboratory.

Table 10.4 Internet Sites for Finding Information or Sources of Information

Name of Site	Title of Site	Web address	Notes
Australia – Oztoxics National Toxics Network (NTN)	Australian NGO on Toxic Chemicals	http://www.oztoxics.org	Great database / source of information on toxic chemicals
Australia Dept of Environment and Heritage homepage	Chemicals home page Chemicals and the Environment Branch	http://www.deh.gov.au then press 'Sustainable Industry', then ' Chemicals' in 'your theme of interest'. or http://www.deh.gov.au/industry/chemicals/index.html	Includes email access to *'National Profile of Chemicals Management Infrastructure in Australia'* Includes access to range of chemical programs and activities Australia Dept of Environment involved in Chemical management issues
Australia Environment = environmental portal – gateway to information on environment	Chemicals home page Chemicals and the Environment Branch	http://www.environment.gov.au then press 'Chemicals' in 'your area of interest'. http://www.environment.gov.au/epg/chemicals.html	Includes email access to *'National Profile of Chemical Management Infrastructure in Australia'* Includes access to range of chemical programs and activities in Australia.
Australia The National Industrial Chemical Notification and Assessment Scheme (NICNAS)	NICNAS home page	http://www.nicnas.gov.au or http://www.chemlink.com.au/nicnas.htm	
Australia. National Occupational Health and Safety Commission	Covers Chemicals / The National Industrial Chemical Notification and Assessment Scheme (NICNAS)/Hazardous Substances and dangerous Goods/Assessment and Registration in Australia. Agricultural and Veterinary Chemicals	http://www.nohsc.gov.au (home page of NOHSC) or directly go to http://www.nicnas.gov.au or http://www.chemlink.com.au/nicnas.htm	
Australia. National Occupational Health and Safety Commission Hazardous Substances Database Information System	Can retrieve classification information on more than 3500 substances –contains national exposure standards for almost 600 atmospheric contaminants	http://www.nohsc.gov.au/applications/hsis	
Australian Pesticides and Veterinary Medicines Authority formerly Australia. National Registration Authority for Agricultural and Veterinary Chemicals (NRA)	APVMA home page – allows you to do search in PUBCRIS = Australian registered Products database.	http://www.apvma.gov.au - can do Search for Products etc. or for assistance go to http://www.chemskill.com.au/consulting/apvma.html	
Canada. Canadian Centre for Occupational Health and Safety	IPCS INCHEM	http://www.inchem.org/	
Crop Life was formerly known as GIFAP (Groupement international des associations nationales de fabricants de produits agrochimiques) and also known as GCPF (Global Crop Protection	Global Crop Protection Federation General Information Publications	http://www.croplife.org/ and www.pestfacts.org	When as GIFAP was International Association of Pesticide Manufacturers who have produced numerous publications including guidelines, pictograms, technical monographs and

Name of Site	Title of Site	Web address	Notes
Federation)			position papers on pesticides and biotechnology.
European Commission	Environment page	http://europa.eu.int/comm/environment/index_en.htm	Policy areas on Chemicals including Dangerous Substances and POPs.
Greenpeace International	Greenpeace International and Australian homepage – go to Campaign - Toxics Greenpeace Toxics Campaign	http://www.greenpeace.org/~toxics/	Greenpeace Australia: http://www.greenpeace.org.au/toxics/index.html http://www.greenpeace.org.au/campaigns/index.html (follow 'eliminate toxics
International Organisation of Consumer Unions (IOCU), now called Consumers International	General Information / Publications	http://www.consumersinternational.org/ then press ' campaigns and programmes'.	NGO with long involvement in chemical issues especially re environment and consumer affairs PNG listed as Member through Independent Consumer and Competition Commission, joined 8 February 2001.
IOMC (Inter-Organization Programme for the Sound management of Chemicals)	Gateway to IOMC programmes and member organizations that address chemical safety.	http://www.who.int/iomc/	
OECD Chemicals Programme	Chemicals Programme	http://www.oecd.org/health click on Chemical Safety.	
OECD Environment	Environmental Health and Safety Programme	http://www.oecd.org/environment click on Chemical Safety	
OECD Pesticide Program	Pesticide Programme	http://www.oecd.org/environment click on Chemical safety then Pesticides	
Pesticide Action Network (PAN) Asia and the Pacific	PAN-AP homepage	http://www.poptel.org.uk/panap/ or www.panap.net	One of five regional centres of PAN-International , pesticide NGO working to promote sustainable agriculture, and oppose the use of pesticides
Pesticide Action Network International	Pesticide Action Network internationa homepage	http://www.pan-international.org	International NGO
Pesticide Action Network North America (PANNA/ US)	Pesticide Action Network US homepage	http://www.panna.org has excellent database at http://www.pesticideinfo.org	US based Pesticide NGO addressing health and environmental problems of pesticides and sustainable agriculture
Pesticide Action Network UK (formerly known as The Pesticides Trust)	Pesticide Action Network UK homepage	http://www.pan-uk.org/	UK based Pesticide NGO addressing health and environmental problems of pesticides and sustainable agriculture
UNEP Chemicals	Internet Guide Finding Information on Chemicals	http://www.chem.unep.ch/irptc/iguide/coverpg.html	Also available as book UNEP Chemicals (IRPTC) 1996.

Name of Site	Title of Site	Web address	Notes
UNEP Chemicals	Publications	http://portalserver.unepchemicals.ch/Publications/Forms/All.htm or http://www.chem.unep.ch/irptc/Publications/pb0901.html	Provides list of many UNEP Chemicals Publications.
UNEP Chemicals	UNEP Chemicals (IRPTC) Pointers to Chemistry-related Material on WWW.	http://irptc.unep.ch/irptc/othersit.html	
UNEP Chemicals and related websites		http://www.chem..unep.ch/irptc/default.html or http://www.chem.unep.ch/ and POPs = www.chem.unep.ch/pops/default.html PTSs = www.chem.unep.ch/pts/default.html PIC = www.chem.unep.ch/pic/default.html see also for related sites www.chem.unep.ch/irptc/othersit.html	
US Environmental Protection Agency Office of Pesticide Programs	Office of Pesticide Programs	http://www.epa.gov/pesticides	
WWF Global Toxics	WWF Toxic Chemicals homepage	http://www.panda.org/ then go to Toxics	Mainly active on conservation/ biodiversity issues but include toxic chemicals campaign

Table 10.5 Availability of International Databases

Databases	Location(s)	Scope	Who will / has access?	How to gain access	International Website	Type of database
ARSAP/CIRAD/SPC/SPREP	Books[18] available from ESCAP and ES-UPNG/author. Part of CIRAD's Iphytrop activities	Pesticides databases for Asia, Africa and Pacific Pacific editions 1990 and 1994 include all pesticides used in PNG up to 1993	All / probably now out of print	On request	-	See two books ARSAP/CIRAD/SPC/ SPREP 1990; ARSAP/CIRAD/SPC 1994
Australia National Pollutant Inventory	Through internet	Consequence of, in part, Australia's Pollutant Release and Transport Registry (PRTR)- Is a very useful source of information on many chemicals	All	Internet	http://www.npi.gov.au	On-line on internet
Australia. National Registration Authority for Agricultural and Veterinary Chemicals (NRA)	Through internet	Registration of Pesticides in database called PUBCRIS			http://www.apvma.gov.au/pubcris/subpage_pubcris.shtml	On line on internet gives all pesticides and veterinary chemicals registered currently in Australia
Australian Inventory of Chemical Substances (AICS) From NICNAS	Through internet	Databases and indexes – includes list of industrial chemicals in use in Australia	Partially restricted/cost	On request	http://www.nohsc.gov.au/nicnasweb/dbs_indexes.htm	AICS CD-ROM available. All available direct on internet. Excellent source of information.
Chemical Abstract Services Database	UPNG-ES On internet	Large number of databases on chemicals	all	On request	http://www.cas.org/	
ESCAP FADINAP (Fertilizer Advisory, Development and Information Network for Asia and the Pacific) Database	Diskettes with Database on Pesticides and the Environment With UPNG-ES / author	Covers agro-chemicals / mainly fertilizers; but includes also a database on pesticides and the environment	all	Internet/ On request	http://www.fadinap.org/onlinedbases.htm and http://www.fadinap.org/pesticide/index.htm	On-line on internet. Also DOS driven, available on diskettes
Global Information Network on Chemicals (GINC)	Not used	World wide network on safe use of chemicals	all	Internet	http://www.nihs.go.jp/GINC/index.html also http://www.nihs.go.jp/GINC/asia/index.html	On-line on internet And Asia Pacific homepage.
ILO Chemical Safety Cards / CD-ROM	Department of Labour and Employment,	Covers safety aspects of all chemicals	All/ small cost	On request	http://www.ilo.org/public/english/90travai/cis/frames10.htm or through http://www.inchem.org go to Chemical safety Cards or directly at	CD-ROM

[18] ARSAP/CIRAD/SPC (1994; ARSAP/CIRAD/SPC/SPREP (1990)

Databases	Location(s)	Scope	Who will / has access?	How to gain access	International Website	Type of database
					http://www.inchem.org/pages/icsc.html For CD-ROM press link or directly at http://www.inchem.org/pages/subscrib.html)	
ILO Chemical Safety Cards / CD-ROM	Department of Labour and Employment,	Covers safety aspects of all chemicals	All/ small cost	On request	http://www.ilo.org/public/english/90travai/cis/frames10.htm http://www.ilo.org/ or through http://www.inchem.org go to Chemical safety Cards or directly at http://www.inchem.org/pages/icsc.html For CD-ROM press link or directly at http://www.inchem.org/pages/subscrib.html)	CD-ROM
ILO CIS	Department of Labour and Employment	Covers all chemicals concerned with chemical safety	All/cost	On request	http://www.inchem.org	On-line , available to download on subscription
IPCS INCHEM ON LINE and IPCS INCHEM CD-ROM	Not used	Same as ILO CIS	All/ costly!	-	http://www.inchem.org For CD-ROM press link or directly at http://www.inchem.org/pages/subscrib.html	
IPCS INTOX	Not used	Poisons information database	all	Internet	http://www.intox.org/ and direct to database / databank http://www.intox.org/databank/index.htm	CD-ROM Description given at http://www.intox.org/cdrom.html Contents of CD-ROM available at http://www.intox.org/fulllist.html
IRPTC Data Profiles	On internet	Covers all chemicals / is an inventory of information sources on chemicals / includes information for Asia and the Pacific.	All / free	On request	http://www.chem.unep.ch/irptc/invent/igo.html or http://www.chem.unep.ch/irptc/irptc/roap/Default.htm	On-line on internet
IRPTC Legal files	DEC On internet	Covers legal aspects of all chemicals	All/ free	On request	http://www.chem..unep.ch/irptc/ - then click on Legal File or http://www.chem.unep.ch/irptc/legint.html	On-line on internet
IRPTC-PC Chemicals Database-	DEC-EP UPNG-ES	Covers toxic chemicals / is an inventory of information sources on chemicals / includes information for Asia and the Pacific.	all	On request	http://www.chem..unep.ch/irptc/ - or http://www.chem.unep.ch/irptc/invent/igo.html or http://www.chem.unep.ch/irptc/irptc/roap/Default.htm	diskettes
OECD - EXICHEM	On line / database on existing chemicals -	Tells about current, planned and completed activities on	all	Internet	http://www.oecd.org Go to Environment or Health, then Chemical	On line

Databases	Location(s)	Scope	Who will / has access?	How to gain access	International Website	Type of database
	Not used	existing chemicals in OECD countries and other bodies			safety. Or Search for "exichem" or "chemical safety".	
Oztoxics National Toxics Network	Through internet	Much information on toxic chemicals	Free / all	Internet	http://www.oztoxics.org	Includes much information on Stockholm and other Conventions plus a POPs handbook.
Poisons Information Database (National University of Singapore)	On line Contact in PNG is Dr Matainaho, Dept of Basic Medical Sciences, UPNG	Poisons information database	all	Internet	http://vhp.nus.edu.sg/PID/ or http://medweb.nus.edu.sg/PID/PID.htm	On line
STN Database		Linked with CAS			http://www.stn.com/	
University of Queensland PESKEM	Diskettes with Database on all pesticides registered in Australia *(seems to have ceased)*		All/cost	On request/payment	http://www.laf.uq.edu.au/cpas/index.html or http://www.aghort.uq.edu.au/cpas	Windows driven. From Diskettes

10.5 National Information Exchange Systems

No scheme exists for exchange of information on chemicals in PNG. It was intended at one stage that PNG should establish a National Register of Potentially Toxic Chemicals (an NRPTC) using the IRPTC-PC database as a start. A staff member of UPNG, Mrs Margaret Gabut, attended a UNITAR/IRPTC training workshop held in Cha-Am, Thailand in 1992 (IRPTC (1992)). It was hoped that she would then be able to assist DEC to establish a NRPTC. This never eventuated. Information exchange systems are meant to operate for PIC and POP chemicals. This occurred on an adhoc basis for a short while in the late 1980s and early 1990s. Presumably this is still done between DEC and UNEP Chemicals. However PNG officials do not provide information overseas except upon request on an ad hoc basis. Establishing such a scheme to exchange both international data and information and to exchange information within PNG could be regarded as a priority for chemical management in the future. It is actually a requirement for PIC procedures.

10.6 Comment / Conclusion

On inspection in government departments and libraries there is an abundance of general information on specific chemicals, but pertinent information on other chemicals and in particular on chemicals as used in PNG is hard to access. PNG derived information on chemicals is very difficult to access / locate, and is scattered around many departments or sections in departments and then usually its collection has been done unsystematically so often vital data and bits of information / documents are missing.

It is only in the past few years that most government departments and universities have had easy access to the Internet, though financial and technical problems often preclude this. Much information, a plethora of pertinent websites and many databases are readily available on / through the internet. Other databases available on diskettes or CD-ROMS are also easily available. Many would greatly assist PNG personnel in chemical management.

No scheme exists for exchange of information on chemicals in PNG, except possibly through the PIC and POPs processes. Improved mechanisms to store, retrieve and exchange information on chemicals need to be developed in PNG.

10.7 Recommendation

It is vital that a review be done to ascertain what information on chemicals useful for chemical management does exist and is actually used in PNG. Also important is information on what national databases exist or are actually being compiled or ought to be compiled and used; and what international databases and websites are used. This needs to be done within government and in the private sector. Existing databases need to be reviewed and improved. Methodologies and harmonised systems for collecting, storing and retrieving information on chemicals need to be established. A mechanism for giving people ready access to that information (or part of it) and for information exchange needs to be established. A website on chemical a management in PNG should be established. Departments need to make more use of international information, websites and databases, and need to be funded adequately to ensure Internet services are paid for and computer facilities are maintained.

Chapter 11 Technical Infrastructure

This chapter provides an overview of the technical infrastructure in Papua New Guinea related to the management of chemicals. It lists laboratory facilities available, and their capabilities to ensure quality of chemicals, to conduct analyses of environmental and food samples, to identify unknown substances and to monitor for possible adverse effects. It also discusses the availability and capability of providing and sharing information by accessing computer databases both within departments and organizations within PNG and through the internet. Access to the internet for chemical management in PNG is briefly discussed. It also highlights the critical situation in universities and technical colleges in training and education in chemical management.

11.1 Overview of Laboratory Infrastructure

Table 11.1 provides an overview of the main laboratory facilities available in the country to support programmes and policies for the management of chemicals. There are a few small private laboratories as well with limited capabilities.

Table 11.1 Overview of Laboratory Infrastructure for Regulatory Chemical Analysis

Name/Description of Laboratory	Location	Equipment/ Analytical Capabilities Available	Accreditation (if yes, by whom?)	Certified GLP (yes/no)
NARI-National Agricultural Laboratory	Port Moresby, NCD	rubber testing; residues & contaminants in foods/ agricultural products and environmental compounds ag products, water, soil, pesticides, heavy metals	yes- NATA (Australia / NISIT). For selected analyses only	yes - selected
UOT –National Analytical Laboratory	Lae, Morobe Province	residues / contaminants in foods and environmental components, mining wastes / effluents, water soils and sediments pathology	yes - NATA (Australia/ NISIT). For selected analyses only	yes - selected
UPNG - Chemistry Dept	Port Moresby, NCD	water sampling, heavy metals, oils, some pesticides & PCBs (limited)	No	no
DOH – POMGH Central Public Health Laboratory	Port Moresby, NCD	pathology / biological samples, water and food	Yes	yes - selected
Mining Company Chemical / Environmental Labs , eg OTML , Porgera Joint Venture, Lihir /	OTML Tabubil, Western Province; PJV Porgera Enga; Lihir, New Ireland	analysis of ores and alloys and minerals; fuel environmental contaminants/ quality indices; water	yes – selected analyses only (some have NATA Australia and NISIT)	yes - selected

Name/Description of Laboratory	Location	Equipment/ Analytical Capabilities Available	Accreditation (if yes, by whom?)	Certified GLP (yes/no)
		geochemistry biological monitoring		
Petroleum Company / Chemical/Environmental Labs, eg Oil Search Laboratory & InterOil Laboratory	Oil Search Kutubu, Southern Highlands Province; InterOil Port Moresby, NCD	crude oil, natural gas, petroleum products, raw water, portable produced water, environmental effluent /contaminants , oil field treatment chemicals	Oil Search not accredited but application of recognized standards; OnterOil is NATA accredited	Yes – selected analyses

source: NISIT (pers. comm) plus Gedisa Kone (Department of Petroleum and Energy).

Laboratories vary in what they can do.

- Only two laboratories have the capabilities to service the needs of government in chemical management in general , these being: NARI's National Agricultural Laboratory and the University of Technology's National Analytical Laboratory.

- Ok Tedi , Porgera and Lihir have their own laboratories which are capable of mineral and environmental / heavy metal analyses, but serve principally their own needs including their environmental monitoring programmes. Industry in general have their own laboratories which serve their immediate needs in mining and oil exploration / extraction.

- The POM General Hospital Central Public Health Laboratory can do microbiological testing.

- The University of PNG Chemistry department has the equipment (though now outdated) to do a wide range of chemical analyses involving pesticides and PCBs (Mowbray (1988))(and referred to in Chapter 13), heavy metals and industrial chemicals. However it now lacks staff and funds to adequately maintain the supplies of needed solvents and gases and other the analytical equipment. It also lacks analytical capability / certification due to insufficiency and continuity of samples to be tested.

here is no Government or private laboratory that can do the wide range of analytical tests of the types needed for overall chemical management. No lab at present can adequately monitor POPs levels in PNG.

To be able to fund analyses, purchase equipment, maintain equipment, be able to obtain the latest state-of-the-art equipment for analytical purposes requires a high flow through of samples to be analysed, plenty of funds and skilled staff, and a low turn-over of staff. Only the Industries' Laboratories, UOT's National Analytical Laboratory and the Government National Agricultural Laboratory are in this situation; and they too are limited in what they can do. They too are seriously constrained by both financial and technical resources available to them. It must be realised that the cost of just purchasing and transporting basic chemicals, gases, glassware let alone to purchase and install high technical equipment in PNG is extraordinary!! The added problems are to have a guarantee of power and running water. Then we need staff with the experience and expertise in the different types of analyses. Furthermore, for enforcement and prosecution, laboratories that do the analyses need to have accreditation, or their results may be discredited. The problems and constraints to doing high quality analytical work are enormous.

The National Agricultural Laboratory, UOT's NAL, and some labs in mining and petroleum companies have NATA and NISIT accreditation for some types of analyses; and seek to follow Good Laboratory Practice.

The authors understand that most of the laboratories utilise standard methodologies and protocols; are certified and participate in some interlaboratory intercalibration exercises. The authors understand Ok Tedi Laboratory has done this, as have UPNG Chemistry Department in the past (not now) both for pesticide and heavy metal samples in animal tissues.

The PNG Government has over the last 20 years commissioned a number of studies officially or unofficially into its laboratory capability and needs. Recommendations have been put aside and reports left to gather dust. One was done by a Professor Thomson in 1978. Once again the government must face the reality that if it is to manage chemicals properly it must commit itself in the long term to develop a good quality Government Laboratory. The authors understand that it is now the intention of Government to try to ensure that the National Agricultural Laboratory develops this capability of servicing Government functions in the areas of chemical management, to provide for:

- quality control / check quality of chemicals
- conduct residue analyses
- identify unknown substances
- conduct monitor studies / monitor for possible adverse effects

AusAID was involved with the NARI National Agricultural Laboratory in training and provision / upgrading of equipment (2002). However the Government must be prepared to both allocate more funds and to ensure a long term funding commitment so the needs of chemical management for the country for the next 20 years are met.

11.2 Overview of Government Websites and Access to the Internet

Most national government departments use computers, as do some of the provincial administrations. How many of the computers are fully functioning is not certain. However it appears that many are not connected to the internet nor have email. This is in part often due to disconnected phones or regular power cuts.

Table 11.2 provides a summary of selected government departments or authorities (and a few sector associations / NGO) websites. It also includes selected websites of private organizations, university and research organizations (mentioned in earlier chapters). Unfortunately many do not work or the information provided is out of date and they are not updated. Few contain or link you to information on chemicals. Government departments without websites listed include Attorney General, Bougainville Affairs, Community Development, Defence, **Environment and Conservation**, Education, Finance, Foreign Affairs, Forest Authority, Higher Education, Independent Consumer and Competition Commission, Labour and Industrial Relations, Lands and Physical Planning, National Planning and Rural Development, Personnel Management,Prime Minister and NEC, Provincial and Local Level Government Affairs / Intergovernmental Relations.

The first PNG National Profile on Chemical Management contained in Chapters 8 and 10 many appropriate (of that edition) websites on chemical management. Despite the fact that this book was widely distributed by both DEC and the POPs project it would seem that few persons have tried to access these websites. Most have never accessed sites for chemical information nor international databases. One reason is that most departments do not have functioning web connections. About half government departments either do not have websites or their websites are not functioning. Where emails function, persons / organizations do actually share information by emailing attachments consisting of small databases or spreadsheets with data and information or by downloading word, excel, pdf and html files. Alternatively some database and information is accessed through CDs.

Table 11.2 Government Department / Organisations and Others Responsible for Chemicals – Websites

Department or Organisation	Web address	Department or Organisation	Web address
General – gateway to government departments PNG Government Online	www.pngonline.gov.pg	Opens – provides websites of many departments.	
Government Departments			
Department of Agriculture and Livestock	www.agriculture.gov.pg	National Institute of Standards and Industrial Technology (NISIT)	www.nisit.gov.pg
Bank of Papua New Guinea	www.bankpng.gov.pg	National Statistics Office	www.nso.gov.pg not work, but does at www.spc.int/prism/country/pg/stats
Office of Civil Aviation	www.oca.gov.pg	Department of Petroleum and Energy	www.petroleum.gov.pg
National Disaster Centre	www.pngndc.gov.pg	Prime Minister's Office	www.pm.gov.pg
National Fisheries Authority	www.fisheries.gov.pg	Department of Police	www.police.gov.pg
Department of Health	www.health.gov.pg	Tourism Promotion Authority	www.pngtourism.org.pg
Office of Information and Communication	www.communication.gov.pg	Department of Trade and Industry	www.pngtradeandindustry.gov.pg
Internal Revenue Commission (Customs)	www.irc.gov.pg	Department of Treasury	www.treasury.gov.pg
Department of Justice	www.justice.gov.pg	Department of Works and Implementation	www.works.gov.pg
Investment Promotion Authority	www.ipa.gov.pg	Department of Mineral Resources/ Mining	www.mineral.gov.pg
Department of Mineral Resources/ Mining	www.mineral.gov.pg	National Institute of Standards and Industrial Technology (NISIT)	www.nisit.gov.pg
Private Sector		*Universities and Research*	
Papua New Guinea Business Directory	www.pngbd.com	University of Papua New Guinea	www.upng.ac.pg
Port Moresby Chamber of Commerce and Industry	www.pomcci.org.pg	University of Technology	www.unitech.ac.pg
Papua New Guinea Chamber of Minerals and Petroleum	www.pngchamberminpet.com.pg	Divine Word University	www.dwu.ac.pg
		University of Goroka	www.uog.ac.pg
		University of Vudal	www.uov.ac.pg
		National Research Institute	www.nri.org.pg
		National Agricultural Research Institute	www.nari.org.pg
		Papua New Guinea Institute of Medical Research	www.pngimr.org.pg
NGOs			
Eco forestry forum	www.ecoforestry.org.pg		

11.3 Overview of Government Information Systems and Computer Capabilities

A directory of data systems, published lists 111 data systems identified to be used in PNG. However none directly compile data on chemical management (Office of National Planning and Implementation, 1998). Table 11.3 provides an overview of which departments are known to have databases or even spreadsheet files containing data or information useful for the implementation of government policies and programmes related to chemicals management.

Table 11.3 PNG databases containing information on chemicals

Computer System/Database	Location	System	Current Uses
National Statistics Office	Waigani, NCD	Databases Provides sells / information on CDs – some linked to GIS software using MapInfo	All Government national statistics
Bank of PNG	POM, NCD	? (published in BPNG "Quarterly Economic Bulletin"	All economic and social statistics on volumes and moneys collected
Internal Revenue Commission (Customs)	POM, NCD	ASYCUDA database	All import and export statistics
DEC-Environmental Protection	Waigani, NCD	Own database or on spreadsheets	Small pesticide registration database
Department of Health - Environmental Health	Waigani, NCD	?	
Department of Trade and Industry	POM, NCD	? (published annually in "Statistical Digest"	Trade and industry statistics
Department of Agriculture and Livestock	POM , NCD Statistics Section, DAL		Ag statistics
Department of Petroleum and Energy	POM, NCD	Asset database management system	Oil and gas data – still being updated
Environmental Science, UPNG	Waigani, NCD	Small databases and spreadsheets	Data on pesticides and hazardous chemicals –used in teaching

As mentioned in the last section, a major problem both in Port Moresby and other major centres in PNG is the fluctuation in power, power cuts and the fact that telephone systems often are cut, and not working or of very poor quality. Email and the Internet access are regularly unavailable to many PNG government departments.

Major constraints remain funding - funds to purchase more computers and to hook onto the Internet. Some departments have limited email / internet access due to shortage of funds and the fact that departments have often not paid their phone bills or can not / do not have funds for phone connections!! Lack of trained technical people to maintain computers is also a problem in some localities and in some departments. The costs of repairs and replacement parts is also prohibitive, as is the cost of inks and paper for printing.

11.4 Overview of Technical Training and Education Programme

The recent review by Ila'ava (2005) for the POPs project summarises some of the major constrains in education, training, research and awareness raising for chemical management. A summary of part of his review is given in Box 11.1, as related to education, research and training.

There are two major universities in Papua New Guinea that train persons with the technical and other expertise required to implement government policies and programmes related to chemical management. One large technical college, Lae Technical College, used to train technician level staff.

The School of Natural and Physical Sciences at the University of Papua New Guinea has the following academic disciplines: biology, chemistry, earth sciences, environmental science and geography,

mathematics, statistics and computer science and physics. Chemistry teaches courses in environmental and analytical chemistry. The fourth year component of Environmental Science covers both environmental and biodiversity / conservation management, including two appropriate units on integrated environmental assessment and chemical risk assessment and environmental protection (Box 11.2). About 10-15 students graduate in Chemistry and 20-25 students in Environmental Science each year. A number of the Chemistry students do the chemical risk course. No courses are taught in Toxicology in the University although aspects of toxicology are included both in the chemical risk course and in some Medical courses eg Pharmacology and Human Biology. The Environmental Science strand of Environmental Science and Geography Discipline at UPNG also teaches other general courses in environmental science and conservation. Its staff (with Biology) are also involved in training programs in environmental and conservation awareness raising and conservation capacity building. Chemistry, Biology, and Environmental Science staff have been involved in curriculum development with the Education department in areas including management of pollution and conservation.

The University of Technology has a more applied slant and within its programs in Applied Sciences teaches environmental and analytical chemistry. With the Engineering departments aspects of environment engineering are taught. UOT has a Centre for Environmental Research.

Employees in Government departments, including DEC, and the universities are sent overseas on work placement training programs or to do higher degree. This has occurred frequently over the years with persons training in Australia, New Zealand, USA and UK in areas relevant to chemical management.

All tertiary institutions in Papua New Guinea at present suffer from a critical shortage of funds and a very reduced Budget. This has meant fewer staff, lack of ability to maintain infrastructure, and a general running down of the facilities. However student numbers have been maintained, indeed have increased. This adds stress to the many other problems of running the university and maintaining the quality of the academic programmes. Research by staff has been severely limited both due to financial and time constraints. Thanks to AusAID assistance, a state of the art computer facility has been established shared by Biology and Environmental Science. The Chemistry Department at UPNG has been unable to keep enough qualified staff to maintain adequately its equipment, and lacks the funds to purchase the necessary chemicals, glassware etc and to keep equipment running. This has had a big impact on the quality of the academic programs it can teach. The University of Technology is in a similar situation to UPNG suffering from a critical shortage of funds. Furthermore staff development activities at the universities are also ‘in limbo’ with an apparent cessation in funding to send staff overseas for further training and higher degrees.

Unfortunately over recent years an extremely strong training program in the technical colleges, in particular Lae Technical College, has been allowed to run down. University technical staff and some from Government departments used to be trained in these institutions, but this seems to have been severely reduced in recent years. The authors are not aware of the present situation at Lae Technical College.

Box 11.1 POPS review on constrains in education, training, research and awareness raising for chemical management (from Ila'ava, 2005)

Box 11.2 Environmental Sciences Programme at the University of Papua New Guinea

Programme Outline

YEAR 1 (external) or 2 (internal)
Introduction to Environmental Science
YEAR 3
Resource Management for Sustainable Development
Sustainable Resources A
Sustainable Resources B
Environmental Science Work Experience

YEAR 4
Integrated Environmental Assessment
Chemical Risk and Environmental Protection
Biodiversity Conservation Strategies
Special Topics in Environmental Science
Environmental Science Project

Course descriptions of Year 4 Courses

1.42301 INTEGRATED ENVIRONMENT ASSESSMENT .

Covers the area of environmental assessment and planning . Provides basic understanding of theory and practice in environmental assessment and planning from an integrated perspective and in the context of ecologically sustainable development - ecological, economic, social and institutional.. Emphasis on the project level and the EIA process. Includes strategic environmental assessment and a wide range of environmental management tools including: risk assessment (brief) ,state of the environment reporting, economic instruments, codes of conduct and best practice, ISO14000, life cycle analysis, environmental auditing, public disclosure/public environmental reporting and conflict resolution. A scenario based is taken where students take on a role and act out a real methods and tools required to carry out the assessment from an integrated perspective with a focus on PNG at local and national level.

1.42302 CHEMICAL RISK AND ENVIRONMENTAL PROTECTION

Introduces the concepts of risk assessment and management, and in particular both chemical and environmental risk assessment. Covers the risk assessment and management process, perceived and real risk, what is acceptable or reasonable risk, how to manage risk and risk communication.; principles and methods of toxicology covering both effects on humans and the environment. Introduces a preventative approach to pollution and environmental protection by emphasizing the concepts of sustainable industrial development, cleaner production, resource recovery and the waste management hierarchy. Critically assesses PNG's new environmental regulatory framework, PNG's National Profile of Chemical Management and PNG's present environmental performance. Students use databases to compile inventories of chemicals and students evaluate real situations involving pollution, chemical risk and waste management - include an environmental audit and comparative risk assessments. Also focus on water and air pollution and solid waste in Port Moresby and examples of industrial accidents overseas including Bhopal, Chernobyl, Coode Island and Exxon Valdez.

Examples of in-house training in chemical management are given in Table 11.4. These involve those in the petroleum industry.

Table 11.4 Technical Training in Chemical Management in Petroleum Industry(provided by Gedisa Kone, Department of Petroleum and Energy)

Organization	Training	Coverage	Participants	Schedule
Department of Transport (Maritime Division)	National Marine Oil Spill Training Exercise	• Oil Spills • Hazardous Chemicals	• Relevant Government Agencies • Oil Industries	Annually
Oil Industries (Oil Search, InterOil, Shell, Mobil)	1. Spill Training Exercises 2. Chemical Emergency Training	• Oil Spills • All Chemicals and Hazardous Substances	• Company Emergency Response Personnel	Monthly/ Annually

11.5 Comments / Conclusions

Laboratory Capabilities

There is no Government or private laboratory that can do the wide range of analytical tests of the types needed to support the Governments needs in overall chemical management. The intention of the Government is to try to ensure that the NARI National Analytical Laboratory develops the capability of servicing Government functions in the areas of chemical management. However it is still restricted in what it can do.

The Government must recognise the need for a state of the art analytical laboratory. Government must be prepared to both allocate more funds now and to give a long term funding commitment such that such a laboratory is not only strengthened now but can serve the long term needs in chemical management for the country for the next 20 years and beyond.

Computer facilities and Access to Internet

Most Government departments have computers although many lack the latest in software and lack CDRoms. Also many have limited access to email and the Internet. These problems need to be addressed.

Technical Training and Education Programs.

The Universities and technical colleges are at presently severely restricted in what they can do because of a severe cut back in their funding by Government, although student numbers remain the same or have increased.

Present initiatives include eliciting support from private companies and NGOs, but this has yet to occur in chemical management. Infrastructure and equipment have become severely run down and the purchasing power to buy necessary materials just to keep for example the science laboratories running for teaching, let alone research and consultancies, are limited. This and the reduced number of staff has had a severe impact on the quality of technical and general training and education programmes provided both at the universities and the technical colleges. There is a drastic need for support and funding of the Universities in PNG in general. In the past overseas funding from UNEP and SPREP provided 'state of the art' chemical analytical and other technical equipment to the universities. Due to lack of funding much of this equipment is now run down and poorly maintained or even obsolete. Funds for other basic supplies of glassware and chemicals and gases have evaporated. In the 1990s AusAID through IDP provided support for Environmental Science training and the Environmental Science Programme was strengthened. Reduced funding for such a programme today severely limits what can be achieved. Yet training in analytical chemistry and

environmental science are two key areas needed for producing chemical managers, in government, industry and the community.

It is important that both the PNG Government and aid providers such as World Bank, AusAID and ADB and others recognise this. Financial support for programs in environmental and analytical chemistry and Environmental Science should be further sought from private institutions in particular the chemical importers and mining companies in PNG. However care must be ensured to guarantee "no strings are tied" to such funding.

11.6 Recommendations

The PNG Government must commit itself in the long term to develop a Government Laboratory capable of servicing its needs in Chemical Management, capable of doing the following

- quality control / checking quality of chemicals
- conducting residue analyses
- identifying unknown substances
- conducting monitoring studies / monitoring for possible adverse effects (lower priority)

The Government must be prepared to both allocate more funds now and to give a long term funding commitment for the next 20 years and beyond.

Government departments involved in chemical management must all ensure that they have computers with the latest software, CDroms and compatible systems. Moves to harmonise and immediately share in country data should be a high priority. Use of the Internet and access to international data sources (discussed in Chapters 10 and 12) must also be a priority. Staff should be trained to use and become familiar with such data / software. Departments should all have informative and up to date websites. Again departments must budget / be funded adequately to ensure Internet services are paid for and computer facilities are maintained...

There is a drastic need for greater / increased support and funding of the Universities and technical colleges in PNG in general. Since chemical management is not seen by the Government as a high priority it is only from a flow-on in support for the Universities that teaching programmes with any emphasis on chemical management and environmental and health needs will be strengthened. Donor agencies and private industry should also be encouraged to support education and training programmes in chemical management in PNG, be they in the training institutions or in-service or in-house or in the community.

Chapter 12 International and Regional Linkages

This chapter describes PNG's participation in international and regional organisations and agreements concerned with the management of chemicals. It also provides international websites for organisations, agreements, information sources and databases on chemical management which may prove useful for chemical managers in PNG.

12.1 Co-operation and Involvement with International Organisations, Bodies and Agreements

This section covers who is responsible for dealing with different international organisations and international agreements, particularly in areas dealing with chemical management. The responsible focal point or agency or contact point for many international bodies / agreements needs to be determined.

Tables 12.1 and 12.2 state the involvement of Papua New Guinea in international activities and agreements and list responsibilities for contacts (where known / identified) with relevant organisations and list key websites for accessing information about many key organisations and agreements. There are indeed many more organisations and agreements on matters pertaining to chemicals and human health and the environment. The ones chosen are those chosen by the author (DLM) as pertinent. The web addresses have been included such that users of this National Profile might access directly information required on the organisation / body or activity, and the international agreements and procedures. Information collated on PNG was initially provided mainly by officers in DEC back in mid 1997 and partially up dated in late 2004. The websites were collated through a search of organisation / treaty websites on chemical management, done in February/March 2000. These web addresses were updated in November 2004.

A detailed list of all environmental treaties , both international and regional signed by Papua New Guinea is provided by the Environmental Treaties and Resource Indicators Service (ENTRI) at the following website:
First enter website: http://sedac.ciesin.org/entri ; then look at 'Which treaties are in force for a given state?' and enter 'Papua New Guinea'. UNEP also has a website for its Division of Environmental Conventions --- environmental legal instruments. including a register of environmental conventions, which includes a summary of the provisions of the instruments and the status of participation in the respective instruments -
at - http://www.unep.org/dec/ and go to links for Chemicals and Wastes. Another useful website listing parties to various international environmental agreements is at - http://www.nato.int/ccms/general/database/appende.html

Important International Agreements ratified by PNG include:

Area of MEA	Convention	Area of MEA	Convention
Climate Change	Vienna Ozone Layer	Wastes, Chemicals & Pollution	UNCLOS Law of the Sea
	Montreal Protocol		London Dumping Convention
	UNFCCC (Climate Change)	Regional	SPREP Convention
	Kyoto Protocol		Prevention of Pollution by Dumping
Wastes, Chemicals & Pollution	POPs (Stockholm)		Cooperation in Combating Pollution Emergencies
	Basel		South Pacific Nuclear Free Zone Treating (Rarotonga)
	Marine Pollution from Ships (MARPOL)		Waigani

Note that PNG has yet to sign and ratify the PIC or Rotterdam Convention., although it has participated in the voluntary process. More details on these and other important convention are provided in the following Tables.

Table 12.1 Membership in International Organisations, Programmes and Bodies

International Organisation/Body/ Activity	Web address of organisation	National Focal Point (Ministry / Agency & Primary Contact Point)	Other Ministries/ Agencies Involved if Environmental	Notes / related activities
FAO (Food and Agricultural Organization)	http://www.fao.org	Department of Agriculture and Livestock, PNG Forestry Authority, National Fisheries Authority	DEC	Pesticides
ILO (International Labour Organisation)	http://www.ilo.org also http://www.ilo.org/public/english/protection/safework/chemical/	Department of Labour and Industrial Relations, Department of Transport and Civil Aviation/ (Maritime Division)	DEC.	Second website gives ILO Safework page for Chemicals Occupational Health and safety
IMO (International Maritime Organization)	http://www.imo.org	Department of Transport and Civil Aviation (Maritime Division)	DEC	Marine Oil spills & pollution
Intergovernmental Forum on Chemical Safety (IFCS)	http://www.who.int/ifcs/index.html	DEC	DAL	On IFCS website DEC is national focal point for PNG Broad chemical management
IOMC (Inter-Organization Programme for the Sound Management of Chemicals)	http://www.who.int/iomc/en/ or http://www.who.int/iomc/index.html	DEC		Both give IOMC homepage. Broad chemical management
ISO (International Organization for Standardization)	http://www.iso.ch or http://www.iso.org	NISIT		On website gives NISIT as a 'correspondent member'. Standards / best practice
OECD (Oranisation for Economic Cooperation and Development)	http://www.oecd.org	Department of Foreign Affairs	DEC	Follow links on Environment, Health and Chemicals
UNEP (United Nations Environment Programme) IRPTC / Chemicals	http://www.chem.unep.ch/irptc or http://www.chem.unep.ch/ and http://www.chem.unep.ch/irptc/irptc/capbuild.html	DEC		Broad chemical management
UNEP Industry and Environment now called Technology, Industry and Economics Division (DTIE)	http://www.unepie.org/	DEC		Cleaner Production / best practice
UNEP Industry and Environment Programme /- Cleaner Production Activities	http://www.uneptie.org/cp/	DEC		Cleaner Production / best practice
UNEP International Environment Technology Centre	http://www.unep.or.jp	DEC		Cleaner Production / best practice
UNEP/PIC (Prior Informed Consent)	http://www.pic.int/	DEC		On website lists 'designated

International Organisation/Body/ Activity	Web address of organisation	National Focal Point (Ministry / Agency & Primary Contact Point)	Other Ministries/ Agencies Involved if Environmental	Notes / related activities
= Rotterdam Convention	and http://www.chem.unep.ch/pic and http://www.fao.org/pic			national authority' for both industrial chemicals and pesticides as Secretary, DEC. PIC
UNEP/POPS (Persistent Organic Pollutants) = Stockholm Convention	http://www.pops.int or http://www.chem.unep.ch/pops	DEC		PNG not listed, as of 5 November 2004. Contact person is National Co-Cordinator POPs Project = Ms Katrina Solien. POPs
UNEP/PRTR (Pollutant Release and Transfer Registers)	http://www.chem.unep.ch/prtr/	DEC		On website no contact point / national representative given for PNG Emissions and discharges
UNIDO (United Nations Industrial Development Organization)	http://www.unido.org	Department of Labour and Industrial Relations Department of Trade and Industry ?	DEC	
UNITAR (United Nations Institute for Training and Research)	http://www.unitar.org and especially http://www.unitar.org/cwm/	?		Second website gives training and capacity building programmes in chemicals and waste management including details on all 'National Profiles'.
WHO (World Health Organization)	http://www.who.int	Department of Health	DEC	Health aspects
WHO/ IPCS (The International Programme on Chemical Safety)	http://www.who.int/pcs/ or http://www.who.ch/pcs/index.htm	DEC	Department of Health	General chemical management
World Bank/IMF (International Monetary Fund)	WB: http://www.worldbank.org IMF: http://www.imf.org	Department of Finance and Treasury Office of National Planning and Implementation	DEC	
WTO (World Trade Organisation)	http://www.wto.org	Department of Foreign Affairs	Department of Trade and Industry	

Table 12.2 Participation in International Agreements/Procedures Related to Chemicals Management

International Agreements	Website of international agreement / procedures	Primary Responsible Agency	Notes / Relevant National Implementation Activities
Basel Convention (Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal)	http://www.basel.int and http://www.ban.org/ For convention also see ENTRI website	DEC Department of Foreign Affairs	PNG signatory and ratified See http://www.ban.org and press country status. And http://www.basel.int/ratif/ratif.html
Chemicals Weapon Convention	http://www.opcw.nl/	Department of Foreign Affairs Department of Defence	PNG signatory/ ratified
Commission on Sustainable Development – covers Agenda 21 and World Summit on Sustainable Development.	http://www.un.org/esa/sustdev/index.html gives Division for Sustainable Development homepage and link to Commission on Sustainable Development. It also provides links to WSSD, Agenda 21 and Millennium Development Goals.	DEC Dept of National Planning and Rural Development Department of Foreign Affairs Department of Prime Minister and NEC PNG Forest Authority	NSDS Environmental Strategic Directions.... PNG Human Development Index NFCAP / PNG Sustainable Forest Management Project(ongoing) NCDS now seems to be defunct! No country profiles/ country reports for PNG have been submitted to CSD. PNG HDR (Office of National Planning (1999))published, 1999.
FAO Code of Conduct (voluntary procedure)[1] – revised 2002.	http://www.fao.org/waicent/FaoInfo/Agricult/AGP/AGPP/Pesticid/Code/PM_Code.htm	DEC Department of Agriculture and Livestock	Requirement in Pesticide Guidelines for all importers and sellers to be familiar with FAO Code
ILO Convention 170 Chemicals Convention, 1990	http://www.ilo.org/ follow 'conventions' then select/display no. 170	Department of Labour and Industrial Relations Department of Foreign Affairs Department of Transport and Civil Aviation (Marine Division))	Not ratified yet by PNG
London Dumping Convention (Convention on the Prevention of Marine Pollution By Dumping of Wastes and Other Materials)	See ENTRI website	DEC Department of Foreign Affairs Department of Trade and Industry Department Transport & Works	PNG signatory and ratified
MARPOL(International Convention for the Prevention of Pollution From Ships)	See both http://www.imo.org/ and go to Conventions; and Australian website http://www.amsa.gov.au/	Department of Foreign Affairs DEC Department of Transport and Civil Aviation	PNG party / signed and ratified By entering IMO website and following conventions can find status of PNG to many marine related conventions
Montreal Protocol (Protocol on Substances that deplete the Ozone Layer)	http://www.unep.org/ozone/index.asp or http://www.unep.ch/ozone/montreal.shtml	DEC Department of Foreign Affairs	PNG signatory and ratified(though not listed on some as signed)

International Agreements	Website of international agreement / procedures	Primary Responsible Agency	Notes / Relevant National Implementation Activities
	For protocol see ENTRI website		
PIC initially a voluntary PIC procedure; now a new convention known as Rotterdam Convention	http://www.pic.int/ and http://www.unep.ch/pic For convention, click on 'English" and follow through to full text.	DEC (designated DNA) for voluntary PIC	DEC is the 'designated national authority ' for voluntary PIC. PNG yet to ratify / become a party.
POPs , known as the Stockholm Convention	http://www.pops.int or http://www.chem.unep.ch/pops	DEC – has POPs National Co-ordinating Committee	POPs project runs from DEC – see Chapter 4.
UN Recommendation for the Transport of Dangerous Goods	See IATA website for dangerous goods regulations http://www.iata.org/ go to 'what we do' and check under both dangerous goods and publications. Also http://www.iata.org/whatwedo/dangerous_goods (HAZMAT)	Department of Transport and Civil Aviation	
UNEP London Guidelines for the Exchange of Information on Chemicals in International Trade. - (voluntary procedure/ information exchange)	http://www.chem.unep.ch/ethics/ click on amended London Guidelines or go directly at http://www.chem.unep.ch/ethics/english/longuien.htm	DEC Department of Transport and Civil Aviation	**DEC is the 'designated national authority ' for the implementation**
United Nations Framework Convention on Climate Change (FCCC)	http://www.unfccc.int	DEC Department of Foreign Affairs	PNG signed and ratified. PNG contact not listed on website list of 'national focal points'
WTO/ agreements (related to chemicals trade – see environment)	http://www.wto.org/	Department of Foreign Affairs Attorney General/Department of Justice	Search of WTO database has nothing on 'chemicals in trade'

There is an urgent need to verify and/or correct and up date the information provided in Tables 12.1 and 12.2 and fill in as appropriate the empty spaces, especially those on the PNG situation.

12.2 Co-operation and Involvement with Regional Organisations, Bodies and Agreements.

This section covers who is responsible for dealing with different regional organisations and agreements, particularly in areas dealing with chemical management.

Again the information provided in this section needs to be verified, corrected and updated. Again the information was collated with the help of mainly staff in DEC in the middle of 1997. The web addresses and references were inserted through an internet search done by author (DLM) in February and March 2000. Web addresses were updated in November 2004.

Tables 12.3 and Table 12.4 state the involvement of Papua New Guinea in regional activities and agreements and lists responsibilities for contacts with such organisations. Other ministries and related national activities need to be inserted in any further edition of this profile.

12.3 Participation in Relevant Technical Assistance Programs in Chemical Management

Table 12.5 provides an overview of some multilateral assistance activities on environmental management in Papua New Guinea, which were or still are directly or indirectly related to the management of chemicals in PNG.

Of greatest significance was the AusAID DEC Institutional Strengthening Project run through Overseas Project Cooperation – Victoria (OPCV) and the Victorian EPA which ended in June 1999, referred to in Chapter 2 section 2.4 AusAID (1999). This project was instrumental in helping DEC develop the new Strategic Plan and Regulatory Framework for Environmental Management referred to in Chapter 6. The DEC Institutional Strengthening project included ten main components, including components on:

Component 5 – Environmental Approvals and Monitoring
Component 6 – Environmental Regulatory Framework Development
Component 9 – Legislation and Enforcement

Under component 6 project activities included:

- Define mission/strategy/work plans in contaminants management
- In-field training in contaminants management
- Courses/ secondments /study tours in contaminants management
- Training in record keeping/reporting in contaminants management

The project which has contributed much to strengthening chemical management recently is the Persistent Organic Pollutants Project (POPs) running from 2002-2005. A summary of this project and its objectives with parts of the outcomes are summarized in Chapter 4. Various workshops have been run over the last two years involving a large number of persons from across departments, organizations and across the country.

The other projects that are mentioned in Table 10.5 are also important in strengthening DEC's capabilities in chemical management.

Various regional training workshops were been held in PNG in the late 1980s and early 1990's involving chemical management in which the author (DLM) has participated as course organiser / trainer. Funding was provided by UNEP, FAO, SPREP and CIRAD. Participants were from countries of the South Pacific including PNG. For the first workshop they also came from South East Asia. The workshops included (and year):

1986: UNEP and UNESCO funded training workshop on Organochlorines for South East Asia and the Pacific.
1989: FAO funded workshop for South Pacific on Safe Use of Pesticides
1990: CIRAD/ARSAP/SPREP Training Workshop on Computerized Databases for Pesticide Registration in South Pacific Countries.

Table 12.3 Membership in Regional Organisations, Programmes and Bodies

International Organisation/Body/ Activity	**Website**	**National Focal Point (Ministry/Agency & Primary Contact Point) Other Ministries/ Agencies Involved**	**Related National Activities / Notes**
APEC (Asia Pacific Economic Cooperation)	http://www.apecsec.org.sg	Department of Foreign Affairs and Trade,	
Regional Development Bank –ie Asian Development Bank	http://www.adb.org	Finance Other: DEC	
Regional Economic Commission - ie ESCAP (United Nations Economic and Social Commission for Asia and the Pacific)	http://www.unescap.org	Department of Foreign Affairs and Trade DEC (Environment)	Agricultural Requisites Scheme for Asia and the Pacific (ARSAP) in ESCAP was useful source of information on pesticides and fertilisers
South Pacific Regional Environment Programme (SPREP) from 2005 known as Pacific Regional Environment Programme.	http://www.sprep.org.ws	Dept of Foreign Affairs and Trade DEC	UPNG also has /SPREP Focal Point Useful summary given at http://www.dfat.gov.au/geo/spacific/regional_orgs/index.html then http://www.dfat.gov.au/geo/spacific/regional_orgs/sprep.html SPREP crucial regional environmental organisation involved with many 'chemicals and human health/ environment' activities' Useful new website SPREP is developing is the Pacific Environmental Information Network (PEIN) accessible though not complete as yet at SPREP-IRC PEIN at http://www.sprep.org.ws/projects/irc_pein.htm
The Pacific Community, formerly known as the South Pacific Commission.	http://www.spc.org.nc	Dept of Foreign Affairs Other: DAL	Useful summary given at http://www.dfat.gov.au/geo/spacific/regional_orgs/index.html then http://www.dfat.gov.au/geo/spacific/regional_orgs/pc.html SPC Plant Protection Service in Fiji plays major role in recommendations re pesticide use in South Pacific countries
The Pacific Islands Forum (from 2000), formerly the South Pacific Forum	http://www.forumsec.org.fj	Dept of Foreign Affairs	Useful summary given at http://www.dfat.gov.au/geo/spacific/regional_orgs/index.html then http://www.dfat.gov.au/geo/spacific/regional_orgs/spf.html

Table 12.4 Participation in Regional Agreements/Procedures Related to Chemicals Management

Regional Agreements	Primary Responsible Agency	Relevant National Implementation Activities Notes
Activities to Implement the Barbados Programme of Action (on Sustainable Development of Small Island Developing States) in the Pacific Region	Department of Foreign Affairs DEC	As for Agenda 21 in Table 12.2. Go to websites: http://www.sidsnet.org http://www.sidsnetpacific.org
Bilateral Agreements (specify) eg **OPRC = Oil Pollution Preparedness Response & Cooperation, it is a Memorandum of Understanding between PNG Department of Transport and Civil Aviation (Maritime) and Australian Marine Safety Authority.**	Department of Foreign Affairs Department of Transport and Civil Aviation	
Convention for the Protection of the Natural Resources and Environment of the South Pacific Region (SPREP Convention)	Department of Foreign Affairs DEC	Can order from http://sprep.org.ws Go to Publications Date entered into force 22/8/90 PNG signed 5/11/87 Full text can be got from ENTRI or Oztoxics websites.
Protocol concerning Cooperation in Combating Pollution Emergencies in the South Pacific Region	Department of Foreign Affairs DEC Department of Transport and Civil Aviation	Date entered into force 18/8/90 PNG signed 3/11/87 TRY ENTRI
Protocol for the Prevention of Pollution of the South Pacific Region by Dumping	Department of Foreign Affairs DEC Department of Transport and Civil Aviation	Date entered into force 18/8/90 PNG signed 3/11/87
South Pacific Nuclear Free Zone Treaty	Department of Foreign Affairs DEC	Date entered into force 15/9/89 PNG signed 16/8/85, ratified 15/8/89 Treaty website / text at http://www.forumsec.org.fj/docs/Gen_Docs/spnfzt.htm
SPREP Protocols / various	Department of Foreign Affairs DEC	
SPREP Action Plan **http://www.sprep.org.ws/att/publication/000124_2001_2004_Action_Plan_complete.pdf**	Department of Foreign Affairs DEC	Much of SPREP's action plan and activities focussed on the small island countries of the South Pacific, rather than PNG
Waigani Convention/ Treaty of Waigani	Department of Foreign Affairs DEC Department of Transport and Civil Aviation	Date Not yet entered into force PNG signed 16/8/95; ratified 11/12/95 Convention website / text at http://www.forumsec.org.fj/docs/Gen_Docs/wc.htm

A workshop on international treaties on chemical management (funded by EA and New Zealand Government) was held for SPREP member countries from 22-26 May 2000 in Nadi, Fiji. The agenda covered POPs, PIC/Rotterdam Convention and Basel and Waigani Conventions. The focus was on explaining to participants the possible benefit of these treaties plus an understanding of the obligations joining such conventions impose and how these can be managed.

Various projects have been ongoing over past years to strengthen the Occupational and Environmental Health Section within the Department of Health.. A consultancy team worked with the National Capital District Commission in an Urban Development and Services Study as part of a strengthening activity, and in October 1995 published a draft paper on Solid Waste Disposal services to the National Capital District (Wilbur Smith Associates (1995; Wilbur Smith Associates (1996)). What follow up has occurred is not certain.

Various bilateral agricultural aid projects in PNG have been run in PNG, which have ignored both the pesticide and quarantine laws, ignoring the legal requirements under existing laws and regulations. Political decisions were made. Government officers felt intimidated and therefore chose to ignore the disregard for PNG pesticide regulations. One of the authors(DLM) discussed these matters with a senior official from one such project concerned .

Table 12.5 Participation as Recipient in Relevant Technical Assistance Projects related to Chemicals

Name of Project	International / Bilateral Donor Agency Involved	National Contact Point	Relevant Activities / Outcomes
DEC Strengthening	AusAID (through Overseas Project Cooperation – Victoria (OPVC) / Victorian EPA)	DEC	Established Environment Act 2000 and in 2002 a set of Environmental Regulations - establishing new strategic plan and regulatory framework for environmental management / training / production of standards, guidelines, codes.
DAL (National Agricultural Laboratory)	AusAID (through SAGRIC)	DAL – National Chemistry Laboratory)	Improve analytical capacity and training
DAL / National Agriculture Research Institute (NARI)	AusAID (with AACM now Dames and Moore) and ACIAR	DAL / NARI	Improve agricultural research and training.
DAL (National Agriculture Quarantine and Inspection Authority (NAQIA)	AusAID (with SAGRIC) …	DAL – Quarantine/ NAQIA	Improve capacity / post entry Quarantine facilities / training.
Mine Monitoring	European Union	DEC - Environment Division.	Mine waste management
University of Technology - National Analytical Laboratory	European Union	DEC - Environment Division.	Analysis of mine waste
Climate Change / Sea Level Rise	SPREP	DEC	
Persistent Organic Pollutants (POPS)	UNEP Chemicals / GEF Funded	DEC	See Chapter 4

12.4 Comments / Analysis

The author (DLM) was able to determine important international agreements that PNG has signed through internet searches and through discussion with DEC officers and others. However it is still necessary to determine whether Papua New Guinea has ratified and incorporated these international agreements into national legislation and implementation activities. This is discussed briefly by Yaru (2005) as part of his review / evaluation and assessment of the legislative framework in PNG, work he did for the POPs project. Aspects of the Montreal Protocol on Substances that Deplete the Ozone Layer have been incorporated into Pesticide Guidelines and the Environmental Contaminants Act. PNG has yet to sign the Rotterdam Convention, despite being involved from the start as a voluntary participant. Others conventions need to be verified by DEC and the Multilateral Division of the Department of Foreign Affairs, and appropriate actions taken. Some are discussed by Yaru (2005) and some in Piest and Velasquez (2003).

International Organisations, in particular United Nations Agencies assist PNG Government Departments. UNDP, FAO and WHO all have a very active presence in PNG, as do the World Bank and AusAID. International guidelines and standards are often referred to and used where appropriate.

Unfortunately, apart from pesticides and the POPs project, there seems to be little effective co-ordination at the national level with respect to implementation of international activities and agreements in the area of chemical management. Regular meetings between government departments and / or industry groups to discuss international concerns, for example PIC and POPS, do not occur, except on an ad hoc basis and on specific issues (or when a consultant arrives to do a specific task). Many key people in government and managers in industry are totally unaware of many international and regional agreements. There appears to be little co-ordination of such activities to do with chemical management.

The author understands there is a mechanism and procedures to ensure co-ordination between ministries / agencies responsible for aid activities and projects which involve the use of chemicals and may cause pollution. The Department of National Planning and Rural Development and its section overseeing all aid projects in PNG, together with the Department primarily responsible for the specific project. In chemicals matters departments and other agencies, should liaise with both the Occupational and Environmental Health section of the Health Department, and the Environment Division of DEC, and possibly the occupational health section of the Department of Labour and Industrial Relations. I understand this does occur from time to time. However aid projects have been run in PNG where PNG legislation has been ignored and both chemical registration and quarantine requirements not adhered to.

The main obstacles to implementing and incorporating international agreements into PNG legislation, regulations and guidelines over recent years have been the scarcity / absence of trained legal persons working in DEC, and the inadequate number of staff working in the relevant section of the Multilateral Division of the Department of Foreign Affairs in areas to do with international agreements. On top of this is the apparent low priorities given by the Government and legislative counsel to such matters, and the time it takes to make the necessary changes in the legislation..

Over the last ten years there have been a number of important bilateral and multilateral aid projects in PNG in areas related to chemical management. The major one was the AusAID DEC Institutional Strengthening project and there are others supported by other AusAID and EC projects both in DAL and DEC. These projects , in part, have attempted to redefine priorities, set new strategic directions, establish clear objectives and to improve both co-ordination and communication. However it is probably important that the time frame to achieve the bold objectives of all projects need be lengthened, and that more public consultation including seeking wider views from outside government ought have been sought. The author (DLM) also at times felt that the consultants or officers from overseas got too impatient with their local counterparts and at times were not prepared to listen to them. Accordingly often the PNGian officers got frustrated because it seemed to them that the overseas consultants often acted "as if they knew what was always best for the PNG situation". However the biggest constraints seems to be that low priority is given to chemical management across departments and there is a scarcity of resources, financial and human, given to these areas. Moreover no financial and human resources seem to be committed to chemical management at the provincial and local government levels. A precursor to make international aid more

effective in chemical management is Government allocating more funds and persons to work in those areas; ie give the area of chemical management a greater priority. Across all departments persons responsible for areas related to chemical management are far too few, and all carry enormous responsibilities and often with limited experience or without more experienced officers to counsel them.

The POPs projects is one where a GEF funded project is involving persons from across the country and across both government departments and those outside government. Mechanisms must be established to sustain this activity on strengthening chemical management beyond the life of the project.

12.5 Recommendations

International agreements to do with chemical management need to be signed, ratified and incorporated into national legislation and implementation activities. A systematic check is needed on what has been done, what has not been done and what still needs to be done; involving both DEC and the Department of Foreign Affairs. PNG needs to ratify / become a party to the PIC / Rotterdam Convention.

There needs to be better and regular co-ordination at the national level with respect to implementation of international activities and agreements in the area of chemical management. It must be recognised that, on the whole, these international agreements will benefit PNG and that the many international bodies (especially) UN agencies and programmes can facilitate better chemical management in PNG. Technical assistance projects can also be of greater value but their activities must be ongoing requiring a greater commitment from the PNG government to provide long term funding and human resources; and at provincial and local government levels as well as at the national level.

There needs to be surety that all aid projects are scrutinised and monitored / audited for conformity and compliance to PNG laws related to chemicals.

More effective international support for strengthening chemical management in PNG must be preceded by the PNG Government allocating more financial and other resources, including people, to sections within the various departments that deal with chemical management; not just DEC but also in the Health, Agricultural and Industry sector departments, and in the provincial governments.

It is important that the activities related to chemical management generated by the POPs project be sustained long beyond the life of the project.

Chapter 13 Awareness and Understanding of Workers and the Public

This chapter overviews the mechanisms available to provide information to workers on chemicals they use or may be exposed to in their workplace, eg on a farm or plantation, in a sawmill or in a small industry. .

It also reviews present community awareness on chemical generally and the community's perception of potential risks associated with chemical production, import, export, handling, use and disposal; and risk communication in general.

13.1 Awareness in the Workplace

Over the last 20 years the author is aware of a number of consultancies done on hazards in the work place and the need to improve occupational health and safety in the workplace. One such study was a WHO-PEPAS study. Other such reports sit with the Environmental Health section of the Health Department. These need to be accessed and any actions arising from them reviewed. The author was involved in a training workshop on safe use of pesticides run jointly by DEC and DAL together with UNEP and FAO in 1989. Similar training courses on safe use of pesticides used to be run at the Highlands Agricultural Training Institute, formerly Highlands Agricultural College, outside Mt Hagen. The PNG Harbours Board recently (April, 2000) ran, with the assistance of the ILO, a week long training program on "Handling Dangerous Goods in Ports"[19]. However too few training courses are run too infrequently on safe use of pesticides and safe use of chemicals and other dangerous goods in the work place in general. Yet when one visits small factories, paint shops, timber sawmills…. one is impressed by the obvious lack of concern for safety, the lack of hazard signs around and yet an abundance of hazards including chemical hazards which are all too obvious. Only major, often international companies, use hazard signs. Smaller ones do not. Oil Search, formerly Chevron, and the larger mining companies certainly view occupational health and safety highly and appear to treat risk minimisation and risk communication in their facilities with high regard and high priority. Timber treatment concerns and agricultural plantations where pesticides are used extensively (using Gramoxone^{R} and Roundup^{R}) are the opposite. Safety precautions to minimise risk to human health and the environment are given scant regard. Workers using highly hazardous timber treatment chemicals and pesticides often wear little if any protective clothing and take few other safety precautions to protect themselves or the environment. They often fail to clean up, wash or change their clothes afterwards. Their employers seem to regard occupational and environmental safety standards as a mere nuisance or of little importance. There has been a recent move by one supplier and the oversea's importer to improve upon this situation. There is an intention to train persons in handling timber treatment chemicals working with the Timber and Forestry Training College in Lae which was been approached to assist.

Generally, with the few exceptions, in industry and in agriculture in PNG few people wear adequate protective gear or take sufficient precautions, often citing the hot humid weather for not doing so. They seem quite prepared to expose themselves to high risk. Their managers/ supervisors seem to accept this, often with cynical disregard. With few exceptions people are inadequately trained to handle hazardous chemicals. Yet in the field and in the many small factories few precautions are taken and there is often either little understanding or a carefree / often fatalistic view on handling chemicals.

In the late 1980s and early 1990s in most centres and in the main shops, and more so over the last ten years, there has been a marked improvement in how hazardous chemicals including pesticides were sold (Hicks 1989; Hicks & Mowbray 1991). In the case of pesticides many of the older unsafe pesticides are no longer available (thanks to pesticide registration) and storing and labelling of pesticides have improved,

[19] Reported in *National*, 18th April 2000. Also in *Post Courier*, 18th April 2000.

though further improvements are still needed. Labels tend to be often the main source of risk communication. Guidelines on pesticide labelling were approved in 1990 (Kesu & Mowbray 1991), but have not been strictly enforced though some of the major suppliers initially made the effort to improve labelling. Pictograms have been encouraged on labels , but little used. However often one still finds labelling guidelines ignored.

Small brochures and booklets have been produced on using pesticides safely, one by DEC in a comic book format in the mid 1980s, and one by DAL (Sutherland 1983) (see Table 13.1). Brochures have been produced by FAO and various pesticide industry organisations on safe use of pesticide and were distributed throughout the country by the author in the late 1980s and early 1990s. The author is unaware of publications to do with safe use of chemicals produced either by the Health Department or the Department of Labour and Industrial Relations. In the late 1980s and early 1990s the author also distributed materials (booklets and charts) on 'treatment of poisoning' by pesticides to all major hospitals in the country. ICI Dulux also distributed in the mid 1980s materials on treatment of poisoning by Gramoxone^{R} (paraquat) also to hospitals. The only recent materials are the newsletters produced by the POPs project but these have a very limited audience.

Table 13.1 Reports/ Booklets/ Brochures Available on Chemicals and Risk Communication in PNG.

Department	**Reports**	**Details**
DEC-EP	Comic book on using pesticides safely.	Printed in both English and Tok Pisin
DAL	Safe and efficient use of pesticides[20]	Printed only in English; reprinted at least once in *Harvest* magazine distributed through PNG ?
DOH - EH / OH	None known	
DLIR	None known	
Biology/Environmental Sciences, UPNG	FAO and industry booklets on safe and efficient use of pesticides distributed throughout country WHO books / booklets and US charts on treatment of poisoning by pesticides distributed to all major hospitals in PNG. ICI booklets on treatment of poisoning by Gramoxone distributed to hospitals	Nearly all materials only in English. Some ICI materials in Tok Pisin.
DEC- POPs Projects	POPs Newsletter – produced by the POPs Awareness Raising Campaign	First printed November 2004

Hazard signs are used in transporting and storage of pesticides, industrial chemicals and petroleum products, on trucks, on buildings and on wharves or in storage sheds. However it seems to the authors that both workers and the general public need to be educated more about what these signs mean and the associated risks; and the precautions that need to be taken. People need to understand what the symbols, words, letters and numbers mean.

[20] (Sutherland 1983)

It would appear that there is little emphasis placed on occupational risk and risk communication concerning chemical use in teaching and training institutions in PNG. Very basic concepts only have been taught in technical colleges, agricultural colleges and universities, and possibly some schools. UPNG Environmental Sciences Programme continues to teach a course on 'Chemical Risk' (as outlined in section 11.3 and in Box 11.2).

There is an urgent need for educational activities (both formal and informal) aimed at increasing general awareness on the risks posed by chemicals from both environmental and occupational exposure; and on the use and appropriateness of hazard signs, labelling and other forms of risk communication. Government departments especially DEC, Health and the Labour Department and ICCC should all participate in such activities, as should industries and NGO organisations. The Department of Health has recently published drafts of important guidelines in areas of occupational health and safety (Hassan and Neyakawapa, 2003; DOH, 2004). However programmes need be presented in ways understandable to the workers through meaningful hazard signs and through leaflets, comic strips, through street theatre, television and radio and workplace discussions. Such programmes must also be in the language that the workers and their supervisors understand.

Some of the larger companies in mining, petroleum and agriculture and a few in the manufacturing sector do run in-service training on aspects of safe use of chemicals. Some have Material Safety Data Sheets (MSDS) available for hazardous substances. Most smaller companies do not.

Unions have an important role to play in improving occupational health standards and in risk reduction. Unfortunately with a few exceptions unions are not very strong in PNG and those that are effective are preoccupied with other pressing concerns. Often workers who are poisoned or who get sick in the work place are laid off or sacked. It seems few if any are compensated or covered by any form of medical insurance.

The Trade Union Congress has involved itself in the POP's project. Hopefully one outcome of the POPs project will be more training and awareness raising among workers on chemical risk and better chemical management and improved occupational health and safety practices.

13.2 Awareness in the Community

Much needs to be done in PNG in general awareness raising in the community on chemicals in general and on the risks associated with chemicals. Forms of risk communication also need be improved particularly in the work place, and in shops which sell hazardous chemicals as mentioned above, but also throughout the community. Awareness raising must cover all chemicals, including consumer chemicals and not just hazardous chemicals. Often people are exposed to risk by misuse of ordinary household chemicals, or through accidents. Some people suffer (often severe) allergies from exposure to aerosol sprays of many kinds or from additives in food substances available from food stores. (Mowbray 1986) reports an incidence of poisoning of two persons by the insecticide Baygon ^{R} (containing dichlorvos and propoxur). The mother sprayed her head and that of her daughter to kill the lice. Quick action by nearby doctors saved their lives. The insecticide was a surface spray intended for cockroach control. Many instances of people spraying their hair with DDT and with pyrethrins have been reported to the author but not documented (ibid).

There is a very low perception and awareness of chemical risks amongst the general public in PNG. It is not uncommon to see persons smoking when handing petrol or kerosene, to see people travelling in the backs of small trucks squashed in with drums of hazardous chemicals (petrol, kerosene and pesticides) and it is well known that many people carelessly spray themselves and their food with aerosol pesticides (and not the spray-on types). Furthermore there is little concern about the health effects of additives and other chemicals in foodstuffs, or more generally chemicals in consumer goods. DDT is known to still be used

illegally for taro beetle control. It is sold illegally on the illegal mark, possibly being stolen Health Department stocks. In some instances reports have been heard that it has been used in fishing, but this has not been verified. The former Consumer Affairs Council, now the Independent Consumer and Competition Commission does not seem to regard chemicals as an important issue. Towns like Port Moresby have very bad problems of pollution from motor vehicle exhaust ((Mowbray 1997, 2005)). Prevention and mitigation of such problems are low priorities. People tend to accept the problem. PNGians especially people in the villages must rank as amongst the highest numbers of men and women smokers of any country in the world. People are concerned with fulfilling their basic needs. Awareness raising activities about good hygiene and nutrition, and disease prevention are common. In recent years massive campaigns occur on HIV-AIDs. It is now recognised as a development problem as well as a health problem. However there is very little awareness raising exists on chemicals. There are a few exceptions. These include pollution from tailings and other wastes from mines, and from chemicals spills associated with mining such as the cyanide spill documented in chapter 3. Here people are quite vocal on pollution by sediment, heavy metals and other chemicals, especially cyanide.

One instance where Government departments (principally Department of Health, and Department of Agriculture and Livestock) and the supplier ICI Dulux had to mount a community awareness program involved the herbicide Gramoxone in the early 1980's. Here Gramoxone (the most common formulation of paraquat in PNG) was implicated in many unintentional cases of poisoning involving many deaths (Mowbray 1986; Wohlfahrt 1981; Wohlfahrt 1982). Such an awareness campaign coupled with changes by the company in the formulation of the chemical (by adding an emetic, stenchant and a dye) and a small new regulation within the Health Act resulted in a dramatic decrease in poisoning cases in PNG. In another case in the late 1980s a pharmaceutical company produced a cough medicine called by the name Paracol. It quickly withdrew the product when it was realised that another paraquat formulation sold by ICI-Dulux also had this same trade name.

Few Non Government Organisations (NGOs) still exists in PNG which specifically focus their attention on chemicals and pollution. Although there are now a plethora of environmental NGOs in PNG most focus their activities solely on conservation issues; they are mainly involved in conservation and development (ICAD) projects and forestry activities. A few groups focus on mining pollution eg NGO Environmental Watch Group, now called Centre for Environment Research and Development, and recently a Madang based NGO which objected to marine pollution by a fish cannery. Greenpeace to a lesser extent touches on chemical issues though it also has its major focus on mining, forestry and conservation matters.

There is a great need for the Health Department, DEC, Consumer Affairs and NGOs and universities to become active in raising community awareness on the risks associated with chemicals in homes and villages, and in public places. Two examples of community outrage in Port Moresby on chemicals in the early 1990s concerned the City Council authorities and its use and storage of malathion in its urban vector control program. Malathion smells very badly. Most people associate bad smell with harmful affects. Consequently the storage of the malathion in a yard next to a house, a church, and near a local market and the widespread spraying of the city both caused an outcry resulting in the storage of the malathion being relocated, and eventually another pesticide being used in the spray programs. Better risk communication and a better understanding of chemicals in the community may have lessened this community outrage.

There is an urgent need for educational activities (both formal and informal) aimed at increasing the general public's awareness on the risks posed by chemicals from both environmental and accidental exposure; and on the use and appropriateness of hazard signs, labelling and other forms of risk communication. Government departments especially DEC, Health, Labour and Industrial Relations and the Independent Consumer and Competition Commission should all participate in such activities, as should industries and NGO organisations. Such programmes need be presented in ways understandable to the public through leaflets, comic strips, on radio and TV, through community theatre; through both village and church meetings. Risk education must also be in the language and a medium that the people understand and identify with.

13.3 Lesson Learned on POPs Awareness raising in PNG

There are some important lessons that can be learned from the POPs awareness raising campaign run by the POPs Office through November and December 2004. This campaign has involved radio and TV programs, video recordings, newsletters, school visits, posters and a quiz competition. The POPs Awareness report (Solien, 2005) and Ila'ava (2005) in his report on education, training, research and awareness raising for the POPs project both drew many of the same conclusions. They found that:

- Current awareness programs on chemicals are ineffective, and ad hoc.
- The level of understanding of chemicals and their hazards is low hence unsafe practices and misuse.
- Little occupational health and safety programs exist for chemical handling and use.
- Little awareness raising materials is being produced.
- There is poor networking between stakeholders.
- The media is not effectively used to disseminate information on chemicals.
- There is ineffective chemical education in school curricula – ideas that chemicals can be hazardous is not in a form understandable by children.
- What little is produced in community education is not in a form that is understandable to public, nor interests them.

Their suggestions include:

- More and effective awareness raising activities are needed where DEC works with schools, media, community groups, NGOs, and businesses particularly in rural areas and with children and women's groups.
- Improved communication networks including websites and 'training trainers' programs are two strategies.
- Programs / materials must be appropriately packaged and communicated in a language and form understandable so people become aware and concerned.
- There is a need to shift the emphasis from technical to health, environment and individual rights concerns.

Presently in PNG there is a very large campaign on HIV-AIDs awareness. Much media attention and community awareness programmes are given to this and other social and development issues. HIV-AIDs is a major cause of sickness and death in PNG. Chemicals do not "obviously" cause or appear to cause many problems to persons in the community in PNG. People are little aware of the insidious nature of the effects of chemicals and pollution. When people are exposed daily to hazardous chemicals such as in vehicle exhaust fumes they tend to accept it because they do not generally think they are affected. If exposed to a dramatic event such as a cyanide spill they may act, but this is the exception. There are few POPS in PNG, these being DDT and PCB and small but unknown amounts of furans and dioxins. The effects of these on human health and the environment are probably small scale or insignificant compared to all the other factors which affect human health and the environment in PNG today. We assume (from our knowledge of the properties of these chemicals) that they probably have some effect but the scale is unknown. Hence people show a disinterest. POPs awareness raising is therefore quite difficult. To communicate awareness people need be alerted and made interested.

13.4 Recommendations

"Training trainers" and in-service training courses in the handling and safe use of chemicals across a number of industries should be conducted on a regularly basis, eg every two years and in all major centres throughout the country. Such courses should be run for personnel from government, business and industry e.g. environmental officers and sales persons as well as persons handling chemicals, e.g. during formulation, transportation, storage and disposal etc., as well as actual use.

A far greater effort needs to be made to ensure that the general public is made more aware of the need to use all chemicals safely in ways that protect themselves and their environment. This includes chemicals in consumer products and the chemicals they use in their homes, in their village and in their gardens.

All departments involved with chemicals should take responsibility to establish education and awareness raising activities to both increase awareness in the community on risks associated with chemicals, and to improve forms of risk communication and risk minimisation in the work place and in shops which sell hazardous chemicals. Industries, NGOs and training and educational institutions should do likewise.

Innovative forms of risk communication need to be tried to ensure that people in both the work place and in the community recognise the need to handle all chemicals in ways to ensure their good health and environmental safety. More effective use needs to be made of the media. Examples include plays / theatre and through sketches on TV and radio programs, and the use of comic strips. Communication must be in a language and a medium that the people understand and can identify with.

The POPs Awareness Raising campaign needs to be transformed into an ongoing campaign or program to inform the public on chemicals in general and as an important avenue for chemical risk communication for hazardous chemicals. Emphasis must also be on safe practices as well as potential risks.

Chapter 14 Resources Available and Needed for Chemicals Management

This chapter overviews the resources available within government departments with responsibilities on the various aspects of chemicals management. These cover human and financial resources, and analytical resources needed and concludes with some recommendations.

14.1 Present Resources Available for Chemical Management in Government Departments / Institutions

Table 14.1 lists existing resources available within Government departments, agencies and other institutions specifically addressing the management of chemicals. Information about numbers of staff, types of expertise and financial resources were requested and collected through a series of questionnaires and interviews done in the latter part of 2004. The table indicates the staff levels and expertise on chemicals management by government departments and authorities, as of mid to late 2004.

Within the Environmental Protection Branch of the Environment Division within the Department of Environment and Conservation (see section 7.2) there are four professionals with some responsibility for chemical management. Their responsibilities include

- Pesticide registration
- Industrial discharges /emissions / licensing
- Developing standards, codes of practice, guidelines, best environmental management practices
- Waste management
- Hazardous chemicals
- Air pollution
- Agricultural industries
- International treaties – Basel, Waigani, Rotterdam (PIC), Stockholm (POPs)

Table 14.1 Resources Available in Government Departments/Institutions, 2004

Ministry/Agency Concerned	Number of staff involved	Type of expertise available
DEC-Environmental Protection / Water Resources Management	9	4 deal with chemical management
Department of Health	4 Health Specialists plus 260 HEO's around PNG	Occupational and environmental health, solid waste, water sanitation
Department of Agriculture and Livestock	270 total workforce, 2 Analytical Support	Analytical Support (plus others deal with chemicals in field)
Department of Mining	10 (Mining Division only)	1 Professional with chemical knowledge
Department of Petroleum and Energy	2	Environmental Officers
Department of Labour and Industrial Relations	4	2 Senior occupational health and safety officers and 2 Provincial Officers
Department of Transport and Civil Aviation	1	Scientific Officer -(Maritime Division) dealing with oil especially.

Department of Justice & Attorney General	2	Legal advice on chemical management
Department of Works	None on chemical management	1 Environmental Officer under World Bank Road Projects
Papua New Guinea Forests Authority	None on chemical management	Only Forestry Officers
IRC (Customs)	2	Graduate chemists
NAQIA	90 working staff	20 deal directly with chemicals
NISIT	8	professionals

Table 14.1 is included without a column indicating "Financial Resources". Operational funds in DEC are negligible and in other departments there is no allocated funding for chemical management. As given in Chapter 1, the Environmental Division in DEC expended or was allocated between K652,000 to K1,052,000 per year over the years 2000-2005. A sizeable proportion of the funds expended / allocated go on salaries leaving little to cover other expenditures Furthermore the proportion of that spent on chemical management was probably quite small. The POPs project for 2002-2005 has injected USD306,000 or approximately one million kina into activities related to POPs and chemical management generally; and have requested an additional USD 150,000.Funding is a major constraint in this section. Despite employing four professional staff their operational budget is very small, as indicated in Chapter 1 (section 1.9). Consequently staff are unable to carry out their tasks, as they would like. Limited funding limits their ability to carry out inspections any where in the country, with the exceptions of Port Moresby and Lae and possibly one or two other major centres.

This lack of funding cripples both the morale and abilities of DEC to perform its mission in PNG is aptly stated by the present minister. Box 14.1 is a condensed version of a report in the *National* newspaper dated back in 2000. However the situation is the same at the end of 2004. However in 2002 –2004 the POPs project has provided funding such that some aspects of chemical management that are the responsibility of the Environment Protection Branch are being carried out and funded by the POPs project through the Task Teams and through the activities of the consultants.

Box 14.1 OEC hamstrung by funding constraints

Environmental monitoring and auditing of waste discharges in mine sites and other resource projects areas are being hampered by the funding constraints of the Office of Environment and Conservation (OEC), Minister Herowa Agiwa said this week.

He said in his Ministerial Statement to Parliament that the lack of funding leaves the OEC vulnerable to criticism that its activities lack credibility because they (the activities) are paid for by outsiders.

Mr Agiwa said while all permitted waste discharges comply with quality standards, there are times when problems arise and the OEC tries its best to take immediate remedial measures.

"Unfortunately, regular auditing, monitoring and inspection cannot be undertaken without adequate funding from the State." "The State as the regulator should provide funding in order to maintain its independence and credibility," he said.

As an example, he said, the Porgera Goldmine spends K3 million to fulfil its environmental monitoring requirements compared to the K5,000 allocated by the State to the OEC annually for environmental auditing of the mine.

Mr Agiwa said: "This was graphically illustrated in two recent pollution incidents - the oil spill at Gasmata and the Tolukuma cyanide spill incident, where the OEC could only deal with it with the assistance of outside sources."

> He said the lack of funding means OEC inspectors can not get to accident sites on time. This in turn means valuable time is lost waiting for funding from outside sources.
>
> Report by D.K. Pindia , *National*, dated 4th May 2000:

The situation on funding has changed very little since then (author, December, 2004).

DEC needs to be involved in training others in chemical management. Training of "environmental officers" at the provincial government level (usually provincial health inspectors) is limited or does not exist. Training of customs officers in identification, processing and handling of hazardous materials has never been done. Workshops with industry, the public and officers with responsibilities in chemical management in sectoral or other departments / agencies do not, or rarely do occur. Little activity focuses on awareness raising. This inability to do their work properly often leads to low morale.

It is necessary that the resources, both human and financial, in the various other departments be identified. It is also important to note what is lacking!! Departments listed are those identified throughout this report to have some responsibility toward chemical management in PNG and who recognise this. From Table 14.1, it can be concluded that chemical management and pollution management receives minimal human and financial support at present at the national level in PNG. This is reflected in the few staff employed whose primary responsibilities seem to be directed toward any aspect of chemical management. In some departments people with technical training in chemistry little use their skills for chemical management, as in IRC / Customs. Here two graduates in Chemistry work within the Inland Revenue Division. Little of their work involves checking for chemical components of different products imported. These chemists could use more their technical skills. Although the table indicates that may staff in DAL and NAQIA are indirectly involved with chemicals, very few are actually involved in chemicals management.

However a more detailed survey needs to be done to ascertain which staff in the various departments actually work on chemical management related issues and the proportion of their time they spend on such activities; and how much financial resource is allocated towards these responsibilities. This would enable an initial start in filling in accurately the gaps in what is needed for chemical management in PNG.

In Chapter 6 section 6.1 mention is made of the Environment Act 2000 and the environmental regulatory framework where management of chemicals will largely focus on level 1 and level 2 activities. The 'Environmental Compliance and Enforcement Branch', was created within the Environment Division in 1999 which takes some responsibilities in this area. However many of the responsibilities for enforcing compliance to the standards, codes and regulations (level 1 activities), and to permits, licences and environmental improvement and management plans (level 2 activities) will rest with officers based at the provincial or regional levels. Yet, from information available, as seen in Table 14.2, there are few environmental officers (if any) employed as such at the provincial level, or any one identified with responsibilities for chemical management. Many staff of DEC employed at the provincial level, mainly as conservation officers, were made redundant in the late 1990s. Some staff within the departments of agriculture and health at the provincial level were gazetted as 'environmental officers' with responsibilities for chemicals, including pesticides, but how many carry out these functions need also be ascertained. It can be safely assumed that few personnel at the provincial or town/city level have responsibilities specifically covering chemicals with the exception of health inspectors.

There is a need to also determine the number of officers with some responsibility at the provincial government level in chemical management, what financial resources are available and their training needs. Effective implementation of the environmental regulatory framework depends upon allocation of sufficient human and financial resources at the provincial government level.

Table 14.2 provides limited information on persons involved at the provincial level who have some responsibilities for chemical management. Unfortunately the table excludes most provinces indicating that little is known and / or only a few people are involved in chemical issues. At the provincial level, very few people appreciate chemical management issues.

Table 14.2 Resources Available in Provincial Government Departments/Institutions, 2004

(Number of Professional Staff working full time or a substantial time in areas of environment management and conservation, and with some responsibilities for chemicals)

Province / Department of ..	Region	Number of Professional Staff with some responsibilities for chemicals
Eastern Highlands	Highlands	15 Health workers Responsible to Malaria control; 9 Agricultural Officers deal with chemicals; 7 Project officers (Natural Resource Department)..
Enga	Highlands	1 Professional
Milne Bay	Southern/Papuan	1 – now with Conservation International in Milne Bay.
National Capital District	Southern/Papuan	Consisting of 13 Vector Control;4 Waste management;2 Environmental Health
Southern Highlands	Highlands	1 Petroleum Officer; 8 HEO's (2 Env. Health)
Western Highland	Highlands	1 trained Agriculturalist

14.2 Resources Needed by Government Departments / Institutions to Fulfil Responsibilities related to Chemicals Management.

Under the new Environment Act most responsibility for chemical management focuses on level 1 and level 2 activities/ streams. To ensure level 1 activities can be regulated officers responsible or working committees (which may well need be established or resurrected) will need to ensure new and appropriate standards, codes and best environmental management practices are developed. Regulations will also need to be developed and together with existing ones need to be implemented and enforced. Procedures need be developed for surveillance and monitoring and for instigating environmental protection orders, clean-up orders and related instruments. This (presumably) is part of the responsibility of the Environmental Compliance and Enforcement Branch. Where level 2 activities are involved much still needs to be done. Under the old / existing Environmental Contaminants Act, regulations and guidelines at present only exist for pesticides, and guidelines only exist for registration and labelling, although DAL has also produced guidelines on safe use. These need to be updated. Further guidelines need to be developed to cover containers, storage and disposal to name a few, and for specific uses eg commercial use / urban pest control and for timber treatment. Nakmai (2005) and the author would suggest a licensing system needs to be established both for urban pest control and for timber treatment chemicals, considering the highly hazardous nature of the chemicals and present bad practices. Totally new regulations need be developed for industrial chemicals and commercial chemicals. The situation on petroleum products could be reviewed though it seems that both DEC and DPE both understanding their responsibilities. Licensing and permitting procedures and associated information storage and retrieval systems need be streamlined. For this up to date computer hardware and easily maintained software are needed. Interdepartmental committees need be set-up. Officers in the other sections of Environment with responsibilities for level 3 activities including EIA and mining, forestry, agriculture and infrastructural projects will also need be involved in aspects of chemical management.

The POPs project has injected an enthusiastic response and commitment from a variety of departments. To sustain such activity, the national government must ensure the appropriate allocation of manpower and financial resources with long term commitments.

All this means that adequate numbers of staff are needed both at the national government and provincial government levels if chemicals are to be effectively managed under the Environment Act and other acts. This means more staff are definitely needed and in addition sufficient operational funds are needed for staff to do their jobs!

Tables 14. 3 is indicative of what might be needed. It address the resources estimated to be needed by some government departments, agents and other institutions in order to fulfil their responsibilities / mandates for chemical management. Data were collected from small questionnaires and interviews with officers from the different departments. Not all responded or were interviewed. What is listed could be regarded as the absolute minimal need. Initially departments were asked their needs to cover pesticides, petroleum products, industrial chemicals and consumer chemicals. Most responses were general in nature. More specific needs need to be determined by a thorough review. It is crucial that the resources, both human and financial, in the various responsible departments be identified and made adequate. A survey needs to be conducted across the various departments to ascertain their perceived needs both in terms of trained people and funds to fulfil their department's responsibilities / mission statement and corporate plan.

14.3 Conclusions

At present chemical management and pollution management receives minimal human and financial at the national level in PNG, and next to no support at the provincial level. This is reflected in the few staff employed whose primary responsibilities seem to be directed toward any aspect of chemical management.

The main national department responsible for chemical management (DEC) is severely hampered in all its responsibilities by severe shortage of staff and funds. In some other departments chemical management is a peripheral responsibility only.

Yet effective implementation of the new environmental regulatory framework and co-ordination in chemical management across all departments / agencies depends upon allocation of sufficient human and financial resources both at the national and provincial government level.

Table 14.3 Resources Needed by Government Institutions to Fulfil Responsibilities Related to Chemicals Management , 2004

Ministry/Agency Concerned	**Number/type of professional staff needed**	**Training Requirements**
DEC - Environmental Protection	at least 4 more - from biologist, chemist, chemical engineer, environmental scientist, toxicologist	BSc/MSc - thorough training in chemical management; administration procedures, protocols, national legislation/international instruments, policy enforcement; waste management, industrial processes, cleanup procedures and cleaner production; public relations; database management; (eco)toxicology, organic chemistry, environmental management, risk analysis, chemical analysis.
DEC-Environmental Compliance and Enforcement	at least 2 more - from legal officer; biologist, chemist, chemical engineer, environmental scientist	Knowledge in environmental law and procedures; EIA process and environmental management; policy enforcement; waste management; environmental law; chemical technology; ecotoxicology, organic chemistry, risk analysis.
Department of Health	at least 2 environmental health officers (HEO's)	Knowledge on occupational health & environmental health impacts; chemical risk analysis, environmental management; waste management.

Department of Agriculture and Livestock	at least 2 chemists and 2 biologists	Knowledge in safe use and handling of pesticides / chemicals; waste management; for analysis - organic chemistry, chemical / environmental analysis, environmental management
Department of Petroleum and Energy	2 Environmental scientists	MSc -Knowledge of chemicals used in petroleum industry; oil/ gas / chemical spill and response management; environmental health and safety; risk assessment; environmental law and policy; environmental management; toxicology; waste management.
Department of Mining	? Environmental scientists	Knowledge on chemicals used in mining; policy enforcement; risk management, waste management, environmental management.
PNG Forest Authority	2 chemists/ environmental scientists	Knowledge on chemicals used in forestry / timber treatment; policy enforcement; occupational health and safety, risk management, waste management, environmental management.
Department of Labour and Industrial Relations	2 Scientistic Officers	Knowledge on occupational health & safety for workers in industry; risk analysis, chemical analysis
Department of Trade and Industry	2 Scientistic Officers	Knowledge on industrial chemicals & environmental health impacts; risk analysis, chemical analysis
Department of Transport and Civil Aviation	2 Professionals and 4 support	Knowledge of oil spill and response management
Department of Provincial and Local Level Government Affairs	1 Professional under Disaster Management Branch	Knowledge of oil spill and response management
Department of Justice & Attorney General	1 legal officer with chemical knowledge	Knowledge both of environmental law and chemistry; environmental management
IRC-(Customs Division)	2 Chemists	Database management; monitoring imports and exports of pesticides/ petroleum products/ other chemicals ; sound knowledge of chemistry.
National Capital District Commission	2 Environmental Health Officers	Knowledge on occupational & environmental health impacts; cleaner production; environmental management; waste management

14.4 Recommendations

Detailed surveys or a detailed audit needs to be done to ascertain which staff in the various departments actually at present work on chemical management related issues and the proportion of their time they spend on such activities; and how much financial resource is allocated towards these responsibilities.

DEC needs additional staff and resources to effectively manage chemicals in PNG.

There is an urgent need to also determine the minimum number of officers whose full time responsibility or a substantial responsibility at both the national and provincial government levels are needed to effectively implement chemical management in Papua New Guinea. They need to both enact their department's

responsibilities and to effect the tasks identified in this report. What also needs to be done is the determination of minimal financial and other resources to ensure that effective chemical management can be carried out.

More staff and funding is not the only necessity. What also is needed is for DEC and other departments / organizations involved to determine a framework for better co-ordination of all aspects of chemical management across the country.

Chapter 15 Recommendations and Action Plan

This chapter gives 38 recommendations to the PNG government to improve chemical management. It supplements the major recommendation from the POPs project.

It includes the action plan for maintaining the National Profile as one component of the National Implementation Plan for the POPs project, but does not include the action plans for each of the task team and consultants reports. These are in each of the task team's / consultant's reports.

The recommendations are taken from chapters 2 to 14. The last recommendations concerns the action plan for the National Profile.

This second Papua New Guinea National Chemical Management Profile remains full of gaps. An ongoing action plan is needed to ensure that the profile becomes a living document. There must be a process by which it is continually corrected and up dated. Only then can chemical management be adequately addressed in Papua New Guinea.

15.1 Chapter Recommendations

Chapter 2 Chemical Production, Import, Export and Use

Recommendation 1

DEC, DTI, DOH and DAL working together with IRC / Customs and with the private sector need to establish and maintain a national chemical database which records quantity and the value of chemical production, import, export and use in Papua New Guinea. This database should be computerised and easily accessible by government, the private sector, and the public. Government departments and trade and private sector organisations should take responsibility for making such data easily available. The database should be based / located with the Registrar of environmental contaminants / Environmental Protection Branch of DEC.

Recommendation 2

DEC and Customs/IRC need to work more closely so that specific chemicals can be better controlled at port of entry and the quantities imported accurately monitored The Harmonized Commodity Description and Coding System (HS) could be amended so to reflect specific chemical groups more accurately eg pesticides such as DDT or paraquat and chemicals such as PCBs or specified hazardous chemicals can be given subcategories. DEC needs to inform Customs on those chemicals with either a 'prohibited' or 'restricted' status. Import control needs to be reviewed.

Recommendation 3

Records are needed for POPs (Stockholm) , PIC (Rotterdam) chemicals and other PTSs and or specified chemicals covered under the Waigani and Basel Conventions or regarded to be hazardous under PNG conditions of use, as may be specified under regulations under the Environment Act or the other acts covering health and environment aspects of chemical management. Detailed records need to be kept (and be readily available and up to date) for all of agricultural chemicals (pesticides and fertilisers), petroleum products, industrial chemicals, and consumer chemicals. The last category needs to be defined. Such data needs to be incorporated into the database as per Recommendation 1. IRC and departments need regularly review the data.

Recommendation 4
Government needs to work with industry to establish workable procedures to obtain information on chemical wastes and emissions and establish a comprehensive database to record such information on wastes and emissions. Industries need to establish systems of regular environmental accounting and environmental auditing and need to provide such information as required by law to government. This also involves developing in - country an enhanced capacity for chemical analysis**.** Such information should be entered into a national pollution inventory, which is available both to the public and to chemical managers.

For recommendations 1 to 4, the government need to determine a mechanism that both protects confidentiality of data for trade reasons but also makes available to the public crucial health and environmental information

Chapter 3 Priority Concerns related to Chemical Production, Import and Use

Recommendation 5
Priorities areas to focus on in pollution and chemical management include
as top priority
protection of waterways especially from mining and agricultural wastes,
chemical accidents in small operations,
import of unknown chemicals,
industrial/agricultural/forestry and solid waste disposal;

as secondary priorities
air pollution from motor vehicles in Port Moresby,
marine pollution,
contamination of drinking water,
hazardous waste treatment and disposal,
hazardous chemicals and pesticides use in industry, agriculture and forestry including use of timber treatment chemicals,
health effects from illegal use of chemicals
storage, disposal and destruction of obsolete chemicals.

Recommendation 6
Areas where more government control / intervention is required also include

ground water pollution, soil contamination, occupational health in agriculture and forestry, and small industries, accidents in small scale transport of hazardous chemicals, and chemical poisoning and wastes from households.

Recommendation 7
An improved process for decision-making in chemical management and for determining priorities must be developed. For this

A reliable data recording system must be established for pollution, waste and chemical management matters.

Consultations and an official workshop or seminar, sanctioned by Government, industry organisations and community groups ought to be organised to evaluate priority concerns in the areas of Pollution and Chemical Management in PNG. (such a workshop may build upon materials / information in this National Chemical management Profile).

Until then priorities will continue to be determined based on professional experience, perceptions and ad hoc information (and possibly political demands).

Government should use the information here as a basis for a more detailed study or (at present) as the basis to establish immediate priorities in chemical management in PNG; and that the POPS National

Co-ordinating Committee be transformed (and expanded) to become an interdepartmental committee to advise the Environment Council and all government in priority areas of chemical management.

Chapter 4 POPs Chemicals in PNG

Only two recommendations are made. The substantial recommendations are not included in the National Profile. They are contained in the various reports : Ila'ava (2005), Kuman (2005), Nakmai 2005; Petsul and Totome, 2005; Solien (2005), Tolimanaram (2005), Wossa and Sinikupa (2005), Yaru, 2005); and in PNG's National Implementation Plan for POPs (DEC, 2005).

Recommendation 8

Given its obligations under the Stockholm, Rotterdam, Basel and Waigani Conventions and others , and due to the insidious nature of POPs and POPs-like chemicals, higher priority must be given to their management.

Recommendation 9

The priority issues identified and the action plans proposed for the PNG National Implementation Plan for POPs ought be endorsed by the PNG government and be given serious consideration by the Conference of Parties of the Stockholm Convention. Backgrounds to and justifications to actions proposed in the POPs NIP are contained in the reports cited

Chapter 5 Environment and Health Effects of Chemicals in PNG

Recommendation 10

A thorough literature review and assessment should be made of all POPs and POPs-like chemicals and their effects on people and on the environment in Papua New Guinea. Such a study should review any studies done since 1990 and include an assessment of poisonings, residue studies and anecdotal information available from available sources.

Chapter 6 Legal Instruments and Non-Regulatory Mechanisms for Managing Chemicals

Recommendation 11

Much work must go into developing further regulations, guidelines and codes for the *Environment Act* with priority given to

Enforcement of legislation. Implement immediately legal instruments in the form of regulations, guidelines, standards, capacity to prosecute.

Make more effective use of economic instruments.

Encouraging industry to adopt cleaner production, best environmental practice and voluntary practices to ensure better chemical management

A system of regular environmental accounting and environmental auditing is also need to provide such information as required by law to government.

Strengthen the institutional framework; and ensure better coordination between government bodies to ensure best use of limited resources of trained personnel and limited financial back up; Increase capacity for implementation at the provincial level. Ensure the continuing development of a chemical management infrastructure and capacity building even post the POPs project.

Strengthening information access and ability to utilise such information. We must improve the capacity to obtain / have access to information and process such information that we can access from within PNG. Furthermore since PNG will continue to lack the required "in-country" analytical capacity and be unable to generate much independent "in-country" data, we need to develop a capacity to evaluate the risk of chemicals under the probable conditions of use in PNG before they are allowed to be imported and used in the country, where possible.

Recommendation 12
An effort be made to ensure all persons in government departments are better aware of their existing legislation to ensure that all departments are better acquainted with their own responsibilities for managing chemicals.

Chapter 7 Departments, Agencies and Other Institutions Managing Chemicals

Recommendation 13
A review of all departments other than DEC, to list areas of chemical management for which they have responsibilities, the relevant legislation and regulations which cover these chemicals, which sections of their departments have these responsibilities, their missions and mandates and the regulatory processes involved, and how their activities might be better coordinated with the other government departments, provincial and local level government and private and community groups. An effort be made to ensure all persons in all government departments are better aware of the existing and complementary legislation across all departments to ensure they are better acquainted with each others mutual and complementary responsibilities for managing chemicals.
Recommendation 14
Responsibilities of provincial governments in chemical management must be clearly stated and mandated, and appropriate strategies be developed, and links with DEC quickly established.
Recommendation 15
A co-ordinating committee (similar to the POPs National Co-ordinating Committee) should be established. Tasks would include to do an audit of the chemical management regulatory and administrative procedures in all departments concerned to determine their effectiveness. In particular an audit should be done in DEC to ascertain how effectively the new framework and procedures are achieving their intended objectives.

Chapter 8 Relevant Activities of Industry, Public Interest Groups and the Research Sector

Recommendation 16
Government should encouraged industrial and trade organisations, trade unions and NGOs to be proactive in the areas of chemical management.
Recommendation 17
Governments should be encouraged to make information more easily available to private and community groups, and indeed to share more information in both the public and private domain.
Recommendation 18
Industry and professional organisations in PNG should be encouraged to develop their own guidelines and codes of practice, and in particular benchmarks and "best practice".
Recommendation 19
Non-government groups should be encouraged to diversify their interests to include both occupational health and environmental pollution / chemical management matters.

Chapter 9 Inter-Departmental Committees and Coordinating Mechanisms

Recommendation 20
A review of all interdepartmental and coordinating committees in the area of chemical management be established, their objectives be reviewed, their composition be reviewed (and broadened) and better mechanisms be established to render them more effective. A “lessons learned” review should be made of the POPs project to establish what are the factors that constrain and what assist improved inter-departmental co-ordinating mechanisms.

Chapter 10 Data Access and Use

Recommendation 21
A review should be carried out to ascertain what information on chemicals useful for chemical management does exist and is actually used in PNG, and what national and international databases and websites are actually being compiled and/or used. This needs to be done within government and in the private sector. Existing databases need be reviewed and improved. Methodologies and harmonised systems for collecting and retrieving information on chemicals need to be established.

Recommendation 22
A website on chemical a management in PNG be established. Other mechanisms for giving people ready access to information (or part of it) and for information exchange needs to be investigated / established.
All departments need to make more use of international information, websites and databases, and be funded adequately to ensure Internet services are paid for and computer facilities are maintained.

Chapter 11 Technical Infrastructure

Recommendation 23
The PNG Government must commit itself in the long term to develop a Government Laboratory capable of servicing its needs in Chemical Management, capable of doing the following
quality control / checking quality of chemicals
conducting residue analyses
identifying unknown substances
conducting monitoring studies / monitoring for possible adverse effects (lower priority)

The Government must be prepared to both allocate more funds now and to give a long term funding commitment for the next 20 years and beyond.

Recommendation 24
Government departments involved in chemical management must all ensure they have computers with the latest software, CDroms and compatible systems. Moves to harmonise and immediately share in country data should be a high priority. Use of the Internet and access to international data sources must also be a priority. Staff should be trained to use and become familiar with such data / software. Departments should all have informative and up to date websites. Departments must budget / be funded adequately to ensure Internet services are paid for and computer facilities are maintained.
Recommendation 25
There is a drastic need for greater / increased support and funding of the Universities and technical colleges in PNG in general, and teaching programmes with any emphasis on chemical management and environmental and health needs in particular. Donor agencies and private industry should also be encouraged to support education and training programmes in chemical management in PNG be they in the training institutions or in-service or in the community.

Chapter 12 International and Regional Linkages

Recommendation 26
International agreements to do with chemical management need to be signed, ratified and incorporated into national legislation and implementation activities. A systematic check is needed on what has been done, what has not been done and what still needs to be done; involving DEC, pertinent departments and authorities and the Department of Foreign Affairs. PNG needs to ratify the Rotterdam Convention.
Recommendation 27
Better and more regular co-ordination at the national level is needed with respect to implementation of international activities and agreements in the area of chemical management. This will more likely enable that PNG will benefit from these international bodies.

Recommendation 28
For technical assistance projects to be of greater value, the PNG government must provide both long term funding and a greater commitment to human resources at the national and provincial government levels.

Recommendation 29
There needs to be surety that all aid projects are scrutinised and audited for conformity and compliance to PNG laws related to chemicals.

Recommendation 30
More effective international support for strengthening chemical management in PNG must be preceded by the PNG Government allocating more financial and other resources, including people, to sections within the various departments that deal with chemical management; not just DEC but also in the Health, Agricultural and Industry sectors. It is crucial that continuation of POPs activities and other activities related to chemical management be sustained.

Chapter 13 Awareness and Understanding of Workers and the Public

Recommendation 31
"Training trainers" and In-service training of personnel e.g. environmental officers and sales persons as well as persons handling chemicals, e.g. during formulation, transportation, storage, use and disposal should be done on a regularly basis, eg every two years.

Recommendation 32
Departments should take responsibility to establish education and awareness raising activities to both increase awareness in the community on risks associated with chemicals, and to improve forms of risk communication in the work place and in shops which sell hazardous chemicals. Industries, NGOs and training and educational institutions should do likewise. Innovative forms of risk communication need be tried.

Recommendation 33
The POPs awareness raising campaign be transformed into an ongoing campaign or program to inform the public on chemicals and the need to use chemicals safely in general and as an important avenue for chemical risk communication for hazardous chemicals.

Chapter 14 Resources Available and Needed for Chemical Management

Recommendation 34
Detailed surveys need to be done to ascertain which staff in the various departments actually at present work on chemical management related issues and the proportion of their time they spend on such activities; and how much financial resource is allocated towards these responsibilities.

Recommendation 35
The minimum number of officers need to be determined / estimated whose full time responsibility, or a substantial responsibility, at both the national and provincial government levels, are needed to effectively implement chemical management in Papua New Guinea to effect the tasks identified in this report and also for those activities incorporated into the POPs national implementation plan.

Recommendation 36

The minimal financial and other resources to ensure that effective chemical management can be effected properly in PNG also needs to be determined.

15.2 Overall Recommendations

Recommendation 37

That this report, entitled *Papua New Guinea National Profile on Chemical Management,* be accepted as an official document evaluating chemical management in Papua New Guinea. That this report be released as a public document immediately. That the contents and recommendations of this report be immediately and thoroughly reviewed and, as appropriate, acted upon by both the Department of Environment and Conservation and the Department of National Planning and Rural Development.

Recommendation 38

That the action plan for a continuing / living "*Papua New Guinea on a National Chemical Management Profile"* as outlined in the following section be endorsed and mechanism to support it be determined.

15.3 Strategy and Action Plan for PNG National Profile of Chemical Management

The objectives and benefits of having a national profile are clearly stated in the Introduction and Aims to this document (pages …).

This second edition of the National Profile has up dated much of the situation on chemical management in PNG since the first edition was published in 2000. It has also incorporated information from the various POPs task team and consultancy reports. However there are still many serious gaps in information that need to be filled. Very few of the recommendations from the first edition have been acted upon.

More importantly these editions were produced by few persons. This is not how it should be. To ensure the National Profile is a living document which is fully accurate and represents the concerns of all stakeholders a process must be established to enable broader participation in its production. The inputs of all stakeholders needs to be co-ordinated to ensure efficiency and integration, hence there is a need for a co-ordinating mechanism.

A strategy is needed to ensure that the National Profile of Chemical Management is a source of up to date information, a process for information exchange, review and decision-making and a baseline to determine what is needed to be done to strengthen chemical management. This process of necessity must also involve all concerned parties.

Building on the second national profile, the strategy aims to establish such a process.

Objective: To establish a process to maintain the National Profile to serve as a document to ensure better chemical management in Papua New Guinea and so facilitate protection of human health and the environment from hazardous chemicals.

Targets:To establish a Process within six months to ensure the National Profile and the status of its recommendations be regularly reviewed and acted upon over the next three years, and that the process involve participation by all stakeholders..

Goals:

1. To establish a co-ordinator for National Profile
2. To establish a working party similar to the POPs National Co-ordinating Committee within three months.
3. To develop a process for maintaining a National Profile within six months to ensure that the profile is "owned" by all stakeholders.
4. To review and update the existing profile, to prioritise the recommendations and to establish strategies, action plans and costing for these priority concerns which are supplemental to those in the POPs National Implementation Plan within 18 months.

5 To produce a third edition of the National Profile up dated with appropriate recommendation and priority concerns within three years.

Framework for Action Plan for PNG National Profile of Chemical Management					
Goals	**Actions**	**Activities**	**Expected Output**	**Performance Indicators**	**Implementing Agencies**
To appoint National Profile Co-ordinator	DEC to appoint an officer to act as National Profile Co-ordinator	Appoint officer Establish office	**Within one month**. Have identified / appointed a National Profile Co	Co-ordinator appointed / familiar with National Profile / initiating actions	DEC Environmental Protection / POPs NCC
To establish a Working Party similar to the POPs National Co-ordinating Committee.	Co-ordinator to work with POPs NCC to establish a national co-ordinating committee. Appoint additional members from key agencies / non – government and private sector	Liaise with all stakeholders identified in National Profile Formally request their participation and commitment with identification of member to working party.	**Within three months** first meeting of Working party	Working party members familiar with National Profile / considering process mechanism	DEC, DOH,DAL, NPRD,DLIR, plus others in POPs NCC plus additional members from outside government and from private sector
To develop a process for maintaining a National Profile to ensure that the profile is "owned" by all stakeholders	Workshop for Working Party to prepare / recommend national profile process mechanism	Provide copies of existing information including national profile and networking activities	**Within six months** Process determined. Confirm members of Working Party Confirm time frames	Endorsement of and commitment to process by all stakeholders across sectors & outside government	DEC, Working party plus all stakeholders
To review and update the existing profile, to prioritise the recommendations and to establish strategies, action plans and costing for these priority concerns which are supplemental to those in the POPs National Implementation Plan	To review /correct detail of each existing chapter including the recommendations and suggest actions	To establish technical sub-committees for each chapter To establish database of additional / corrected information To hold national workshop(s) to ensure broad input To develop action plans on priority recommendations with full costs	**Within 18 months.** Reviewed / corrected updating the chapters and priority recommendations decided and costed. Improved functioning process	Gaps filled in and corrections made to Second edition National Profile , and appropriate strategies proposed for actions to be taken on recommendations Improved networking and information sharing Active involvement of all stakeholders – regular meetings of working party and technical subcommittees	DEC, Working Party
To produce a third edition of the National Profile up dated with appropriate recommendation and priority concerns	To produce both a detailed National Profile and an abridged and briefer version for decision-makers and the public.	Technical sub-committees to appoint lead writer to rewrite each chapter , recommendations and action plans Organise reviews of each chapter To hold national workshop(s) Organise publication and distribution of revised national profile	**Within three years** publish a third edition of National Profile with its priority recommendations. Successfully establish a sustainable process involving all stakeholders in chemical management	Working Party endorse the third edition National Profile and strategies proposed for actions to be taken on recommendations Improved environmental performance and better chemical management in PNG	DEC, Working Party, NEC and all stakeholders.

Financial Plan for PNG National Profile of Chemical Management					
Activities	**Expected Output**	**Year 1**	**Year 2**	**Year 3**	**Proposed Source of Funding**
Appoint Officer / Establish office	**Within one month**. Have identified / appointed a National Profile Co	K30,000 salary + Operating costs	K50,000 salary+ Operating costs	K50,000 salary+ Operating costs	GEF in year 1; Share GEF / DEC in years2 & 3
Liaise with all stakeholders identified in National Profile Formally request their participation and commitment with identification of member to working party.	**Within three months** first meeting of Working party	K10,000 Operating costs			GEF in year 1:
Provide copies of existing information including national profile and networking activities	**Within six months** Process determined. Confirm members of Working Party Confirm time frames	K10,000 Operating costs			GEF in year 1
To establish technical sub-committees for each chapter To establish database of additional / corrected information To hold national workshop(s) to ensure broad input To develop action plans on priority recommendations with full costs	**Within 18 months.** Reviewed / corrected updating the chapters and priority recommendations decided and costed.	K10,000 Operating costs	K70,000 Operating costs Including workshop		GEF in year 1; Share GEF / DEC in years2
Technical sub-committees to appoint lead writer to rewrite each chapter , recommendations and action plans Organise reviews of each chapter Organise publication and distribution of revised national profile	**Within three years** publish a third edition of National Profile with its priority recommendations. Successfully establish a sustainable process involving all stakeholders in chemical Management			K70,000 Operating costs Including workshop	Share GEF / DEC
TOTAL COSTS = K300,000		**K 60,000**	**K120,000**	**K120,00**	**GEF in year 1; Share GEF / DEC in years2 & 3**

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- Includes other important reports and papers which address aspects of chemical management in Papua New Guinea

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APPENDIX 1

Table 1. People who participated in the POPS Project

Names	Government Departments	Designation	How they Participated?
Aipe, Talu	WHPA	Policy Planning & Monitoring	Task Team 7 member
Akotai, Samson	Unitech	Lecturer	Task Team 4 member
Asigau, William	DOW	Environmental Officer	Ordinary Participant
Avoa, Gerard	Gulf Admin..	Environment & Conservation Officer	Task Team One member
Balingson, Baning	LUCTO	Environmental Health Officer	Task Team two member
Bogombari, John	DOJ & AG	Legal Officer	Task Team 7 Member
Daink, Francis	DAL	Director-Science & Technology	TT 7 Team Leader
Dinyial, Davidson	NGO (Carita)		Task Team 9 member
Erepan, Beno	DOCD	Principal Research Officer	
Fong, Leonard	Morobe Gold	HSE Officer	Task Team 8 member
Gadebo, Douglas	PNGTUC	National Seafarer Secretary	TT 7 & NCC Member
Gali, Betty	DOCD	Senior Research Officer	
Gwakoro, Taikone	Morobe Adm.	Morobe Admin. Rep.	Task Team one member
Josahia, Torea	DTCA	Senior Engineer (RS & TM)	
Kagena, Cecila	DAL	Coordinator-Women in Agriculture (Gender)	Task Team Nine Member
Kapari, Michael	UOG	Lecturer	Task Team two member
Kavanamur, Emmanuel	FPDC-EHP	A/General Manager	Task Team 5 member
Kellis, Willie	PNG Power	Safety Officer	Task Team four member
Kenneth, Jonathan	DNP & ORD	Renewable Planner	
Kenney, Cynthia	IRC/Customs	A/Director-Contraband	TT 7 & NCC Member
Kents, Peter	Education Department		Task Team 9 member
Kepore, Timothy	NISIT	Scientific Officer	TT 6 Team Leader
Kiniafa, Daisy	DPI-EHP	Extension Officer	Task Team 5 member
Kipa, Michael	Unitech	Lecturer-Applied Science	TT 9 Team Leader
Koma, Mathilda	NEWG	Campaign Coordinator	NCC Member
Kone, Gedisa	DPE	Environment Officer	Task Team One Member
Kore, Harry	DJ & AG	Senior Legal Officer	TT 7 & NCC Member
Kuinata, Lastus	Ramu Sugar	Senior Agronomists	Task Team 7 member
Kula, Veari	DEC		Task Team 6 member
Kuman, Noel	POPS Project	POPS Project Volunteer	Consultant & TT 7 member
Kupu, Erick Tom	DTCA	Scientific Officer	Task Team Eight Member
Lavoga, Maria	DLIR	A/Assistant Secretary	NCC Member
Liru, Edward	DAL-Wewak	Senior Advisior	Task Team two member
Lohia, Bodibo	DLIR	A/Assistant Secretary (OHS)	NCC Member
Makita, Leo	DOH		Task Team two member
Malawae, Donnath	PNGTUC-Lae (Marine time)		Task Team 7 member
Marai, Kevin	NBC	Radio Announcer	Task Team 9 member
Marcus, John	DOM	Mines Safety Officer	Task Team 4 member
Masamdu, Roy	NARI-Lae	Principal Entomologists	Task Team 9 member
Maven, Philip	TUC-Lae		Task Team 6 member
Minei, Alfred	Manus	Town Manager-LLLGC	Task Team 5 member
Mopafi, Evelyn	DOM	Research Scientists	
More, Isowa	NCDC	Environmental Health Officer	TT1 Member
Mowbray, David	UPNG	Lecturer in Environmental Science	Consultant & TT1 Leader
Muru, William	DOH	A/Assistant Secretary	NCC Member
Muye-Kipong, Monica	NGO	Assistant-Freelance	Task Team 9 member
Nakmai, Lois	DEC	Assistance Secretary-Environment Protection	Consultant & Task Team Eight Member
Natera, Ernest	FPDC-EHP	Post Harvest Tech.	Task Team 5 member
Ngere, Otto	NARI-Keravat	Entomologists	Task Team 7 member
Nicholas, Eddie	DEC	Scientific Officer-Environment Protection Branch	Task Team 7 Team Leader
Nipuru, Francis	Customs-Lae		Task Team 7 member
Nohnah, Joe	Trukai Industries-Lae	OHS & E Officer	Task Team 7 member
Nouairi, Tonny	DEC		Task Team 7 member

Omena, Mathew	PNGIMR	Researcher	Task Team two member
Onaga, Ian	DAL	A/Director Filed & Technical Services	NCC Chairman & Task Team one member
One, Kelly	DLIR		NCC Member
Orake, Gretel .N.	DEC	Scientific Officer	Task Team 8 member
Orrell, Ian	OPRA	Oil Palm Researcher	NCC Member
Page, Bill	OPRA	Senior Entomologists	Task Team 7 member
Peandhi, Eric	DTI	A/Senior Technical Analysts	Task Team 6 member
Pecyuma, Brian	Sandaun	Sanduan Administration Rep.	Task Team 6 member
Pendrigh, Lui	DPE	Policy Officer	Task Team 5 member
Petsul, Peter	UPNG	Lecturer in Chemistry	TT5 Leader & Consultant
Pital, Henry	PNG Power		Task Team 4 member
Popena, Patriciai	DOM	Environmental Officer	
Posanai, Enoch	DOH	Deputy Secretary	NCC Member
Powi, William	PM & NEC	Director (L & R)	NCC Member
Romalus, Rose	CIC		Task Team 5 member
Samo, Daniel	PNG Power Ltd	Distribution Substation Superintendent	Task Team 4 member
Sawaku, Kawi	WP	Western Province Admin. Rep.	Task Team 4 member
Seekles, Rudi	KK Kingston		Task Team 6 member
Simbiken, Nelson	CIC-Goroka	Senior Entomologists	Task Team two member
Sine, Robert	DEC	Ecologists	Task Team 4 member
Tai, Nelson	DPE	Energy Researcher	
Taia, Elias	DAL		Task Team 7 member
Taimbari, Fabian	DEC	Law Enforcement Officer-Wildlife	Task Team 8 member
Tandarapa, Tony	DOH-Goroka		Task Team two member
Terina, Simevoon	NCDC Health	Environmental Health Officer	Task Team five member
Tjamei, Lawrence	Manus	Administrator	Task Team 5 member
Tolimanaram, Ben	PNG Power	Power Station Manager	Consultant & TT4 member
Totome, Robin	UPNG	Lecturer in Biology	TT 5 Leader & Consultant
Tsigese, Titus	PNG Power	OIC-Environment	Task Team 4 member
Udu, Tau Lohia	PNG Pest Control		Task Team 6 member
Vali, Tau	DPA	Deputy Secretary	NCC Member
Vali, Kwaipo	PM & NEC	Assistant Director (Coordination)	Task Team one member
Walia, Abilo	IRC/Customs	A/Assistant Commissioner Enforcement	Task Team 7 Member
Willies, David	DPE		Task Team one member
Yaipupu, Jessie	Health-EHP		Task Team 9 member
Yakip, Susan	DEC	Environment Protection Officer	
Yano, Nelson	DOH	A/Advisor	NCC Member (Alternative
Zamzai, Sinikupa	EHP-Admin..	Provincial Planner	Team Leader-TT2

APPENDIX 2

Useful Information Sources on PNG on the Web

Websites

http://www.niugini.com/pngonline/home.html
detailed profile on PNG giving information on provinces, physical features, vegetation, climate, history, population, culture …

http://www.pngonline.gov.pg
gets you into PNG government departments

http://www.pngbuai.com
introduces you to many sites in PNG / is a web resources directory for PNG

http://www.ausaid.gov.au/country/papua.cfm, and
http://www.ausaid.gov.au/country/PNG/PNG_intro.cfm
AusAID very general / brief overview on PNG.

http://www.adb.org/PapuaNewGuinea/
about ADB assistance to PNG and gives recent economic and social indicators for PNG

http://www.worldbank.org go to countries and region ./ Pacific/ PNG about World Bank assistance to PNG

http://www.imf.org select country PNG
about IMF assistance to PNG and gives recent economic and social indicators for PNG

http://www.spc.int/prism/index.htm , is Pacific Regional Information System (PRISM) – contains information on each Pacific country, though much is out of date.

Maps of PNG are available at
http://gis.mortonblacketer.com.au/upngis
or
http://www.rsc.upng.ac.pg
This is the UPNG Remote Sensing Centre - provides access to remotely sensed satellite data and GIS products covering land cover and land use in PNG.

http://www.odci.gov/ - go to World Factbook and click on PNG.
USA CIA site - provides some facts on PNG geography, people, government, economy …

University of PNG 2002 World Summit on Sustainable Development Johannesburg August 2002. Papua New Guinea National Assessment Report – Response to Rio and Agenda 21. Prepared for the Independent State of Papua New Guinea(draft). Port Moresby, August 2002 . Draft is available at website www.upng.ac.pg go to Environmental Science.

Nicholls, Stephen 2004. The Priority Concerns of Papua New Guinea. Report International Waters Program. Country Report Series 2004/01. Available on SPREP Website – http://www.sprep.org.ws then go to International Waters Program, then Reports and Documents.

Government of Papua New Guinea 2004. Papua New Guinea's National Assessment Report. on the Implementation of the Barbados Programme of Action for the Sustainable Development of Small Island Developing States. Port Moresby, June 2004
Available in 'pdf' at website www.sidsnetpacific.org