Ministry for the
Environment
Manatū Mō Te Taiao

Environmental performance indicators

Summary of Proposals for Waste, Hazardous Substances and Toxic Contaminants

Signposts for sustainability

This is a summary document, full reports can be made available by contacting the Ministry for the Environment. You can forward your comments on this summary to:

Karen Bell
Project Leader
Environmental Performance Indicators
Ministry for the Environment
P O Box 10-362
Wellington
New Zealand

Telephone: (04) 917 7400
Direct Dial (04) 917 7476
Fax: (04) 917-7523
Email: karen.bell@mfe.govt.nz

Environmental Performance Indicators

Summary of Proposals for Waste, Hazardous Substances and Toxic Contaminants

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1. Overview of EPI programme

Within a few years New Zealand will have in place a system to monitor changes in the environment. The intention of the Environmental Performance Indicators (EPI) Programme is to track trends in New Zealand's environment and to trigger timely and appropriate action to address environmental problems. Some of these actions will improve both the health of the environment, and of living things which depend on it.

The Purpose of the Environmental Performance Indicators Programme

The overall purpose of the EPI programme is to ***develop and use indicators to measure and report how well we are looking after the environment****.*

The Government's objectives for the EPI programme are:

- *to systematically measure the performance of its environmental policies and legislation*
- *to better prioritise policy and improve decision making*
- *to systematically report on the State of New Zealand's environmental assets.*

The idea is to develop tools similar to those available to assess the economy. Development costs mean we have to choose indicators that allow us to measure trends in key environmental issues. We need indicators that, together, will produce data contributing to a fuller picture of the state of the environment.

What are the characteristics?

Indicators should be:

- Measurable with available technology
- Measurable at reasonable cost
- Scientifically defensible
- Easy to interpret and understand
- Policy-relevant.

The key policy issues have been identified in the *Environment 2010 Strategy*. The Ministry for the Environment (MfE) ran a series of public meetings and invited comment and submissions. From this a framework of indicators was drawn up. In this framework, indicators are defined as either **Pressure** (on the environment), **State** (describing the condition) or **Response** (describing organised behaviour to reduce, prevent or mitigate undesirable changes).

The plan is to build on existing monitoring. Much of the current data is held by central government, regional councils, territorial local authorities, crown research institutes and iwi.

Responsibility for future monitoring will lie largely with these agencies. However the responsibility to develop, standardise and "nationalise" the Programme rests with MfE.

The current priority is to pilot and implement indicators for stratospheric ozone, climate change, air, fresh water and land. At the same time, we need to confirm indicators for marine environment, biological diversity, and waste and hazardous substances. Indicators for transport, energy, pests, weeds and diseases are to follow. Indicators relevant to Maori are being developed in parallel with the development of other indicators. The aim is to have a set of core indicators in place by the turn of the century.

The benefits of the EPI programme will be provision of better information, integration of environmental monitoring efforts and improved policy decisions.

Overall benefits to the environment are such that we call EPIs "signposts for sustainability".

2. Introduction

This summary document us one step closer to the implementation of the EPI programme. It covers two substantial reports commissioned by the Ministry for the Environment. The first is the *Waste and Hazardous Substances Indicators Discussion Document* (MfE October 1998), and the second is a *Review of Environmental Performance Indicators for Toxic Contaminants in the Environment* (Technical Paper No.37). As commissioned technical advice, the second report has been assessed against indicator needs and recommends a limited set of toxic and ecotoxic indicators.

Indicators presented in this document and the discussion document are only potential indicators. Submissions on proposed indicators are requested by **19 December 1998**.

The waste and hazardous substances are primarily “pressure” indicators. On the other hand, the toxic and ecotoxic contaminant indicators are state indicators for land, air, water and the health of ecosystems and people. The proposed indicators will be developed in stages. Stage 1 indicators are considered to be those closer to implementation than stage 2, for which more work is required.

3. Policy goals

The Government's policy goals from the *Environment 2010 Strategy* are:

> *To manage waste, contaminated sites and hazardous substances by:*
> - *managing waste to reduce risks to environmental quality and public health to levels that are widely agreed as being socially acceptable;*
> - *cleaning up contaminated sites to reduce risk to the environment, people and the economy;*
> - *managing or preventing the harmful effects of hazardous substances in order to protect the environment and well-being of people and communities so as to enable the maximum net national benefit to be achieved.*

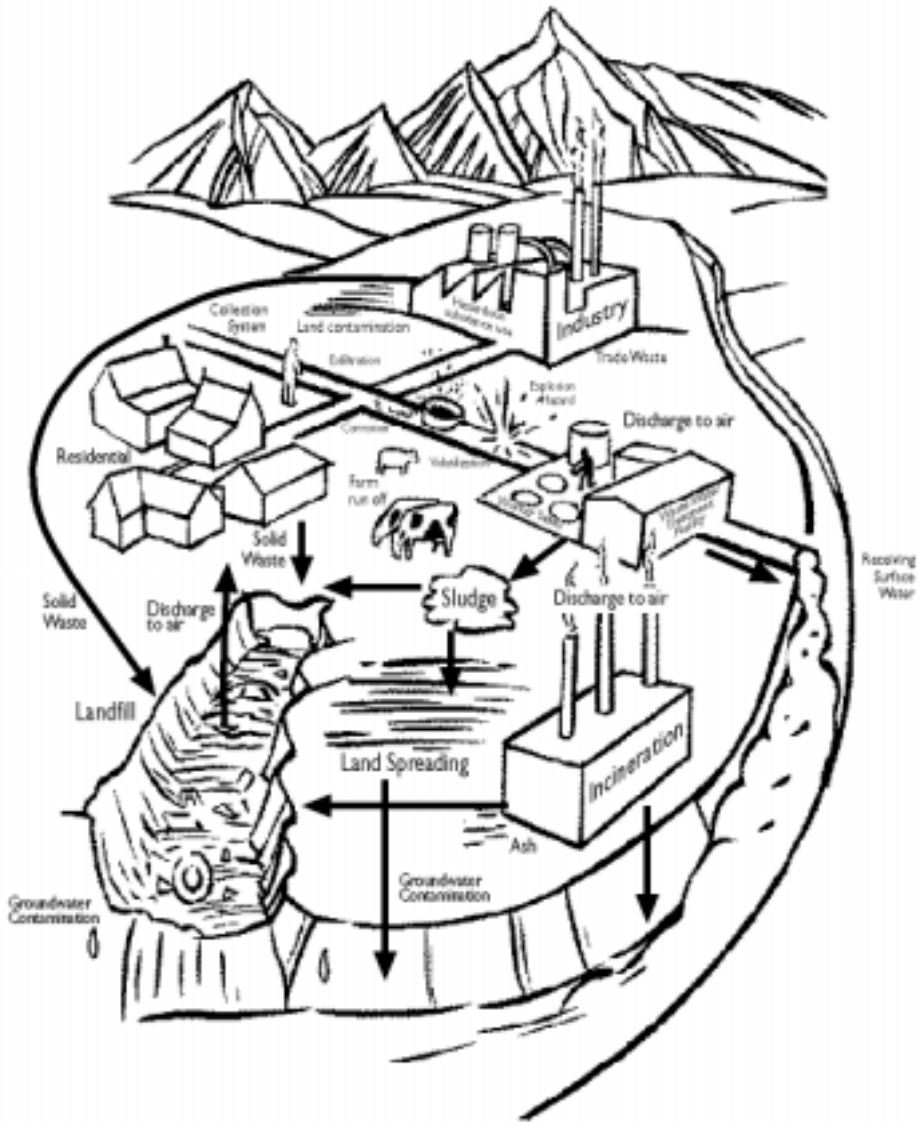
From this broad goal "measures of success" were developed for waste, hazardous substances, hazardous waste and contaminated sites.

Indicator selection for the waste, contaminated sites, hazardous waste and hazardous substances strands of the EPI programme involved consultation with a large range of parties (the EPI programme is described in more detail in the full discussion document).

Have a look at our website for indicators data and more information about the EPI programme:
www/mfe.govt.nz/monitoring/indicators.htm

4. Integration

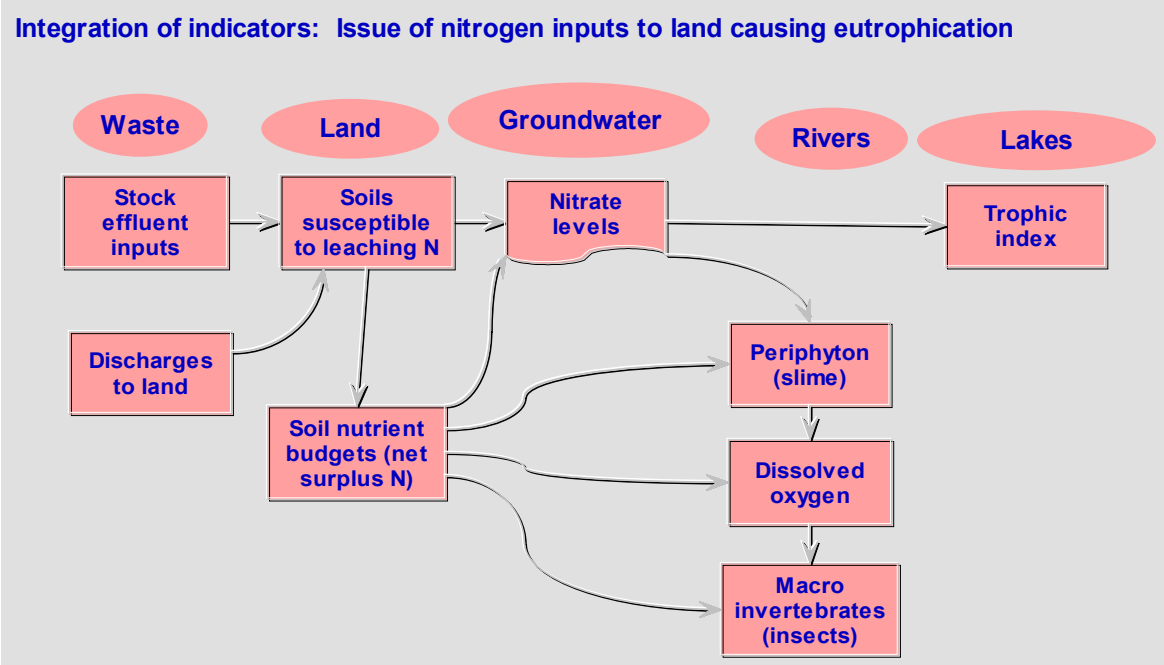
Figure 1: Linkages between waste, hazardous substances, hazardous waste and contaminated sites in the environment



The indicators presented here have important links to other strands in the EPI programme. Figure 1 gives a picture of some of these environmental linkages.

As the generation and disposal of waste and hazardous substances are pressures on environmental resources, most of the indicators presented are pressure indicators.

Figure 2: Integration Diagram



There are also strong links to the **state** indicators presented in other documents, in particular land and water. Figure 2 illustrates the linkage for the issue of nitrogen inputs to land causing eutrophication of water bodies.

5. Indicators for Solid and Liquid Waste

For the purpose of the EPI programme, waste is defined as:

> *Materials and energy which have no further use and are released to the environment as a means of disposal.*

Waste is generated in solid, liquid or gaseous forms.

Table 1 presents the proposed indicators for solid and liquid waste. The solid waste indicators enable the changing source, quantities and composition for each key management method to be monitored over time. They also provide useful information on the changes in risk posed by disposal methods such as landfills. Only some of this information is currently widely monitored by local authorities. Standard methods will need to be developed, or refined (e.g. the *Waste Analysis Protocol* (WAP)).

Liquid waste can be defined as waste that is generated or converted to a liquid form for disposal. These indicators focus particularly on the organic loadings on our waterways, including major discharges and an estimate of effluent from

farm animals. Much of this information is currently available.

Further work (stage 2) is proposed to develop indicators on recycling and to refine the liquid waste indicators to include information on treatment.

Table 1	Solid Waste Proposed Indicators	Liquid Waste Proposed Indicators
Stage 1	Quantity of waste disposed to landfills. Composition of waste disposed to landfills. Source of waste disposed to landfills: • Residential • Non-residential Number of landfills in each category of a 'landfill grading system'.	Quantity of major discharges to water: • BOD Stock effluent equivalent of total nitrogen.
Stage 2	Quantity of waste recycled. Source of waste recycled.	Quantity of major discharges to water: • Faecal coliforms • Suspended solids Quantity of contaminant (nitrogen) in wastewater discharged to land % of municipal wastewater discharges to land, fresh water, coastal water with: • no treatment • primary treatment • secondary treatment • tertiary treatment

6. Indicators for Hazardous Substances

Because of the historic framework of hazardous substances law, limited information is available on hazardous substances. Furthermore, the Resource Management Act (RMA) is limited to the effects of hazardous waste on the environment; it does not control quantities produced or their use.

Demand for improved controls on the manufacture, transport, use, storage and disposal of hazardous substances has increased in line with increased understanding of the nature and extent of such activities on the environment and

on human health. The Hazardous Substances and New Organisms Act (HSNO) reflects this concern, and provides for comprehensive management of intentional manufactured and imported hazardous substances. However, the Act has yet to become fully operational.

Table 2 presents the proposed indicators for hazardous substances. We recognise that some of these indicators are still crude, due to information being limited to quantities and incident reporting. But information should be available in the future to assist in monitoring policy goals for hazardous substances.

Table 2	**Hazardous Substances Proposed Indicators**
Stage 1	The number of incidents reported. The number of new substances registered under HSNO. The number of substances deregistered under HSNO. The number and quantities of toxic and ecotoxic hazardous substances: • Produced • Imported • Exported.
Stage 2	The number of incidents which fall into the following categories: • Major • Minor.

For these proposed indicators, it is assumed that the Environmental Risk Management Authority (ERMA) will establish the reporting systems. In the future, ERMA may develop more sophisticated, risk-based indicators.

7. Indicators for Hazardous Waste

Hazardous wastes are those hazardous substances **not** intentionally manufactured. Usually these wastes are by-products of industrial processes, which require disposal.

The proposed stage 1 indicator would be based on data collected at those large landfills currently monitoring hazardous waste, and already available data on imports and exports. The proposals for stage 2 depend largely on decisions about options being considered under the Ministry's Hazardous Waste Management Programme, but should ensure more comprehensive coverage.

The proposed indicators cover the tracking of hazardous waste from industrial sources, the quantities generated of such waste, and the amount treated and disposed. They will assist in identifying risks to the environment from hazardous wastes.

Table 3	Hazardous Waste Proposed Indicators
Stage 1	The quantity of hazardous waste which is: • accepted at landfills • imported • exported.
Stage 2	The quantity of hazardous waste being generated from industrial sources. The quantity of hazardous waste being effectively treated to remove its hazardous characteristics. The quantity of hazardous waste being disposed to: • landfill • sewer • export • import.

8. Indicators for Contaminated Sites

The Australian and New Zealand Environment and Conservation Council (ANZECC) defines a contaminated site as:

> *"A site at which hazardous substances occur at concentrations above background levels and where assessment indicates it poses, or is likely to pose an immediate or long-term hazard to human health or the environment".*

Many contaminated sites have arisen as a result of the inappropriate handling and management of hazardous substances, and past disposal practices. Information on the extent of risk posed by contaminated sites continues to increase as more extensive and accurate surveys are conducted.

Because of the information already available on high risk sites, and awareness concerning new sites, information for this indicator should be relatively easy to collect.

Table 4	Contaminated Sites Proposed Indicators
Stage 1	The total number of sites and the number of high risk sites which fall into the following categories: • number of additional sites added to the register during the past year • not investigated • under investigation • confirmed contaminated • remediated site • not contaminated.

9. Indicators for Toxic Contaminants in the Environment

9.1 Introduction

Public submissions on environmental performance indicators for air, fresh water and land emphasised the need for of toxic contaminants to air, fresh water and land. This resulted in Technical Report No. 37 being commissioned. The word toxic is defined in the HSNO Act as toxic to humans; while ecotoxic refers to ecosystems. In this report toxic is used generically to cover both.

Following the process outlined in the **Overview** section, an initial list was developed of priority toxic contaminants based on a number of overseas examples as well as other relevant toxic contaminant and pollutant release inventories.

Selection of indicators was dictated by the indicator selection criteria (see page 5). Toxic contaminant indicators proposals to build on currently available toxic contaminant monitoring data and 'modify' those current programmes to provide the required EPI information. After identifying 'useable' stage 1 indicators, additional, stage 2 key indicators have been identified for development.

The Technical Report identified a wide range of potential indicators, from which seven indicators were identified as suitable for the New Zealand context. Generally, measuring a huge range of toxic contaminants in the environment is problematic. We found that biomonitoring techniques provided a more robust basis for indicator development than other methods.

Table 5:	Proposed Indicators for Toxic Contaminants
Stage1	Toxic contaminants in meat Toxic contaminants in diet Toxic contaminants in human milk
Stage 2	Benzene in air Nitrates in groundwater Toxic contaminants in fresh water eels Toxic contaminants in marine mussels Toxic contaminants in marine sediments

9.2 Air

Air quality in some New Zealand urban environments is a significant issue, affecting both human and environmental health. Air quality issues encompass a range of contaminants.

While a number of toxic contaminant monitoring programmes are underway, including those set up by regional councils, the techniques and interpretation of this monitoring are both new and difficult.

Technical Report No. 37 suggests the following substances are of most concern:

- Volatile hydrocarbons (e.g. benzene, 1,3-butadiene, toluene, formaldehyde, ethene, proene, n-butene, trichloroethylene, dioxins) found in fuels
- PAHs (e.g. benzo(a)pyrene, total)
- Metals, e.g. mercury, cadmium, lead, zinc, chromium, arsenic)

On the other hand, the toxic substances selected for indicators should reflect the key risks to air quality in New Zealand. Most of the contaminants of concern are found at very low levels and with huge variability in the environment. Thus there are real practical problems in obtaining information which is both meaningful and cost effective.

Benzene

Based on these criteria, benzene was identified as a matter of greatest concern. It arises mainly from transport and appears to be widespread. Benzene has already been confirmed as a stage 2 indicator for air quality and this recommendation is endorsed here.

9.3 Land

The Technical Report did not recommend any soil or land indicators per se. This is because of the generally lower levels and variability (generally only a few "hot spots") in the environment and the lack of regional monitoring. Animals, on the other hand, have the potential to provide an integrated indicator of environmental quality - mainly soil quality.

In the absence of endemic terrestrial mammals, birds, particularly harrier hawks, were considered as having the potential for eggs to be collected without sacrifice of adults.

Selected toxic contaminants in bird species would provide an overall indicator of environmental health. Being a high level predator, the hawk feeds over an extended area, providing good integration. Gulls and sparrows, mice, hedgehogs and earthworms may also be useful. The limitation for the EPI programme of using such animals as indicators is the lack of established monitoring and an inability to interpret the identified response seen in the organism. Since much more work is needed in this area, biochemical markers in selected species are recommended as a priority for further research.

Meat Contaminants

As a more practical and immediate alternative the Technical Report recommends as an indicator chemical residue levels in sheep and cattle meat.

MAF Regulatory Authority operates a chemical residue monitoring programme in which animal tissue is taken on-farm and at point of slaughter for analytical testing of a range of agricultural compounds and veterinary medicines. Environmental pesticides and heavy metals are also included.

We propose that this survey be used to develop an indicator. We propose to report the frequency of exceedances of the maximum residue level be reported for the following selected compounds:

- DDT (and metabolites)
- heavy metals (As, Cd, Pb, Hg).

9.4 Rivers, Lakes and Groundwater

Toxic contaminants can be found in all parts of the aquatic environment. The Technical Report focuses on:

- groundwater monitoring
- fresh water biomonitoring
- marine biomonitoring and sediment monitoring.

Nitrates in Groundwater

The Ministry for the Environment commissioned a report on *Environmental Performance Indicators for Groundwater* (Technical Report No. 38). This concludes that the key issues are groundwater quantity and nitrate contamination. In most regions these can be estimated from existing networks, but a common data base is still problematic. Other groundwater quality issues may arise, such as chemical and microbiological requirements for human health. Groundwater invertebrates are seen as showing promise as indicators of ecological health but a significant amount of research would be needed before this potential was realised.

Feral Eels

Of all the fish species found in New Zealand, eels are best understood in terms of bioaccumulation. Already they have been used in the Organochlorines Programme where the accumulation of persistent organochlorines, undetectable in host waters, have been identified in eel tissue. (see *Reporting on Persistent Organochlorines in New Zealand, Proposed Environmental Indicators for the Marine Environment,* MfE 1998).

Biomonitoring species using mussels or eels

Some fresh water organisms can also be transplanted into rivers or lakes to provide an indication of the presence of toxic contaminants (i.e. they are 'sentinel' species).

The New Zealand fresh water mussel is already in use as a sentinel species in the Waikato and Tarawera Rivers.

They have the potential to provide an integrated, cost-effective indicator and can be benchmarked against international criteria for toxic contaminants.

Is fresh water biomonitoring a higher priority than marine biomonitoring?

However, insufficient work has been done to develop a national indicator based on existing biomonitoring of eels or mussels. A series of representative sites would need to be set up throughout New Zealand. Actual set-up may prove expensive.

A possible alternative is macroinvertebrate monitoring - a key indicator in the fresh water strand. Its effectiveness for monitoring ecotoxic contamination is being investigated as part of its development.

Feral eels, which are more cost-effective to monitor than caged eels - and still widespread - could be used to measure levels of DDT, Hg and Benzo(a)pyrene. PCBs could also be recorded.

9.5 Marine

Mussels

Marine invertebrates, such as mussels and oysters, are among the most suitable biological indicators for toxic contaminants. They are filter-feeders, which means that they accumulate most organic contaminants and metals from the water column, from sediments and food sources.

Marine invertebrates are used world wide for pollution monitoring because they are relatively resistant to pollution, transplantable, and because contaminant levels in their tissue generally reflect changes in contaminant levels in their environment. Lower pollution in New Zealand raises the need for more sensitive methods.

For 11 years the Auckland Regional Council has used resident Pacific oysters (*Crassostrea gigas*) to measure spatial and temporal trends in organic and heavy metal contaminants. Given the variability in estuarine and marine invertebrate distribution and availability, sentinel invertebrate species such as mussels is a good indicator of water-borne contaminants in the coastal environment.

Sediment

As sediments are the most significant repository of toxic contaminants in the estuarine and marine environment, monitoring of sediment quality at carefully selected locations could provide further information on the quality of the inshore environment.

Generally the science of toxics in sediments is better understood than it is in organisms. Sediment quality is highly variable because of contaminant sources and in relation to sediment properties. A list of key sites would need to be identified, and regional councils would need to agree to monitor at these sites.

Are mussels or sediments the best indicator?

We propose toxic contaminants in either mussels or sediments as stage 2 indicators for the marine environment. These are the same indicators proposed in the marine strand (*Marine Environmental Performance Indicators*, MfE 1998).

Technical Report No. 37 concludes that the following suite of contaminants are typically important in the estuarine-marine environment in New Zealand:

- As, Cu, Cr (relating to the timber industry)
- Cu, Pb, Zn (relating to transport)
- Cu, Cr, Ni (relating to tanning and metal industries)
- Cd, Hg (less specifically located)
- DDT as the key POP
- Benzo(a)pyrene as a key PAH

- Ammonia (because of its role in sediment toxicity).

We propose a basic suite of toxic contaminants be measured as indicators in mussels or sediments:

- Lead and mercury as the key metals
- Benzo(a)pyrene as the key PAH
- DDT (and metabolites) and PCBs as the key POPs.

9.6 Human Exposure

Diet Survey

Human diet surveys (conducted about every seven years) and breast milk surveys (conducted only once to date) have been carried out by the Ministry of Health in New Zealand. This work, which until now has been used primarily for human health rather than environmental monitoring, yields data that enables comparisons over time as well as with overseas studies. The surveys both provide good and relatively easily accessed surrogates of the impact on humans of contaminants and toxins in the environment.

Human milk

Human milk was last surveyed in 1988, and a new survey is now underway. It is an indicator at the top end of the food chain, and therefore capable of signalling important changes in the wider environment over time.

Because not all food consumed here is grown in New Zealand, this data could be "biased". For instance imported canned fish can contain organochlorines in concentrations that are low, but still higher than are found in fish taken from New Zealand waters.

Is human milk or the diet survey the best indicator?

We propose that **either** the breast milk or diet survey be used as an indicator. The chosen survey would have to be undertaken regularly (e.g. every five years) to provide useful time-series information. The following toxic contaminants are proposed:

- DDT (and metabolites), PCBs and dioxins as the key POPs
- As, Cd, Pb and Hg as the key heavy metals.

10. Maori Specific Indicators

Recognising the value of indigenous knowledge, the Ministry seeks to incorporate Maori concepts and ensure the indicators are relevant to Maori.

The EPI programme will be producing a discussion document specifically on Maori-relevant indicators across all strands of the Programme. This document will draw together the lessons we have learnt from a series of hui on

EPIs, the Maori Environmental Monitoring Group and the selected Maori case studies. The document is due for release in April 1999. Maori views on waste indicators were considered as part of the waste and hazardous substances strand. While comment on the indicators is welcome, we anticipate that most comment on these indicators will focus on the more comprehensive document in 1999.

We expect that many of the proposed indicators set out here will be of interest to Maori. These include the discharge of effluent and wastewater, especially if additional information relevant to Maori was provided (e.g. proximity to waahi tapu).

The only Maori-specific indicator to emerge, which also met our selection criteria, relates to raahui (see Table 6).

Raahui are tradition bans on fishing and other activities. These may be applied for environmental reasons and provides an indication of a trend in perceived environmental quality. A system for recording and reporting raahui would have to be established.

Table 6	**Potential Maori Indicator**
Stage 2	Days per year and extent over which raahui is applied to address the adverse effects of waste.

11. Reasons for Rejecting Other Indicators

For a range of reasons, many seemingly suitable indicators for waste, hazardous substances, and toxic contaminants fell outside the criteria for assessing indicators, and the scope of the programme. In some cases, the proposed indicators could be dealt with more appropriately in other strands of the EPI programme (e.g. state indicators for groundwater). In other cases, it was realised that the proposed indicator would only have minor value at a national level, or that targeting a specific industry was unhelpful. Sometimes there were difficulties in gathering of robust data, or it was decided that more research was necessary before a decision was made.

Two examples of indicators considered but rejected at this stage are waste generation and the Pollution Release Transfer Register (PRTR).

Although generation of waste is very policy relevant, there appear to be no robust methods for measuring it.

Unfortunately PRTRs require industry to report (by regulation) the release of toxic contaminants. Although very relevant, this idea has been recently considered, and rejected, because we were not convinced that the benefits for New Zealand (which lacks a large industrial base) outweigh the compliance costs. A simpler alternative is being investigated under a Sustainable Management Fund project - monitoring the toxic contaminants in sewage sludge.

The Ministry seeks feedback on the indicators outlined in this document. Specifically, the Ministry seeks a response by **Saturday 19 December 1998**.

You can forward your comments, or a request for further information on the EPI programme, or the indicators outlined in this document to:

Karen Bell
Project Leader
Environmental Performance Indicators
Ministry for the Environment
P O Box 10-362
Wellington
New Zealand

Telephone:	(04) 917 7400
Direct Dial	(04) 917 7476
Fax:	(04) 917-7523
Email:	karen.bell@mfe.govt.nz