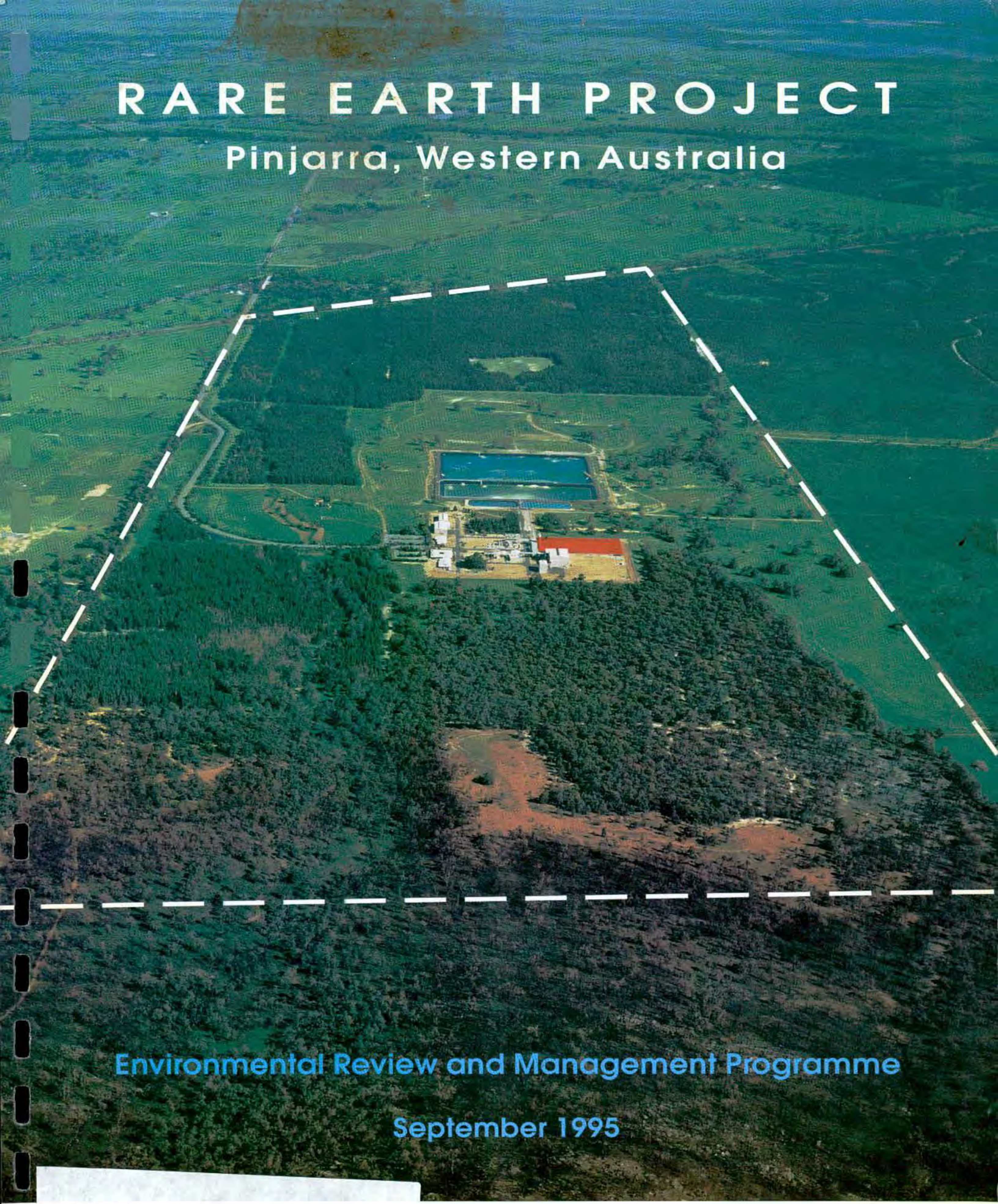
RARE EARTH PROJECT

Pinjarra, Western Australia



Environmental Review and Management Programme

September 1995

DAMES & MOORE

ENGINEERING EXCELLENCE - ENVIRONMENTAL RESPONSIBILITY

COVER:

Aerial view of Rhône Poulenc's Pinjarra property.
The dash line denotes the property boundary and the proposed location of the Rare Earth Plant is shown in red.

ENVIRONMENTAL REVIEW AND MANAGEMENT PROGRAMME
RARE EARTH PLANT
for
Rhône-Poulenc Chimie Australia Pty Ltd

DAMES & MOORE
Ref: CMG:sor/12088-057-363/DK:P-8500(2)/PER
September 1995

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INVITATION

The Environmental Protection Authority (EPA) invites people to make a submission on this proposal.

Rhône-Poulenc Chimie Australia Pty Ltd proposes to develop a Rare Earth Plant on a site adjacent to the existing Rhône-Poulenc Gallium Plant at Pinjarra, Western Australia. In accordance with the provisions of the Environmental Protection Act, 1994 (as amended) an Environmental Review and Management Programme (ERMP) has been prepared. The ERMP provides relevant details of the project and the proposed management techniques to enable the environmental acceptability of the project to be assessed. The ERMP is available for public review for ten weeks commencing 16 October 1995 and closing 27 December 1995.

Comments from Government Agencies and the public will assist the EPA to prepare an assessment report in which it will make a recommendation to Government.

Why write a submission?
A submission is a way to provide information, express your opinion and put forward your suggested course of action - including any alternative approach. It is useful if you indicate any suggestions you have to improve the proposal.

All submissions received by the EPA will be acknowledged. Submissions will be treated as public documents unless specifically marked confidential, and may be quoted in full or in part in each report.

Why not join a group?
If you prefer not to write your own comments, it may be worthwhile joining with a group or other groups interested in making a submission on similar issues. Joint submissions may help to reduce the workload for an individual or group, as well as increase the pool of ideas and information. If you form a small group (up to 10 people) please indicate all the names of the participants. If your group is larger, please indicate how many people your submission represents.

Developing a submission
You may agree or disagree with, or comment on, the general issues discussed in the ERMP or the specific proposals. It helps if you give reasons for your conclusions, supported by relevant data. You may make an important contribution by suggesting ways to make the proposal environmentally more acceptable.

When making comments on specific proposals in the ERMP:

- clearly state your point of view;
- indicate the source of your information or argument if this is applicable; and
- suggest recommendations, safeguards or alternatives.

Points to keep in mind
By keeping the following points in mind, you will make it easier for your submission to be analysed:

- attempt to list points so that the issues raised are clear. A summary of your submission is helpful;
- refer each point to the appropriate section, chapter or recommendation in the ERMP;
- if you discuss different sections of the ERMP, keep them distinct and separate, so there is no confusion as to which section you are considering; and
- attach any factual information you may wish to provide and give details of the source. Make sure your information is accurate.

Remember to include:

- your name;
- address;
- date; and
- whether you want your submission to be confidential.

The closing date for submissions is: 27 December 1995

Submissions should be addressed to:

Environmental Protection Authority
Westralia Square
141 St George's Terrace
PERTH WA 6000
Attention: Ms Xuan Nguyen

More information on how to make a submission can be obtained from the free pamphlet "Environmental Impact Assessment - How to Make a Submission" available from the Library of the Department of Environmental Protection Tel: (09) 222 7127.

ENVIRONMENTAL REVIEW AND MANAGEMENT PROGRAMME
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EXECUTIVE SUMMARY

INTRODUCTION

Rhône-Poulenc Chimie Australia Pty Ltd (Rhône-Poulenc - the Proponent) proposes to develop a Rare Earth Plant on a site adjacent to the existing Rhône-Poulenc Gallium Plant. The plant site is located approximately 100km south of Perth, 30km southeast of Mandurah, the nearest regional centre and 9.5km southeast of Pinjarra, the nearest town.

The project will involve the processing of monazite ore to produce rare earth nitrate for export. Wastes from the process will be disposed of at the approved Government Intractable Waste Disposal Facility (IWDF) near Mt Walton located in the Goldfields.

Monazite is produced in Australia as a by-product from the processing of mineral sands to produce the titanium minerals, ilmenite, rutile and zircon. It is a rare earth phosphate which also contains small quantities of other elements including thorium (approximately 6 percent ThO_2), uranium, iron, titanium and other metals.

Following referral of the project to the Western Australian Environmental Protection Authority (EPA), the Proponent was notified that the project should be formally assessed as an Environmental Review and Management Programme (ERMP). The ERMP aims to provide relevant details of the project and the proposed management techniques to enable the environmental acceptability of the project to be assessed.

HISTORY OF PREVIOUS PROJECT

Rhône-Poulenc was granted approval by the Western Australian Government to develop a gallium extraction plant at the Pinjarra site in 1987. The Gallium Plant was designed and constructed during 1987-1989 and was operational from 1989-1990 at which time it was placed on a care and maintenance programme due to a downturn in market conditions of gallium. The establishment of the Rare Earth Plant will facilitate the early restart of the Gallium Plant.

Rhône-Poulenc also sought to establish a Rare Earth Plant at the Pinjarra site in 1988. The 1988 project was subject to environmental impact assessment under Western Australian and Commonwealth Government legislation.

The Federal Environment Protection Agency approved the complete project subject to the WA EPA's assessment. The EPA found Stage I (to produce rare earth hydroxide) of the rare earths project to be environmentally acceptable (subject to various conditions) but that Stage II (to separate the rare earths from the rare earth nitrate) of the project, which would generate quantities of ammonium nitrate as a by-product, was not environmentally acceptable due to the concern of long term storage of the ammonium nitrate residue at the Pinjarra site.

In response to the assessment Rhône-Poulenc developed a revised strategy for the management of the waste by-product (principally ammonium nitrate). An ERMP was prepared for the revised strategy, however, it did not receive formal assessment as Rhône-Poulenc withdrew their proposal in 1990 due to commercial reasons.

DIFFERENCE BETWEEN THIS PROJECT AND PREVIOUS RARE EARTH PROJECT

The current project involves a different process which does not result in the generation of ammonium nitrate or a separate radium stream, thereby effectively eliminating the waste streams of concern for the previous project. The revised scope of the project involves the processing of monazite ore to produce rare earth nitrate, tricalcium phosphate as a by-product and low level radioactive material (gangue residue) as the principal waste product.

Subsequent to the public release of the previous ERMP/Draft EIS, the waste disposal facility component of the 1988 project was incorporated into the State Government's proposal for an Integrated Waste Disposal Facility, since re-named the Intractable Waste Disposal Facility (IWDF), located near Mt Walton in the Eastern Goldfields.

A Public Environmental Review (PER) was prepared by the Health Department of Western Australia which included the proposal to dispose of 7,000 tonnes of thorium hydroxide waste, generated by the processing of monazite to produce rare earths, at the IWDF. The PER, including the disposal of thorium hydroxide waste, was assessed by the EPA and then subsequently approved by the Minister for the Environment subject to certain environmental conditions. Number 5 of the Ministerial conditions states: "Prior to commissioning, the proponent shall prepare an Environmental Management Programme (EMP) to the satisfaction of the Environmental Protection Authority". In this context, the proponent refers to the operator of the IWDF, currently the Western Australian Department of Environmental Protection's (DEP's) Waste Management Division who will be responsible for the waste. To conform with the Ministerial conditions, the DEP's Waste Management Division will prepare an EMP on waste disposal operations. The EMP will be available for public comment during the ERMP public review period.

The PER for the IWDF and the subsequent EPA Report and Recommendations and Ministerial Conditions stipulated that the proponent of the IWDF site would own and operate the facility and would assume responsibility for collection of the waste from storage and transport to the waste disposal site. However, Rhône-Poulenc has been advised that the transport of the low level radioactive waste to the IWDF will be their responsibility, therefore the transport of the waste will be assessed as part of Rhône-Poulenc's project.

TIMING, OBJECTIVE AND LEGISLATION

It is intended that the construction of the plant should commence in early 1996, with commissioning scheduled for early 1997. Once approval is obtained for the Rare Earth Plant the Gallium Plant will be recommissioned to commence production in 1996. The expected life of the project is a minimum period of 20 years, however, this could be extended depending on the longevity of the monazite source from the Titanium Mineral Producers.

The general objective of the project is to develop a processing industry that will add value to a commodity that is currently a non-commercial by-product from mineral sands separation plants.

The plant will be designated a mine for the purpose of the Mines Regulations Act, 1974. In addition to obtaining approval from the State Minister for the Environment, the Proponent will have to comply with legislation and regulations administered by a number of Federal and State Government bodies.

BENEFITS OF THE PROJECT

The project has a number of significant economic and community benefits, including improved utilisation of Western Australian mineral resources, enhanced export earnings and employment opportunities. The project will add significant value to the monazite which will be processed to produce a rare earth nitrate product which in turn will be exported for processing into rare earth finished products. Principal applications of rare earths are in catalysts, metallurgy, glass making, lighting, magnets, electronics, ceramics, radiation safety and pigments with significant environmental benefits from some of these applications such as catalytic converters, reducing emissions from vehicle exhaust, high efficiency lighting, X-ray screens which reduce radiation exposure and as a replacement for toxic metals in pigments for plastics and paints.

The development of the project is consistent with both the Commonwealth and State Governments' strategy to develop downstream processing of Australia's mineral resources and will result in an increase in export earnings to the Australian economy, in the order of $27 million from the Rare Earth Plant and $20 million from the Gallium Plant.

Other significant benefits of the project will include:

- *the potential for downstream industries, utilising value-added products of the processing plant such as the rare earth component of the nitrate product;*
- *the generation of up to 150 jobs during the construction phase and at least 50 permanent positions once the plant is operational; and*
- *an industrial investment of an additional $50 million to a total of $100 million for the site.*

EVALUATION OF ALTERNATIVES

The principal project alternatives evaluated are those relating to packaging and transport of the monazite and waste and the method of disposal at the IWDF.

The preferences for the location of the plant and liquid effluent disposal are largely governed by the existing infrastructure at the Pinjarra site.

Monazite could be supplied to the plant either by road or rail/road in the form of bulk quantities or in two tonne bulka bags. Due to the lack of a suitable railway siding at Pinjarra, it is proposed that monazite will be transported by road from the mineral sands separation plants to the Pinjarra site.

The Proponent will incorporate procedures in the plant design for both bulk and bag input of monazite as the form of packaging has yet to be finalised with the Titanium Mineral Producers supplying the monazite.

The gangue residue will be transported in packaged form. The Proponent assessed both two tonne bulka bags and 200 litre drums for the packaging of waste. Transport in bulka bags is currently preferred as it reduces packaging time, hence a reduction in potential radiation exposure to workers.

Road and a combination of road and rail have been evaluated to assess the health, environmental and economical aspects of transporting the gangue residue from the Pinjarra plant site to the IWDF. The Proponents preferred option is for road transport as it has occupational health, management and economic advantages over a road/rail combination. There are fewer handling operations of the containers, reducing the potential risk of accidents occurring during the transfer *of containers. Direct road transport also reduces the number of people involved in the transport operations, thereby minimising the number of workers with potential radiation exposure. The Proponent, together with the transport contractor will have control over the container movements for the entire route.*

The selection of a road route for the road transport of the waste was based on the following criteria:

- *the safest route;*
- *minimisation of the potential impact on communities and traffic;*
- *Category 1 and Category 2 roads (as defined by DOME) wherever possible;*
- *four lane roads in preference to two lane roads, where possible;*
- *roads of suitable width and condition for truck usage;*
- *the availability of Emergency Response Teams to minimise response time; and*
- *preference for roads that have already been approved by Main Roads Western Australia for B-double use.*

This resulted in a preferred route via:

- *Napier Road;*
- *Pinjarra-Williams Road;*
- *South Western Highway;*
- *Albany Highway;*
- *Tonkin Highway;*
- *Roe Highway;*
- *Great Eastern Highway; and*
- *IWDF Access Road.*

PROJECT DESCRIPTION

The Rare Earth Plant will be designed to receive, store and process up to 12,000tpa of monazite to produce a solid rare earth nitrate concentrate totalling 15,000tpa. It is a possibility that some of the rare earth nitrate product will be produced in liquid form. The product will be transported by road to Fremantle for export to France and the USA. The product will not be radioactive.

The Rare Earth Plant will produce a neutralised slurry effluent, comprising mainly tricalcium phosphate (TCP) (23,000tpa) which is largely insoluble, and a low level radioactive solid residue (gangue residue) (6,000tpa) containing thorium, uranium and their radioactive decay products.

The tricalcium phosphate slurry will be held in an evaporation pond from where the solid will be removed as a filter cake and recycled as a source of phosphate for the fertiliser industry.

The remaining effluent water will be evaporated in the ponds.

The gangue residue will be transported to and disposed of at the IWDF. The site of this facility was selected so that it could accept low level radioactive waste such as that to be produced by the Rare Earth Plant.

Processing extracts the rare earth elements from the monazite ore. This involves the following stages:

- ***Ore attack:*** *the cracking of the ground monazite ore by caustic soda resulting in a slurry mixture of trisodium phosphate in solution and solid rare earth hydroxide. This solid contains all constituents of the monazite except the phosphate.*

- ***Hydroxide separation and caustic recycling:*** *the rare earth hydroxide will then be separated from the trisodium phosphate solution, backwashed and filtered to form hydroxide cake. The phosphate stream will be treated with lime to recover caustic soda and to produce tricalcium phosphate as a by-product. The caustic soda will be separated from the tricalcium phosphate by filtration and reconcentrated for recycling to the ore attack unit. The tricalcium phosphate will be neutralised with sulphuric acid and/or with acidic effluent from the Gallium Plant before being stored in the evaporation pond. This pond will act as a temporary storage from which tricalcium phosphate cake will be recovered and recycled as a phosphate for on-selling to the fertiliser industry.*

- ***Acid attack of hydroxide:*** *the hydroxide cake will be dissolved in nitric acid and chemically treated with barium, sulphuric acid and caustic soda to precipitate out its entire radioactive content (thorium, uranium and the decay products). The precipitated solid will be filtered out to leave a non-radioactive solution of rare earth nitrate. The solid will then be transported to the IWDF site. The rare earth nitrate stream will be concentrated by evaporation, cooled and packaged for export as the final product of the plant.*

Raw materials including monazite and process chemicals will be sourced in Western Australia and transported to the site by road in accordance with the appropriate transportation regulations and codes. The rare earth nitrate product will be packaged and transported from the Pinjarra site to Fremantle by road. Tricalcium phosphate by-product will be stored temporarily in the evaporation pond and then recovered and filtered prior to being transported by road from the Pinjarra site to Kwinana.

The main wastes generated by the process and their proposed disposal methods will be:

- *slurry effluent, principally comprising tricalcium phosphate, which will be directed to the evaporation ponds for temporary storage prior to transporting to selected fertiliser companies;*
- *non-radioactive liquid process wastes to be disposed of in the on-site evaporation ponds; and*
- *low level radioactive gangue residue; containing thorium, uranium and their radioactive decay products, to be disposed of at the IWDF.*

A variety of materials will be either disposed of or stored temporarily in the evaporation ponds, the most significant are:

- *tricalcium phosphate;*
- *calcium sulphate;*
- *sodium sulphate;*
- *sodium chloride; and*
- *water.*

The existing evaporation pond system constructed for the Gallium Plant at the Pinjarra plant site comprises two stormwater ponds and two larger evaporation ponds. The evaporation pond system was designed and constructed following extensive consultation with appropriate Government authorities and experienced engineering consultants and has been operational for Gallium Plant effluents.

Gangue residue, containing all the radionuclide streams, will be packaged in bulka bags and loaded into containers for transport to the IWDF by road. Process liquid wastes (containing mainly sodium salts) and plant washdowns will be recycled where possible and then directed to the evaporation ponds for disposal.

The gangue residue will contain:

- *the non-rare earth fraction of the ore;*
- *some non-attacked monazite;*
- *thorium, uranium, iron and titanium as insoluble hydroxides;*
- *insoluble barium sulphate;*
- *radium and lead in the form of insoluble barium sulphate co-precipitates; and*
- *zircon and silica.*

The residue will be insoluble and will be sufficiently moist (around 40%) to ensure that it will not dust and to allow it to be readily recoverable should an accidental spill occur. It will contain the radioactive components of the monazite at approximately double the original concentration. The specifications of the waste will conform with those defined by the Code of Practice for Near-Surface Disposal of Radioactive Waste in Australia (NHMRC, 1992) and by the operators of the IWDF.

The gangue residue will be automatically placed into heavy duty two tonne bulka bags. The bags containing the residue will be initially stored in a dedicated building and then loaded into either standard ISO steel shipping containers or purpose built steel containers for transportation. Each truck would carry two steel containers with up to twelve two tonne bags. Three truck movements a week will be required to transport the waste from Pinjarra to the IWDF via the major roads and highways mentioned previously.

Management of the disposal operations at the IWDF will be the responsibility of the operator of the IWDF and therefore details of the disposal operations are not contained in the ERMP. Disposal of the waste will be subject to separate assessment by way of an Environmental Management Programme (EMP) prepared by the operator of the IWDF. The EMP will be released during the ERMP public review period to allow public assessment of the Rhône-Poulenc project and the subsequent disposal operations.

Construction of the proposed plant is anticipated to take approximately 12 months and will take into account special requirements for a processing plant of this type. The expected life of the project is a minimum period of 20 years, however, this could be extended depending on the longevity of the monazite source from the Titanium Mineral Producers.

The majority of the plant infrastructure and services for the Rare Earth Plant already exists as part of the Gallium Plant. Existing off-site facilities and transport networks will be used where necessary.

COMMUNITY CONSULTATION PROGRAMME

The Proponent has given a high priority to community consultation during the planning and assessment phases of the project. The community consultation programme commenced at the initial planning stage of the project to enable the following:

- *early advice to community and interest groups;*
- *a genuine two-way consultative process;*
- *community access to the Proponent's decision-makers; and*
- *a flexible approach to project planning to accommodate community concerns.*

An extensive programme was implemented during the preparation of the ERMP and will continue during the public review period, with follow-on programmes conducted during the construction and operations of the plant.

The programme comprises the following:

- *meetings with Federal, State and Local Government bodies;*
- *issue of media statements;*
- *distribution of letters to various parties announcing and providing details of the project;*
- *open day site visits;*
- *briefings with Murray, Coolgardie and Yilgarn Shire Councils;*
- *briefings to community and interest groups;*
- *meetings with shire and city representatives along the transport route;*
- *meeting with city representatives of Kalgoorlie/Boulder;*
- *speaking engagements to clubs and other groups;*
- *distribution of background information leaflets;*
- *establishment of a free call line as a source of information;*
- *preparation of a static display for use in the local areas;*
- *workshops held at Pinjarra, Coolgardie and Southern Cross;*
- *establishment of an information centre in Pinjarra;*
- *direct mail information to local residents;*
- *a workshop held with Conservation Council representatives; and*
- *briefings to the Mt Walton Community Liaison Committee.*

Key issues raised by community groups fall into five principal categories:

- *transport;*
- *plant site safety;*
- *environmental management at both the Pinjarra site and the IWDF site;*
- *social issues; and*
- *philosophical concerns (general concerns not directly related to the Proponent).*

Specific questions were raised at the workshops, these were recorded and answered by the Proponent and its technical advisers at the workshop when time allowed. All of these questions are documented in the ERMP with the Proponent's response.

EXISTING ENVIRONMENT

The existing environment of the Pinjarra area has been well described as a result of the various developments proposed for the area. The climate is temperate mediterranean with a substantial excess of evaporation over precipitation. The plant lies in the foothills of the Darling Scarp and extensive site studies have been undertaken to assess and describe the climate, geology, hydrogeology, biology, radiology, heritage, ethnography and archaeology of the site.

The site is located above thick sedimentary sequences of the Perth Basin. Regional groundwater flow is to the west and northwest and surface drainage flows in two westward-flowing streams, one towards the Murray River and the other flowing into surface sands.

There is no native vegetation left on the actual plant site. There are a few remaining Jarrah (Eucalyptus marginata) and Marri (E. calophylla) scattered through the property. Approximately 190ha of trees have been established on the property comprising of native trees and shrubs planted around the southern border and a hardwood plantation of Blue Gums (E. globuli) developed by CALM.

The primary land use of the region is farming, forestry and mining. Shires of Murray, Mandurah and Waroona have been selected for purpose of the study. Population projections for the study region indicate higher levels than Western Australian growth rates. Unemployment in the study region is higher than the State average, however, this figure is largely attributable to the Mandurah area, which comprises 70% of the workforce, with a high unemployment rate.

Ethnographical and archaeological studies have identified a disused Aboriginal camp site on the Proponent's property. There is now no physical sign to mark the site of the camp and its mapped location is based totally on memory of the Aboriginal people consulted. No further disturbance is planned near the location of the temporary campsite.

A survey of baseline radiation levels at the plant site was carried out in 1988. The results suggest that the site already has natural levels of radiation which are above world average levels but are within the range of natural background radiation levels found in Western Australia. A further survey of the plant site and surrounding areas for radiation levels concerning radon and radon daughters will be undertaken prior to commissioning of the plant.

ISSUES AND MANAGEMENT

The principal environmental issues relate to the fact that monazite, the ore that will be processed to produce rare earth nitrate, contains radioactive elements. The radioactive component will not be recovered in the process, and will be contained in the waste material generated by processing monazite. The waste will be transported to the IWDF. In addition to the monazite feedstock, other raw materials such as acids and lime will be required for the process. The transport of the raw materials and waste are discussed in the ERMP.

A summary of the issues and management relating to the project is presented as Table 1.

The main environmental issues fall into three categories:

- *transport;*
- *waste disposal; and*
- *radiological issues.*

Transport

The existing road network will be used for the transport of all materials for the project and for workforce and service vehicle movements. The increase in existing heavy vehicle movements on roads in the Pinjarra area is in the order of 4-18%. Vehicle movements due to the operations workforce would increase the existing traffic volumes by about 5%. Monazite and some of the process chemicals are classified as Dangerous Goods and transport handling methods will conform to the requirements of the Dangerous Goods Regulations, 1992. In addition, the transport of monazite will comply with the Code of Practice for the Safe Transport of Radioactive Substances, 1990 (referred to as the Code for Transport) (Commonwealth of Australia, 1990). There is a good safety record for these materials being transported on metropolitan and country roads in large quantities. The increase in the number of truck movements of these materials due to the project will be small.

Three truck loads of gangue residue will be transported from the plant site to the IWDF each week. The transport will be in compliance with the Code for Transport (Commonwealth of Australia, 1990).

The gangue residue will be in the form of a moist clay and will be insoluble, non-toxic and will not be a chemical hazard. It is classified as Low Specific Activity type material for the purpose of transport which is the lowest category of hazard for the transport of radioactive materials. The hazard of this material is very low when compared with other radioactive materials regularly transported throughout the State such as industrial radiography sources, radio-pharmaceuticals and some other industrial sources. It also represents a low hazard when compared with the transport of other common hazardous materials such as LPG, petrol, sodium cyanide, chlorine and chlorine compounds and many other chemicals regularly transported by road.

A driver safety training programme and an emergency response plan will be prepared by the Proponent to minimise the risk of spillage of waste and, in the unlikely event of an accident, stipulate procedures to minimise any human health risks and clean-up any spilt material.

Waste Disposal

The effluent disposed of in the evaporation ponds will comprise non-radioactive liquid process wastes containing sodium salts, water from plant washdown areas and, if necessary, water from the stormwater pond. Rare Earth Plant process wastewaters will be neutralised by Gallium Plant effluent and will be non-toxic and pose little potential impact to the environment even in the unlikely event of seepage.

The design features of the evaporation ponds will ensure that, in addition to the substantial clay liner which minimises leachate from the ponds, any material seeping through the clay liner will be intercepted by the underdrainage system and returned to storage.

Management of potential leachates will be facilitated by the groundwater monitoring system that is already in place at the plant site. This system allows abstraction from the bores as well as groundwater level and quality determination and will thus indicate any development of leachate plumes in the subsurface and allow for plume recovery.

Results of groundwater monitoring have indicated that there have been no significant changes in the chemistry of the groundwater under the site due to the presence or operation of the evaporation ponds. The monitoring bores will continue to be monitored on a regular basis with the monitoring programme extended upon commissioning of the Rare Earth Plant.

Disposal of low level radioactive waste, resulting from mineral processing such as monazite, at the IWDF was previously proposed by the Health Department of Western Australia and was subsequently given conditional approval by the Western Australia Minister for the Environment. One of the approval conditions is that the operator of the IWDF shall prepare an EMP to the satisfaction of the EPA and this made available to the public. Therefore, the current operator of the IWDF (DEP's Waste Management Division) is preparing an EMP which will be available for public comment during the ERMP public review period.

Gangue residue is a low level radioactive waste, therefore it must be disposed of correctly. Disposal operations and management of such operations will be in accordance with the following requirements:

- *existing Ministerial conditions for operation of the IWDF site;*
- *applicable legislation;*
- *the National Health and Medical Research Council Code for Near-Surface Disposal of Radioactive Waste (NHMRC, 1992);*
- *the EMP for the disposal operations; and*
- *the IWDF site Radiation Management Plan (RMP).*

The total area, of the IWDF site is approximately 2,500ha, an area of 6ha (0.25% of the total site area) will be required for 20 years disposal of waste from the Rare Earth Plant.

Waste disposal operations including transport will be subject to an annual audit to assess if the operations comply with the relevant regulations and environmental approvals given for the project.

Radiological Issues

The principal issues relating to the radiological components of the project are:

- *radiation from the plant;*
- *transport of the monazite and gangue residue; and*
- *disposal at the IWDF site.*

Radiation protection procedures are required to ensure that workers and the general public do not receive unacceptable levels of exposure. These procedures apply to all aspects of the project where radioactive materials are handled or processed, including:

- *transport of monazite feedstock to the Pinjarra plant;*
- *transfer of monazite to the mill;*
- *grinding of monazite;*
- *removal of phosphate from the monazite matrix by dissolution with sodium hydroxide to produce a filter cake of rare earth hydroxide;*
- *dissolution of the rare earths from the rare earth hydroxide with nitric acid;*
- *precipitating of radium with barium sulphate; and*
- *packaging, transport and disposal of gangue residue containing the radioactive components of the monazite.*

The Rare Earth Plant has been specifically designed in its layout to minimise radiation exposure to workers. The overall layout is designed to separate the parts of the plant where radioactive materials are handled from the rest of the process units, resulting in well defined restricted areas and better control of access by personnel.

The radiation objectives for design and management of the plant will be approximately half the regulatory dose limits for radiation exposure. A principal objective will be to minimise doses to workers and the general population ensuring that, with occupancy factors and other administrative precautions, the doses will be as low as reasonably achievable (ALARA).

Exposure to gamma radiation can be controlled by adhesion to the principles of radiation protection, namely; time, distance and shielding. In order to minimise radiation exposure, controlled areas will be designated in which administrative controls over access and working times will be exercised. Workers will only need to remain in the controlled areas of the plant for a short time as the use of automation and modern process control can reduce the manual time required. Areas occupied by the workers will be located as far as practicable from the controlled areas and appropriate shielding will be provided to reduce general gamma radiation levels.

Control of airborne activity will be achieved through containment of the activity and by wet processing to reduce dust production. Any airborne activity in vented vessels will be filtered to remove particulates, and gaseous radon and thoron will be vented outside the plant building to ensure suitable dilution is achieved.

The operation of the Rare Earth Plant will have no significant impact on the radiation exposure of the general public.

A comprehensive Radiation Management Plan (RMP) for the Rare Earth Plant and its environment will be prepared and implemented to ensure that the safety and health of the Proponent's employees and the general public will not be impaired. The RMP will include a radiation monitoring programme for all operations of the plant. The monitoring programme will aim at detecting and determining any releases of radioactive materials and will also measure radiation doses to workers and estimated doses to the general public. It will cover the following three stages:

- *pre-operational monitoring;*
- *operational monitoring; and*
- *post-operational monitoring.*

In addition, occupational health monitoring will be undertaken for plant site workers.

Pre-operational monitoring is aimed at providing a baseline of environmental radiation data which will be used to determine whether there have been significant changes attributable to the operation of the plant. Operational monitoring will aim at identifying any changes to the baseline levels measured in the pre-operational monitoring. Pre-operational monitoring data will also provide a reference level for rehabilitation of the site upon decommissioning.

Monitoring will be detailed in the RMP and will include:

- *Gamma radiation monitoring;*
- *Radon flux;*
- *Radionuclides in soil and sediment;*
- *Radionuclides in air;*
- *Radon, thoron and descendants; and*
- *Radionuclides in water.*

Occupational monitoring of workers at the plant site will be detailed in the RMP for the plant. The aim of the monitoring is to detect any increases in radiation levels in the plant and at fixed locations (environmental monitoring) and to measure the actual exposure of workers (personnel monitoring).

The results of the monitoring programmes will be used to estimate the total dose to workers. The Proponent will establish an operational dose constraint of half the maximum dose limit to assist in keeping doses as low as reasonably achievable (ALARA principle).

The Code for Transport is designed to ensure that doses to the public during transport of radioactive substances are very small. Compliance with this Code and the nature of the material will ensure that public exposure during transport is negligible. Estimations of dose levels based on measured radiation levels from bags and containers of monazite indicate that it would require a person to be in contact with the waste for five hours to reach the public dose limit. It is unlikely that members of the public would remain close to the waste for such periods even in emergency situations.

The Proponent will establish an operational dose constraint for drivers involved in transporting the waste to reduce driver dose limits to less than half of the regulatory limits.

Radiological issues relevant to the IWDF site will be:

- *minimising the health risk to humans from radiation exposure; and*
- *protecting the environment in both the short and long term from unacceptable radiation exposure.*

Radiation exposure and the protection of the environment will be managed in the short term through the development and use of the EMP and RMP for the disposal operations. In the long term, exposure and protection of the environment will be controlled through the integrity of the disposal structure.

OTHER ENVIRONMENTAL ISSUES

Other potential environmental issues relating to the project are; the pipeline used to transfer caustic soda from the nearby refinery, storage and handling of process chemicals, noise, and the visual impact of the plant. Social issues mainly relate to the positive effect of employment generation in the local area and the economic advantages of a new industry.

The plant site incorporates a substantial buffer area, the total development will impinge on less than 25ha within a total landholding of 515ha. The proposed Rare Earth Plant location is 500 metres from the closest boundary and it is a further 300m from the boundary to the nearest residence.

DECOMMISSIONING AND REHABILITATION

A decommissioning and rehabilitation programme will be undertaken for the Pinjarra site at the end of the plant's life. The objectives of the programme will be to:

- *eliminate unacceptable health hazards;*
- *restore the site to a condition such that it may be returned to its former land use (for agricultural purposes), or such other use as may be appropriate at the time of decommissioning; and*

- *ensure that the State does not incur any ongoing liability with regard to the plant.*

Management of the closure and rehabilitation of the evaporation ponds will require that the remaining free water be evaporated and cover materials placed over the ponds and contoured to promote runoff.

GENERAL MANAGEMENT

In accordance with the Proponent's overall commitment to the development of an environmentally sound project 35 commitments have been made in the ERMP.

TABLE 1

SUMMARY OF THE ISSUES AND MANAGEMENT OF THE RHÔNE-POULENC RARE EARTH PLANT AT PINJARRA

Category	Topic	Aspects of Concern	Present Status	Proposed Action and Objective	Proposed Management	Predicted Outcome
Biophysical Environment	Vegetation and Flora	Loss or degradation to vegetation and flora	• Plant site already cleared. • Small percentage of native vegetation remaining on the proposed additional pond site (if required).	• Clear area required for pond (if necessary). • Aim is to minimise disturbance to vegetation.	• Area to be cleared for the pond is less than 1% of the total property. • Revegetation is well established on the property (20ha of screening vegetation and 170ha of hardwood plantation).	• No significant impact on vegetation and flora on the site.
	Fauna	Impact on rare, restricted and endangered fauna due to vegetation clearing and plant operations	• Unlikely to be any rare, restricted or endangered fauna on the site. • No likely habitats on site to be cleared.	• Clearing is unlikely to result in the disturbance to fauna.	• None required.	• No impact on rare, restricted or endangered fauna.
	Reserves	Impact on Reserves in the area	• Nearest reserves and State Forest blocks are greater than 1km from plant site.	• Not applicable.	• None required.	• No impact on Reserves.
	Radiological Environment	Increase in ambient radiation levels around the Proponent's property	• Site already has natural levels of radiation above those of world average, but are within the range of natural background radiation levels found in WA.	• Radioactive components in the process are due to those contained in the monazite feedstock. There is no additional radioactivity generated by the process. • Some minor releases of radon during the processing of monazite. • All radioactive material will be contained in the waste to be disposed of at the Government's Intractable Waste Disposal Facility (IWDF) in the eastern Goldfields of WA.	• Plant designed in both layout and process technology to minimise radiation emanation. • A Radiation Management Plant (RMP) will be prepared detailing operational procedures and environmental monitoring for radiation levels including radon.	• No significant increase in ambient radiation levels at the plant boundary.
	Hydrology	Impact on surface drainage	• Gallium Plant and infrastructure exist alongside proposed plant site. • Rare Earth Plant site already cleared. • Evaporation ponds have been constructed and operational.	• Construct Rare Earth Plant building. • Additional evaporation pond may be required. • Plant and pond sites are located with respect to surface drainage of the site.	• Plant runoff initially directed to the stormwater ponds. • Additional pond designed not to impact on surface drainage.	• Minimal impact on surface drainage.
Pollution Potential	Effluent Disposal	Impact of the disposal of process effluents on the environment	• Gallium Plant effluents directed to the existing evaporation ponds when the plant was operational. • Ponds currently contain residue of Gallium Plant effluents and rainwater.	• Process effluent from the Rare Earth Plant will be neutralised with Gallium Plant effluent and directed to the evaporation ponds. • The effluent will principally comprise sodium salts. • Effluents will be concentrated by solar evaporation, thereby reducing the volume to be disposed.	• Regular monitoring of the evaporation ponds to determine, input and output volumes, quality of the effluent. • Sumps in the underdrainage systems will be monitored for water levels and water quality to determine if there is any seepage from the ponds. • Water collected in the underdrainage system will be collected and returned to storage.	• Minimal potential impact on the environment.
	Evaporation Ponds	Impacts on groundwater resources under the site due to leakage from the evaporation ponds	• Moderate amount of reasonable quality groundwater under the site. • Evaporation ponds are constructed and have been operational for Gallium Plant effluents.	• To dispose of non-radioactive process effluents into the existing evaporation ponds. • Ponds have been designed with a substantial clay liner to minimise leachate and an under drainage system to collect any seepage and return it to storage. • The objective of the ponds is to achieve zero discharge to the groundwater environment.	• Pond design to minimise leachate. • Groundwater monitoring system comprising 33 bores at 11 locations around the site. • Bores are monitored on a regular basis for groundwater levels, and quality determination and will thus indicate any development of leachate plumes in the subsurface. • Bores will allow for plume recovery by abstraction, if necessary.	• No impact on groundwater quality is expected. • Seven years of monitoring has indicated that there have been no significant changes in the chemistry of the groundwater due to the presence or operation of the evaporation ponds.
		Impact of a breach of the evaporation ponds on the surface hydrology of the area	• Evaporation ponds are located in the Murray River catchment area. • Murray River flows into the nutrient enriched Peel-Harvey Estuary.	• Non-radioactive process effluent will be disposed of in the evaporation ponds. • Tricalcium phosphate will be stored temporarily in the ponds prior to being recovered for sale to the fertiliser industry. • Evaporation ponds have been designed to ensure containment of material.	• Design of the evaporation ponds has accounted for factors such as overtopping and erosion. • The contents are unlikely to escape from the evaporation ponds, however, worst case situations due to a total breach of a wall or overtopping have been assessed.	• Minimum potential impact on the Murray River system due to the normal storage and disposal of process effluent in the ponds. • Minimal potential impact on the Murray River system in the unlikely event of a total breach of the ponds.

TABLE 1
(continued)

Category	Topic	Aspects of Concern	Present Status	Proposed Action and Objective	Proposed Management	Predicted Outcome
Pollution Potential (continued)	Solid Waste Disposal	Impact of the disposal of the low level radioactive gangue residue	• The State Government has established an Intractable Waste Disposal Facility (IWDF) near Mt Walton in the Eastern Goldfields of Western Australia. • The IWDF has been approved as a suitable site for the disposal of this type of waste.	• Gangue residue will be disposed of by burial at the IWDF. • The disposal of the waste will be the responsibility of the State Government but will be funded by the Proponent. • Waste disposal and operations will be detailed in an Environmental Management Programme (EMP) to be prepared by the operator of the IWDF in conjunction with this project.	• The IWDF has been selected from a detailed site selection study as an appropriate site for a disposal facility due to factors such as remoteness, geological stability, arid climate and lack of potable aquifers. • Waste disposal operations will be the responsibility of the Government and will be conducted in an environmentally acceptable manner and in accordance with legislative requirements including the detailed EMP and RMPs prepared specifically for the disposal of waste from the Rare Earth project. • Environmental and personnel monitoring will be conducted to ensure the management objectives are being achieved.	• Disposal of the gangue residue at the IWDF will have minimal impact on the environment.
	Transport of Materials	Impact of a spill of raw materials and process chemicals whilst being transported	• There is an existing regime of truck movements of raw material (monazite and lime) and process chemicals (acids) on metropolitan and country roads in Western Australia in much larger quantities than required for this project. • Most of the materials are classified as Dangerous Goods.	• Raw materials and process chemicals will be transported to the Pinjarra plant site by road in appropriate trucking containers by the suppliers of the materials in a safe manner. • There will be approximately 22 trucks per week transporting the raw materials and process chemicals to the plant.	• All materials will be transported according to the appropriate codes and regulations. • Acids and monazite will be transported according to the requirements of the Dangerous Goods Regulations, 1992. • Monazite, a low level radioactive material, will be transported also according to the requirements of the Code of Practice for the Safe Transport of Radioactive Substances, 1990. • Emergency Response plans are established for these materials. • Drivers contracted to the companies supplying the material are specifically trained for emergency situations.	• The potential for a spill from trucks transporting materials for this project is low due to the small increase in number of trucks required. • In the unlikely event of a spill, adequate emergency response plans will be in place to minimise any pollution potential from a spill.
		Impact of a spill of tricalcium phosphate or rare earth nitrate products	• Similar products containing phosphate and nitrate are currently transported by road in Western Australia. These products are not classified as Dangerous Goods.	• Tricalcium phosphate will be transported from the Pinjarra plant site to Kwinana in the form of a moist slurry most likely in a tanker truck. • Rare earth nitrate will be packaged and transported by road from Pinjarra to Fremantle for export. • Transport of these materials will be the responsibility of the Proponent and transport procedures will ensure that there is minimal potential of a spill should an accident occur. • A total of 28 trucks per week is likely to be transporting the products from the Rare Earth Plant.	• Transport of these materials will be according to the appropriate Codes and Regulations as will the packaging requirements of the product. • The Proponent will contract only reputable transport operators and will ensure that the codes and regulations are adhered to. • Emergency response plans and clean-up procedures will be prepared to ensure that in the unlikely event of a spill there is little or no impact on the environment.	• There is unlikely to be any impact on the environment due to the transport of the products from the Rare Earth Plant.
		Impact of a spill of low level radioactive gangue residue	• Low level radioactive materials, such as from mineral sand processing, are currently transported on country and metropolitan roads in Western Australia. • Other radioactive materials of much higher radioactivity (such as Industrial Radiography sources, radio-pharmaceutical and some industrial sources) are regularly transported throughout the State.	• The gangue residue will be packaged in bulka bags and transported in containers on trucks, from Pinjarra to the IWDF. • The transport operations and procedures will minimise the risk of a spill.	• The material will be packaged into heavy duty bulka bags and packed into containers to minimise the potential of spillage. • The material will be a moist clay like form which will not flow or dust. It will be insoluble and immobile thus minimising dispersion into the environment from a spill and allowing for ease of recovery. • Transport will be according to the requirements of the Code of Practice for the Safe Transport of Radioactive Substance, 1990. • Transport operations will be approved by the appropriate authorities. • Detailed emergency response plans and clean-up procedures will be prepared to deal with a spill if it occurs. • All of spilt material will be retrieved and repackaged for disposal.	• There will be minimum potential hazard to the public or impact on the environment from a spill of the gangue residue.

TABLE 1
(continued)

Category	Topic	Aspects of Concern	Present Status	Proposed Action and Objective	Proposed Management	Predicted Outcome
Pollution Potential (continued)	Noise	Noise impact from construction activities	• No current construction activities.	• Construction of the Rare Earth Plant involves heavy machinery and transport of construction materials. • The objective is to minimise any potential noise impact due to construction activity.	• Restriction of construction activities to daylight hours. • Acceptable and appropriate site management through the construction stage. • Appropriate noise regulations will be adhered to. • Large buffer area between plant site and nearest neighbour.	• No significant impact expected from construction activities. • Any potential impact due to noise from construction activities will be short-lived.
		Noise impacts during the operations due to the plant	• Plant site is located within a large buffer area. • Some existing noise levels from the nearby Alcoa Refinery. • Noise levels from other rare earth plants indicate that the plant operations will be relatively quiet.	• The main noise source will be from electrical motors. These motors will be relatively small and will be enclosed in buildings. • Noise from plant operations will be minimal.	• The plant will be designed for noise containment, such as housing motors inside building. • A noise monitoring survey will be conducted prior to and during plant operations. • Noise levels from the Gallium Plant and Rare Earth Plant operating simultaneously will meet the requirements of the noise regulations and appropriate actions will be taken to rectify any noise problems should levels exceed those in the noise regulations.	• No noise impact is expected due to plant operations.
		Noise relating to transport of materials due to plant operations	• High frequency of existing heavy vehicle movements associated with industry throughout the region.	• 22 heavy vehicle movements per day or an increase of between 4-18% in heavy vehicle movements in the Pinjarra region. • The objective is to minimise the noise impact of heavy vehicles associated with the project.	• Truck movements will be restricted to Monday to Friday business hours, wherever possible.	• No significant impact due to the increase in heavy vehicle movements.
	Caustic Soda Pipeline	Rupture of the pipeline supplying caustic soda	• A carbon steel pipeline has been constructed to supply caustic soda to the Gallium Plant. • Alcoa has many kilometres of similar pipes throughout its site.	• Caustic soda will be pumped directly from Alcoa's Refinery to the Proponent's operations.	• Monitoring will be conducted at each end measuring the rate, pressure and temperature. • Inbuilt alarm systems. • Pipeline inspected daily. • Pipeline can be shutdown immediately. • Clean-up procedure will be implemented in the unlikely event of a spill.	• Minimum potential impact on the environment.
Social Surroundings	Ethnographical Sites	Impact on Aboriginal sites near the plant	• One Aboriginal site identified as a relatively short term camping site (external to plant site).	• No disturbance planned.	• Avoid site.	• No impact.
	Archaeological Sites	Impact on archaeological sites	• No archaeological sites have been identified at the plant site.	• Not applicable.	• None required.	• No impact.
	Historical Sites	Impact on historical sites	• No sites in or near the process plant site are listed on the National Estate.	• Not applicable.	• None required.	• No impact.
	Traffic	Impact of increase in traffic numbers due to the project in terms of safety and noise	• Relatively high volumes of traffic through the region including heavy vehicles. • Annual average daily traffic volumes range between 1,000 to 11,000 on the main roads in the Pinjarra region with an estimated 6% to 12% heavy vehicle component through Pinjarra.	• 22 truck movements per day in the Pinjarra region increasing the heavy vehicle components through Pinjarra between 4-18%. • Other vehicle movements per day increasing existing levels by around 5%. • The objective is to manage the impact of additional vehicle movements due to the project.	• Truck movements will be scheduled, wherever possible, for business hours Monday to Friday. • The most appropriate and safest roads will be used as the transport route.	• A relative impact on Pinjarra residents due to the 4-18% increase in heavy vehicles and 5% increase in other vehicle movements.
	Visual	Impact of the Plant on Visual Amenity	• Gallium Plant and Infrastructure exists on the site. • Alcoa's Alumina refinery in the region. • Extensive vegetation screening already on the Proponent's property. • Large buffer area around plant site.	• Construction of an additional building for the Rare Earth Plant.	• Use of vegetation to screen the buildings. • Construction of the new building will be designed to blend in with the existing buildings.	• No impact on visual amenity.
	Economic	Regional benefits of the project	• Gallium Plant is currently on a care and maintenance programme and will be restarted with the Rare Earth Plant. • High unemployment in the region. • Monazite is currently being disposed of as a waste. • No income to the State or Australia from the monazite resource.	• Establish the Rare Earth Plant and restart the Gallium Plant. • Employ up to 60 people (from local area). • Process the monazite to produce a valuable product for export.	• Preference to employ local people. • Use of local services, suppliers and contractors for plant operations.	• Provide employment opportunities and flow on effects to the local community. • Help to reduce the high levels of unemployment in the region. • Increase the export income to Australia of around $50 million for Rare Earth and Gallium. • Produce a product suitable for future downstream processing in Australia.

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ENVIRONMENTAL REVIEW AND MANAGEMENT PROGRAMME
RARE EARTH PLANT
for
Rhône-Poulenc Chimie Australia Pty Ltd

1.0 INTRODUCTION

1.1 BACKGROUND

Rhône-Poulenc Chimie Australia Pty Ltd (Rhône-Poulenc) proposes to develop a Rare Earth Plant on a site adjacent to the existing Rhône-Poulenc Gallium Plant. The plant site is located 4km south of Alcoa's alumina refinery at Pinjarra, approximately 100km south of Perth via the South West Highway and 30km southeast of Mandurah, the nearest regional centre. It is 9.5km southeast of Pinjarra, the nearest town, via the Pinjarra-Williams Road (Figures 1.1, 1.2, and 1.3).

The project will involve the processing of monazite ore to produce rare earth nitrate for export. Wastes from the process will be disposed of at an approved Government Facility near Mt Walton located in the Goldfields (Figure 1.1).

Monazite is produced in Australia as a by-product from the processing of mineral sands to produce the titanium minerals ilmenite, rutile and zircon. It is a rare earth phosphate which also contains small quantities of other elements including thorium (approximately 6 percent ThO_2), uranium, iron, titanium and other metals.

The monazite feedstock for the proposed processing plant will be obtained from existing mineral sands separation plants at Narngulu (near Geraldton), Eneabba, Capel and Bunbury in Western Australia (Figure 1.1).

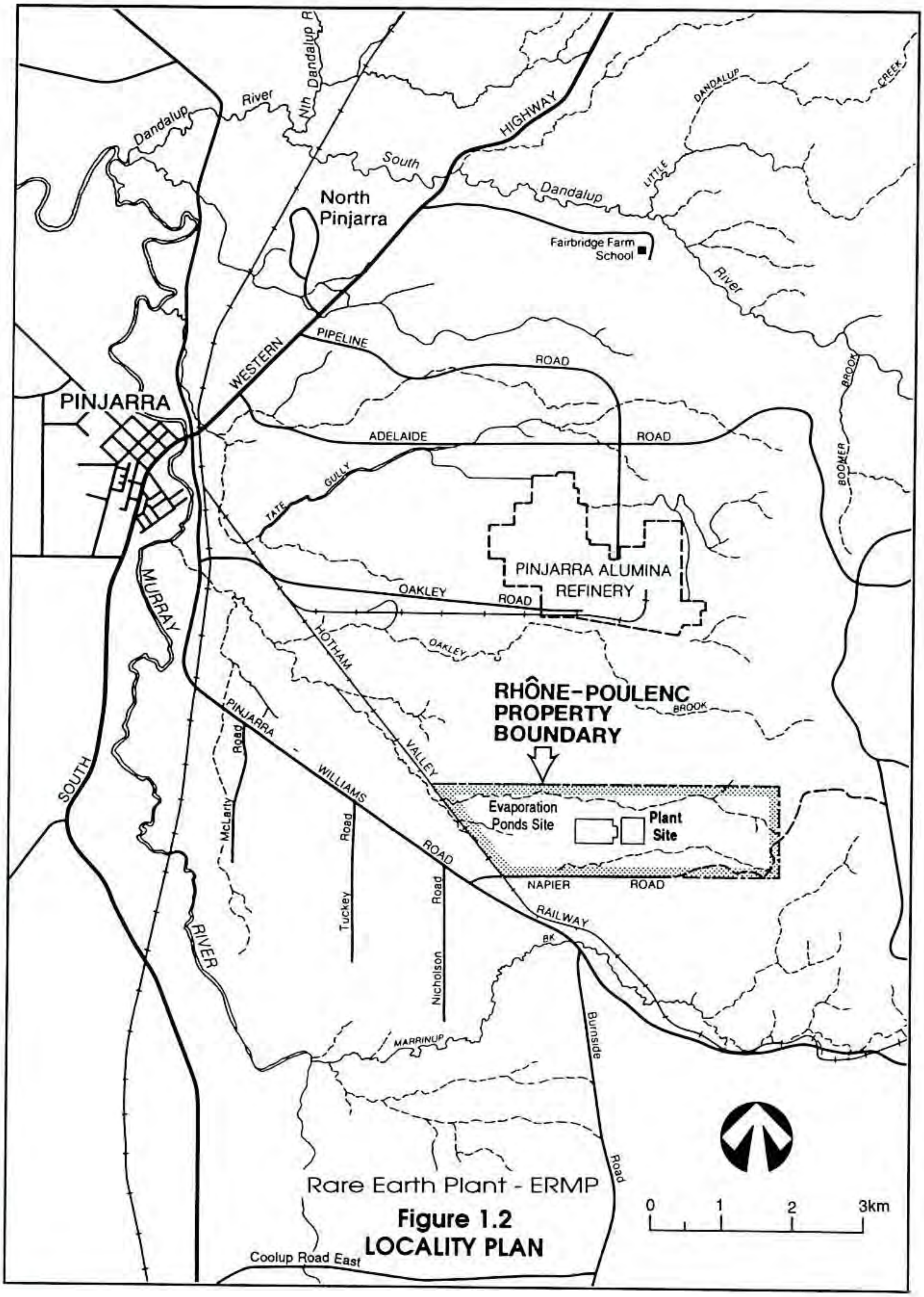
Currently monazite has no commercial value and its disposal incurs a cost. The present practice is to transport the monazite-rich tailings stream from the separation plants back to the minesites for storage or disposal. The Rhône-Poulenc proposal therefore provides the opportunity to add value to a mineral currently having no commercial value.

As part of the environmental assessment process in Western Australia, the project was referred to the Environmental Protection Authority (EPA). The Proponent was notified that the project would be formally assessed as an Environmental Review and Management Programme (ERMP), in accordance with the provisions of the Environmental Protection Act 1994 (as amended). The ERMP has been prepared specifically for the Rare Earth Plant in accordance with guidelines prepared by the DEP/EPA (Appendix A).

Rare Earth Plant - ERMP
Figure 1.1
LOCATION MAP

1.2 HISTORY OF PREVIOUS PROJECTS

Rhône-Poulenc was granted approval by the Western Australian Government to develop a gallium extraction plant at the Pinjarra site in 1987. The Gallium Plant was designed and constructed during 1987-1989 and was operational from 1989 to 1990 at which time it was placed on a care and maintenance programme due to a downturn in market conditions. It represents an investment of $50 million, including $20 million worth of infrastructure consisting of laboratories, offices, workshops, utilities (compressed air, steam, communications, water, fire protection, etc.), amenities, buildings and evaporation ponds. There is also an established network of groundwater monitoring bores. This infrastructure was established to service both the Gallium Plant and a future Rare Earth Plant. The establishment of a Rare Earth Plant will facilitate an earlier restart of the Gallium Plant.


Dandalup
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WESTERN
North
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DANDALUP
LITTLE
CREEK
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Fairbridge Farm
School
PIPELINE
ROAD
PINJARRA
ADELAIDE
ROAD
BROOK
BOOMER
TATE
GULLY
PINJARRA ALUMINA
REFINERY
OAKLEY
ROAD
OAKLEY
MURRAY
HOTHAM
RHÔNE-POULENC
PROPERTY
BOUNDARY
BROOK
PINJARRA
Road
McLarty
WILLIAMS
VALLEY
Evaporation
Ponds Site
Plant
Site
ROAD
NAPIER
ROAD
Road
Tuckey
Road
Nicholson
RAILWAY
BK
SOUTH
RIVER
Burnside
MARRINUP
Road
Rare Earth Plant - ERMP
Figure 1.2
LOCALITY PLAN
Coolup Road East
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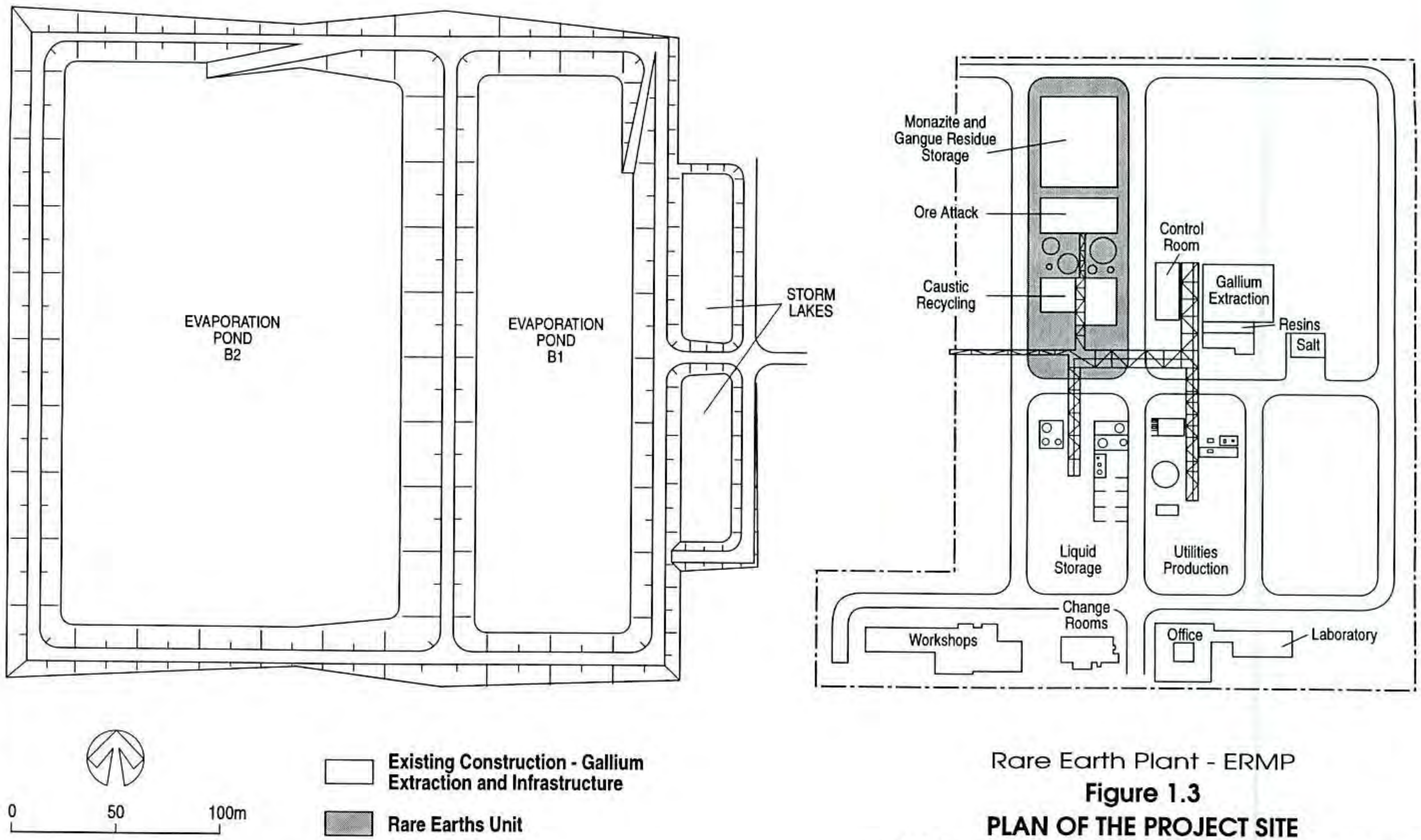


Rare Earth Plant - ERMP

Figure 1.3

PLAN OF THE PROJECT SITE

GALLIUM EXTRACTION AND RARE EARTH PLANT

Rhône-Poulenc sought to establish a Rare Earth Plant at the Pinjarra site in 1988. The project was to process monazite to produce rare earth hydroxides and the separation of rare earths from rare earth nitrate. The 1988 project was the subject of an environmental impact assessment under Western Australian and Commonwealth Government legislation. An Environmental Review and Management Programme/Draft Environmental Impact Statement (ERMP/Draft EIS) was released for public review in February 1988 (Dames & Moore, 1988a), and the Supplement to the EIS (Dames & Moore, 1988b) was released in September 1988. The project, as described in the ERMP/Draft EIS, included the construction and operation of facilities at two locations:

- the processing plant at Pinjarra; and
- a waste disposal facility in the Eastern Goldfields.

Subsequent to the public release of the ERMP/Draft EIS, the waste disposal facility component of the 1988 project was incorporated into the State Government's proposal for an Integrated Waste Disposal Facility, since re-named the Intractable Waste Disposal Facility (IWDF), located near Mt Walton in the Eastern Goldfields. This change to Rhône-Poulenc's proposal meant that responsibility for disposing of wastes at the IWDF passed to the operator of the IWDF when the waste left Rhône-Poulenc's Pinjarra plant site (Dames & Moore 1988b).

A Public Environmental Review (PER) was prepared by the Health Department of Western Australia (Maunsell, 1988) which included the proposal to dispose of 7,000 tonnes of thorium hydroxide waste, generated by the processing of monazite to produce rare earths, at the IWDF. The PER, including the disposal of thorium hydroxide waste, was assessed by the EPA (EPA, 1988b) and then subsequently approved by the Minister for the Environment subject to certain environmental conditions. A copy of the EPA's Report and Recommendations and the Ministerial conditions associated with the IWDF proposal are presented in Appendix B. Both the EPA's Report and Recommendations and the Ministerial Conditions require that an Environmental Management Programme (EMP) be prepared by the operator of the IWDF and that the EMP be available to the members of the public.

An EMP was prepared by the Health Department of Western Australia (Health Department of Western Australia, 1989) for the disposal of radioactive waste at the IWDF. The programme specifically addressed, amongst other things, the disposal of thorium hydroxide waste from the proposed Rhône-Poulenc Rare Earth facility by burial in trenches. However, due to Rhône-Poulenc withdrawing its original proposal in 1990 the component of the EMP relating to the disposal of rare earth wastes was not assessed.

The Western Australian EPA released its Report and Recommendations on Rhône-Poulenc's ERMP/EIS (EPA, 1988a) in September 1988 and the Environmental Assessment Report of the Commonwealth Department of the Arts, Sport, the Environment, Tourism and Territories (DASETT, 1988) was released in October 1988. The summary and recommendations of both assessment reports are presented in Appendix C.

The Federal Environment Protection Agency approved the complete project subject to the WA EPA's assessment. The EPA found Stage I (to produce rare earth hydroxide) of the rare earths project to be environmentally acceptable (subject to various conditions, such as the proponent adhering to environmental management commitments made in the ERMP/Draft EIS) but that Stage II (to separate the rare earths from the rare earth nitrate) of the project, which would generate quantities of ammonium nitrate as a by-product, was not environmentally acceptable for the following reasons:

- "*The long term storage of large quantities of ammonium nitrate in the Peel-Harvey Catchment is unacceptable in the long term because of the potential to add significant quantities of nitrogen to the Peel-Harvey Inlet, an area already subject to nutrient enrichment problems;*

- *The long term storage of large quantities of ammonium nitrate above potable and near potable ground water sources is unacceptable in the long term because of the potential to pollute those sources with nitrate; and*

- *There is no apparent environmentally acceptable method for the removal, transportation and disposal of radium contaminated ammonium nitrate.*"

(EPA, 1988a)

In response to this assessment, Rhône-Poulenc developed a revised strategy for the management of the waste by-products (principally ammonium nitrate). The EPA was formally advised of the Rhône-Poulenc's intention to pursue these new management strategies in May 1989 and responded by requiring the preparation of a further ERMP, which was released in August 1989. However, this revised strategy did not receive formal assessment because Rhône-Poulenc withdrew its proposal in early 1990 due to commercial reasons.

1.3 DIFFERENCE BETWEEN THIS PROJECT AND PREVIOUS RARE EARTH PROJECT

The major concern with the previous project related to the disposal of waste products associated with Stage II, in particular ammonium nitrate and the radium contaminated ammonium nitrate. Rhône-Poulenc's current project involves a different process which does not result in the generation of ammonium nitrate or a separate radium stream, thereby effectively eliminating the waste streams of concern. The revised scope of the project involves the processing of monazite ore to produce a rare earth nitrate, tricalcium phosphate (a by-product) and low level radioactive material (gangue residue) as the principal waste product.

The radium content of the monazite previously proposed to be disposed of with the ammonium nitrate stream, will now be contained in the low level radioactive waste as an insoluble co-precipitate of barium sulphate. The addition of the radium to the waste will not significantly alter the radioactivity of the gangue residue.

Another major difference between the 1988 project and the current project concerns the IWDF at Mt Walton. This facility has been established since assessment of the previous project and is now operational for the disposal of low level radioactive wastes. One of the main objectives for the IWDF facility was to provide a disposal site for low level radioactive wastes generated by the processing of monazite, which cannot be disposed of in an environmentally acceptable manner at the site of the processing plant (Maunsell, 1988).

The PER for the IWDF and the subsequent EPA Report and Recommendations and Ministerial Conditions (Appendix B) stipulated that the proponent of the IWDF site, at that time the Health Department of Western Australia, would own and operate the facility and would assume responsibility for collection and transport of the waste to the waste disposal site.

However, Rhône-Poulenc has been advised that the transport of the low level radioactive waste to the IWDF will be its responsibility. Therefore the transport of the waste will be assessed as part of Rhône-Poulenc's project.

The disposal of thorium hydroxide waste at the IWDF as proposed by the previous project was found to be environmentally acceptable by the EPA and approved by the Minister for Environment subject to environmental conditions. Number 5 of the Ministerial conditions states: "Prior to commissioning, the proponent shall prepare an Environmental Management Programme (EMP) to the satisfaction of the Environmental Protection Authority". In this context, the proponent refers to the operator of the IWDF, currently the Western Australian Department of Environmental Protection's (DEP's) Waste Management Division who will be responsible for the waste. To conform with the Ministerial conditions, the DEP's Waste Management Division will prepare an EMP on waste disposal operations. The EMP will be available for public comment during the ERMP public review period.

Due to the existing approvals for the IWDF, it is proposed to dispose of the gangue residue (containing all radionuclide waste streams) at the existing IWDF site.

Evaporation ponds already constructed on-site for effluent from the Gallium Plant will be used for the disposal of the non-radioactive liquid process wastes and for the temporary storage of tricalcium phosphate prior to sale to the fertiliser industry. There will be no ammonium nitrate disposed of in the ponds in contrast to what was proposed in the 1988 project.

1.4 THE PROPONENT

The Proponent for the project is:

Rhône-Poulenc Chimie Australia Pty Ltd	Postal address
Lot 1 Napier Road	PO Box 355
Pinjarra WA 6208	Pinjarra WA 6208
ACN 009 237 718	

Rhône-Poulenc Chimie Australia Pty Ltd is a wholly-owned subsidiary of Rhône-Poulenc Chimie SA which is a French company. However, the ownership of Rhône-Poulenc Chimie Australia Pty Ltd will be transferred to Rhône-Poulenc Australia Holdings Pty Ltd which is the leading company for the 100% owned Rhône-Poulenc Australia operations. Rhône-Poulenc Australia has operated in Australia since the 1930s and has invested $150 million in local manufacturing and operations. The Rhône-Poulenc Australia Group employs 500 people with approximately 75% of Australian turnover having local manufactured added value. All profits and cash flows generated in Australia have been reinvested in the business to support local growth and investment. The Group plans to invest a further $70 million in Australia of which $50 million relates to rare earth processing.

Rhône-Poulenc (and its predecessor, Societe des Terres Rares) has been processing monazite since the beginning of the 20th Century and is acknowledged to be a world leader in the field. Rhône-Poulenc is the largest chemical industry group in France, and one of the largest in the world. It has approximately 81,000 employees worldwide. The group operates in four main sectors, namely:

- chemicals;
- health products;
- fibres and polymers; and
- agricultural chemicals.

Rhône-Poulenc was one of the first chemical companies in the world to set environmental targets for waste and emission reductions through to the year 2000 and reports its progress, environmental actions and plans publicly each year. A copy of the 1994 Rhône-Poulenc environmental report is available from the above address.

Rhône-Poulenc is actively pursuing forming a consortium with the Australian titanium mineral producers which may change the identity of the Proponent. Until any consortium arrangements are finalised, Rhône-Poulenc will be solely responsible for the project.

Management of the waste disposal operations at the IWDF will be the responsibility of the DEP's Waste Management Division. However, the Proponent will fund all costs of operations for the disposal of waste from the Rare Earth Plant.

1.5 OBJECTIVE, SCOPE AND TIMING OF THE PROJECT

The general objective of the project is to develop a processing industry that will add considerable value to a commodity that is currently a non-commercial by-product from mineral sands separation operations.

The scope of the project will eventually encompass the following phases of monazite processing:

- the construction and operation of a Rare Earth Plant near Pinjarra, Western Australia;
- transporting monazite to the processing plant from various locations in Western Australia;
- exporting product in the form of rare earth nitrates through the port of Fremantle;
- the sale of solid tricalcium phosphate to the fertiliser industry;
- disposal of non-radioactive liquid process wastes into evaporation ponds at the Pinjarra plant site; and
- disposal of a solid waste (gangue residue), containing thorium, uranium and their decay progeny and other inert constituents at the Western Australian Government's IWDF at Mt Walton.

Key dates in the timing of the project are:

Commence Construction	-	early 1996
Plant Commissioning	-	early 1997

Plant operations are expected to continue for a minimum of 20 years, with a possible extension to operations if sources of monazite continue to be available.

1.6 OTHER RARE EARTH PROJECTS

Similar proposals for Rare Earths Plants in Australia have been the subject of environmental assessments, the two most recent being:

- Port Pirie Rare Earths Plant Stage 3; SX Holdings Limited; and
- Mt Weld Rare Earths Project; Ashton Rare Earths Ltd.

SX Holdings Limited intended to establish a Rare Earths Plant at Port Pirie, South Australia. Stage 3 of the development was the proposed establishment of a monazite cracking plant and associated rare earths separation facility. The proposed project would also entail transporting feedstock and chemicals to the site, and products and wastes from the site (Kinhill, 1990).

Stage 3 of the Port Pirie project was assessed by the South Australian Department of Environment and Planning who found the environmental issues relating to the project to be manageable (Department of Environment and Planning, 1991).

Ashton Rare Earths Ltd proposed to mine and beneficiate a rare earths deposit at Mt Weld and to process the beneficiated material to produce various rare earth oxides, concentrates and compounds (Kinhill, 1992). The Mt Weld proposal involved the following:

- "*mining the rare earths deposit at Mt Weld, located 35km southeast of Laverton;*
- *beneficiation of ores at Mt Weld to form an ore concentrate;*
- *transport of the ore concentrate 880km by road to a secondary processing plant in the proposed Meenaar Industrial Park, located 20km east of Northam;*
- *processing of the ore concentrate at Meenaar to produce rare earth compounds;*
- *transport of chemicals by road from Kwinana and Kewdale to Meenaar for use during secondary processing and to Mt Weld for beneficiation of ore;*
- *transport of residues produced during secondary processing by road back to Mt Weld for disposal by burial; and*
- *transport of rare earth products by road from Meenaar to Fremantle for export by ship."*

(EPA, 1992)

The Mt Weld project was assessed by the EPA and the report and recommendations released in August 1992 (EPA, 1992). The EPA concluded that the proposal by Ashton Rare Earths Ltd was acceptable, with all impacts being manageable either by the environmental management commitments given by Ashton or by the EPA's recommendations in Bulletin 646.

In reaching this conclusion, the EPA identified the main environmental issues requiring detailed consideration as:

- "*protection of the groundwater resource at Mt Weld;*
- *solid and liquid waste management at Mt Weld and at Meenaar;*
- *protection of residents and property at Meenaar from noise, dust and gaseous emissions from the secondary processing plant;*
- *risks and hazards at Meenaar, including radiation and seismicity; and*
- *transport of beneficiated concentrates, plant residues and dangerous goods."*

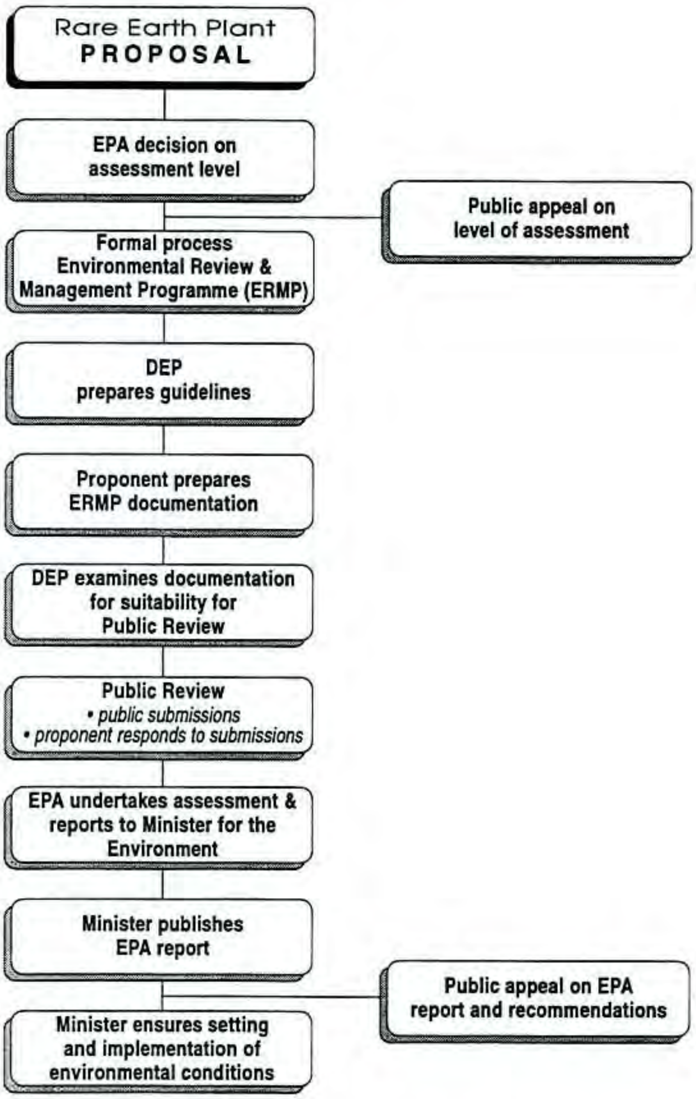
(EPA, 1992)

Both of these projects have, however, been deferred for economic reasons.

1.7 ENVIRONMENTAL IMPACT ASSESSMENT

The Environmental Impact Assessment procedure is a formalised process designed to provide information to the EPA, the DEP and the public about proposed developments with the potential to create significant environmental and social effects.

The Western Australian Environmental Protection Act 1986 was proclaimed on 20 February 1987 (and amended on 14 January 1994) and this project will be assessed under that legislation. Administrative procedures associated with the Act formalise the review process and the enforcement of the Proponent's management commitments. These procedures are illustrated diagrammatically on Figure 1.4.



Rare Earth Plant - ERMP

Figure 1.4
ENVIRONMENTAL ASSESSMENT PROCESS

Following notification of the Proponent's intention to pursue the development of a Rare Earth Plant, the Minister for Environment advised that an Environmental Review and Management Programme (ERMP) would be required. The ERMP is a public document which allows the public, DEP, EPA and other interested parties to examine the project in detail during a ten week public review period. The EPA then provides advice to the Minister for the Environment, taking into account submissions received during the period of public review.

The Rare Earth Project is also designated under the Commonwealth Environment Protection (Impact of Proposals) Act 1974. Rhône-Poulenc were advised that the Commonwealth will undertake a co-operative assessment of the project with the Western Australian EPA, hence Commonwealth requirements will be addressed in the ERMP.

1.8 AIM AND STRUCTURE OF THE ENVIRONMENTAL REVIEW AND MANAGEMENT PROGRAMME

The ERMP aims to provide relevant details of the project and the proposed management techniques to enable the environmental acceptability of the project to be assessed. The principal aim of this document is to identify the environmental issues associated with the project and propose management strategies to minimise and control any potential adverse impacts.

The main text of the ERMP is structured into four major components:

- introduction, evaluation of alternatives and project description (Sections 1.0, 2.0 and 3.0);
- community consultation (Section 4.0);
- a description of the existing biophysical and social environment (Section 5.0); and
- the environmental and social issues and their management (Sections 6.0, 7.0 and 8.0).

The ERMP also contains ten appendices, as follows:

- Department of Environmental Protection Guidelines (Appendix A);
- EPA Report and Recommendations for the Proposed Integrated Waste Disposal Facility in the Eastern Goldfields and the associated Ministerial Conditions (Appendix B);
- Summary and Recommendations from the EPA and the Commonwealth Department of the Arts, Sports, Environment, Tourism and Territories Assessment (DASETT) Reports on the 1988 proposal (Appendix C);
- Comparison of Risks and Hazards for Road and Rail (Appendix D);
- Specification for Waste Generated by the Rare Earth Plant (Appendix E);
- Community Consultation Programme (Appendix F);
- Rhône-Poulenc Policies (Appendix G);
- Outline of the Emergency Response Plan for the Transport of Gangue Residue (Appendix H);
- Groundwater Monitoring Results (Appendix I); and
- Evaporation Pond Contingency Planning (Appendix J).

1.9 RELEVANT LEGISLATION AND POLICIES

In addition to obtaining approval from the State Minister for the Environment, the Proponent will have to comply with legislation and regulations administered by a number of Federal and State Government bodies including:

- Mines Regulation Act, 1974;
- Radiation Safety Act, 1975-1981, including the Radiation Safety (General) Regulations, 1983 and the Radiation Safety (Transport of Radioactive Substances) Regulations 1991;

- Environmental Protection Act, 1986 (as amended January 1994);
- Aboriginal Heritage Act, 1972-1980;
- Conservation and Land Management Act, 1984;
- Water Authority Act, 1984;
- State Planning Commission Act, 1985;
- Bushfires Act, 1954-1981;
- Agriculture and Related Resources Protection Act, 1976-1981;
- Soil and Land Conservation Act, 1945-1982;
- Explosives and Dangerous Goods Act, 1961-1979;
- Dangerous Goods Regulations, 1992;
- Australian Code for the Transport of Dangerous Goods by Road and Rail, 1992;
- Code of Practice on Radiation Protection in the Mining and Milling of Radioactive Ores, 1987;
- Code of Practice on the Management of Radioactive Wastes from the Mining and Milling of Radioactive Ores, 1982;
- Code of Practice for the Safe Transport of Radioactive Substances, 1990;
- Code of Practice for the Near Surface Disposal of Radioactive Wastes in Australia, 1992; and
- Occupational Health, Safety and Welfare Act 1984 and Regulations 1988.

1.10 BENEFITS OF THE PROJECT

1.10.1 General

The project has a number of significant economic and community benefits, including improved utilisation of Western Australian mineral resources, enhanced export earnings, and employment opportunities. The project will supply materials that can be used in the manufacture of products with environmental benefits such as improved energy efficient lights, catalytic converters to help reduce pollution from car emissions, a replacement for toxic metals in pigments and plastics and a variety of medical applications.

1.10.2 Industrial Benefits

A major benefit of the project is the utilisation of Western Australian monazite. This monazite is a by-product of titanium mineral production, a major industry in Western Australia.

Monazite was previously exported from Australia, principally to France. This practice ceased in early 1994 due to the availability of non-radioactive rare earth raw materials from sources such as China and the USA. Hence, currently there is no market for the Australian monazite, and the titanium mineral producers have been either stockpiling the monazite or returning it to the mines for disposal with the mine overburden and other mineral sands processing wastes.

The project will produce a non-radioactive rare earth nitrate which will be suitable for exporting and processing into rare earth finished product plants. Therefore, the project will add significant value to the monazite which is currently regarded as a waste product, the disposal of which is a cost to the titanium mineral producers. The process will also produce tricalcium phosphate which will be sold as a feedstock for fertiliser production.

The project will utilise raw materials and reagents currently being produced in Western Australia. In addition, suppliers, contractors and service industries will provide a range of goods and services to support the plant and its organisation.

Monazite processing has, to date, not been carried out in Australia. The project will therefore introduce new skills and technologies into Australia.

1.10.3 Rare Earths and their Uses

The term 'rare earths' is technically defined by the International Union of Pure and Applied Chemistry as the collective noun for a group of elements, lanthanum to lutetium (atomic numbers 57 to 71) and commonly known as the lanthanides. In addition to the lanthanides, yttrium (atomic number 39) and scandium (atomic number 21) are included as rare earths since they frequently occur with them in nature.

The rare earths can be broadly divided into two groups, the ceric or light earths and the yttric or heavy earths as shown in Table 1.1.

TABLE 1.1

RARE EARTHS

Light (ceric)			Heavy (yttric)		
Element	**Atomic No.**	**Symbol**	**Element**	**Atomic No.**	**Symbol**
Lanthanum	57	La	Terbium	65	Tb
Cerium	58	Ce	Dysprosium	66	Dy
Praseodymium	59	Pr	Holmium	67	Ho
Neodymium	60	Nd	Erbium	68	Er
Promethium[2]	61	Pm	Thulium	69	Tm
Samarium[1]	62	Sm	Ytterbium	70	Yb
Europium[1]	63	Eu	Lutetium	71	Lu
Gadolinium[1]	64	Gd	Scandium	21	Sc
			Yttrium	39	Y

Notes: 1 These elements are sometimes referred to as the middle group as they are between the light and heavy groups.
2 Promethium does not occur in nature as all isotopes are radioactive with short half lives.

The rare earths term is a misnomer since they are not particularly rare. They are generally found in varying concentrations in a number of ores and are more plentiful in the earth's crust than other commonly known metals such as silver (O'Driscoll, 1988).

The atomic structure of rare earth elements gives rise to their unique spectral and magnetic properties which results in a wide variety of high technology applications. In most applications rare earths are used because of the technical superiority imparted by a specific property of the particular element. The unique technical properties imparted by rare earths have been the key to the development of many innovative electronic products (Kinhill, 1992).

The principal applications of rare earths today are in catalysts, metallurgy, glass making, lighting, magnets, electronics, ceramics, radiation safety and pigments. Examples are:

- **Catalysts:** Catalysts for fuel cracking and car-exhaust catalytic converters.

- **Metallurgy:** Special alloys, mischmetal, flints.

- **Glassmaking:** Polishing mineral and organic glass (for spectacle and camera lenses, flat glass, etc.) for glass colouring or decolourising, special glasses for the nuclear industry, television and lasers.

- **Lighting:** Trichromatic fluorescent tubes, high-pressure mercury-vapour lamps, phosphor for colour television tubes, phosphor for X-ray intensifying screens, etc.

- **Magnets:** Miniature magnets for electric motors, tape-recorders, earphones.

- **Electronics:** Bubble memory, powder for making ceramic capacitors.

- **Ceramics:** New ceramics that conduct electricity or have high thermomechanical properties. Yellow and pink pigments for tiles.

- **Pigments:** Toxic metals such as cadmium and lead are being replaced by rare earths.

Organic rare earths are currently finding new applications, in particular in fuel additives, plastics and driers for paints.

Some of the above applications result in substantial environmental and health benefits. For example:

- The widespread use of unleaded petrol and the resultant reduction in lead in the environment has only been possible with the development of catalytic converters which contain rare earth compounds. Reducing hydrocarbons, carbon monoxide and nitric oxides in car exhaust gases to the level required in regulations is only possible because of the ready availability of rare earths. Recently, a new product using rare earths has been developed which will significantly reduce diesel emissions and the release of solid particulates.

- High efficiency lighting technology, reducing both energy consumption and the production of greenhouse gases as a result of reduced electricity generation, is dependent upon the use of rare earths. Rare earths are also essential in the production of highly efficient permanent magnets, which are also energy-saving by nature.

- X-ray intensifying screens have the potential to reduce radiation exposures by 75%. Rare earths compounds are essential components of such screens.

- Rare earths are being introduced to replace toxic metals such as cadmium and lead in pigments for the plastics, paints and ink industries.

1.10.4 Economic Benefits

The benefits associated with the project are substantial, and the development of the project is consistent with both the Commonwealth and State Governments' strategy to develop downstream processing of Australia's mineral resources.

The National Perspective

The project would benefit Australia by:

- producing value-added export earnings from the rare earth nitrate;
- the potential for downstream industries, utilising value-added products of the processing plant such as the rare earth component of the nitrate product;
- broadening Australia's economic and industrial bases; and
- providing income to the Federal Government in the form of income tax and other miscellaneous taxes and charges.

The State and Local Perspective

Benefits to Western Australia include:

- the generation of up to 150 jobs during the construction phase of the project and at least 50 permanent positions once the plant is operational;
- an increase in the number of indirect employment opportunities through increased demand for materials, goods and services, as a result of using local suppliers and contractors for works associated with the plant and its labour force;
- an additional $27 million per annum of export earnings to the Australian economy;
- the viability of the existing Gallium Plant, which is currently on care and maintenance, will be improved through the sharing of labour and services and will be recommissioned during the establishment of the Rare Earth Plant;
- the restart of the Gallium Plant would add approximately $20 million per annum of export earnings to the Australian economy and at least an additional 10 direct employment opportunities;
- a total industrial investment of some $100 million ($50 million for the Gallium Plant; $50 million for the Rare Earth Plant);
- income to the State Government in the form of payroll tax, stamp duties, licence fees and other miscellaneous charges; and
- tricalcium phosphate will be produced as a by-product for use in the Western Australian fertiliser industry.

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2.0 EVALUATION OF ALTERNATIVES

2.1 LOCATION OF PLANT

Issues relating to the siting of the Rare Earth Plant were examined thoroughly during the previous project (Dames & Moore 1988a). The following is a summary of these findings.

The basic criteria for siting the processing plant were:

- proximity to locally supplied basic input materials, namely monazite and process reagents;
- proximity to port facilities for the export of products;
- proximity to the industrial infrastructure required for a complex, high technology process plant;
- availability of a skilled local workforce and the associated necessary social infrastructure; and
- environmental acceptability.

Rhône-Poulenc determined that these criteria could all be met by siting the project in the southwest of Western Australia, between Perth and Bunbury.

The final choice of Pinjarra was influenced strongly by the decision of Rhône-Poulenc to proceed with establishing a Gallium Plant. The extraction of gallium requires the processing of large quantities of the alumina refinery Bayer Liquor Stream. This factor dictated that the gallium extraction plant be in close proximity to an alumina refinery to allow for a connecting pipeline. Therefore, there was a major advantage in locating the Gallium Plant near Alcoa's Pinjarra alumina refinery, as this refinery is the largest in Western Australia and offers the greatest potential for gallium extraction. Rhône-Poulenc subsequently entered into an agreement with Alcoa of Australia to extract gallium from the refinery process stream.

Construction of the Gallium Plant was completed in 1988. The Gallium Plant comprises of a number of facilities that can be shared with a Rare Earth Plant, including:

- a system of evaporation ponds;
- infrastructure such as water, power, gas and communications;
- administrative offices, laboratory and maintenance workshops; and
- pipelines from Alcoa supplying caustic soda and water.

Substantial economic and environmental benefits will accrue from the co-location of the Gallium and Rare Earth Plants. These can be summarised as follows:

- the sharing of infrastructure services and labour which will facilitate the restart of the Gallium Plant (as market conditions improve);
- the evaporation ponds developed for the Gallium Plant effluent disposal will also be used for the Rare Earth Plant effluent;
- the materials that will be disposed of in the ponds are complementary in-so-far as the effluent from the Rare Earth Plant is largely alkaline, while the Gallium Plant effluent is largely acidic;
- the operation of a single pond system will ensure that the resources committed to the design and monitoring of the ponds, and the development of contingency plans in the event of a leakage from the ponds, will be concentrated at one location; and

- the environmental management of a single pond system will be more efficient and effective than the operation of two separate systems.

2.2 PROCESS ALTERNATIVES

The 1988 rare earths project involved two stages:

- Stage I: caustic attack of the monazite leading to separation of rare earth hydroxide; and

- Stage II: nitric attack of rare earth hydroxide which separates thorium hydroxide waste solid from a rare earth nitrate solution (containing ^{226}Ra and ^{228}Ra). A liquid - liquid extraction step was then proposed to separate the radiums from the rare earths, producing a waste stream of ammonium nitrate containing radium.

The proposed disposal of this waste stream was found to be environmentally unacceptable by the EPA (EPA, 1988a). Therefore, the Proponent is not proposing to proceed with this process and has made modifications to remove the radiums from the rare earth nitrate stream and to produce rare earth nitrate as the final product, thereby, eliminating the production of ammonium nitrate.

2.3 WASTE DISPOSAL ALTERNATIVES

The two principal waste streams from the currently proposed Rare Earth Plant are:

- a neutralised slurry effluent of process wastes; and
- low level radioactive solid residue (referred to as gangue residue).

2.3.1 Slurry Effluent

The disposal of the neutralised slurry effluent and process wastewaters into evaporation ponds is the most appropriate method from both an economic and an environmental point of view. A description of the process wastes and the evaporation ponds is presented in Sections 3.4 and 3.5, respectively.

The process wastes will contain a significant quantity of tricalcium phosphate, which will be temporarily stored in the evaporation ponds. The tricalcium phosphate is suitable as a feedstock for the fertiliser industry and hence this is the preferred use. An agreement, in principal, has been reached between the Proponent and a fertiliser company for sale of the tricalcium phosphate for use in superphosphate production. Therefore, the tricalcium phosphate will be recovered from the evaporation pond for sale.

2.3.2 Gangue Residue

Disposal Location

The Proponent considers the most viable option for the disposal of the gangue residue is at the Government owned and operated IWDF east of Mt Walton (Figure 1.1). No alternatives were considered for the disposal of the gangue residue produced during the operations of the plant since the IWDF was specifically intended for this purpose.

The IWDF received conditional approval from the Minister for Environment for the disposal of low level radioactive waste such as that produced from the processing of monazite to produce rare earths. The EPA Report and Recommendations on the disposal of radioactive waste at the IWDF including the Ministerial approval is presented as Appendix B.

A description of the gangue residue and the proposed disposal method are presented in Section 3.4.2 and 3.5.2, respectively. Details on the disposal operations at the IWDF will be presented in the DEP Waste Management Division's EMP.

2.4 TRANSPORT ALTERNATIVES

2.4.1 Monazite

2.4.1.1 Form of Packaging

Monazite could be supplied to the Rare Earth Plant by road or rail/road in the form of bulk quantities or in two tonne bulka bags.

To unload a bulk load of monazite from a truck the bottom neck of the trailer would be connected by a flexible pipe directly to the pneumatic conveyor feeding relay hopper, thereby providing a fully enclosed system from the truck to the main storage silo.

When receiving bulk bags, monazite will be discharged into a hopper which will feed into the pneumatic conveyor relay hopper. A dust collecting barrier will be arranged between the bag being unloaded and the mouth of the hopper to reduce potential dust exposure to the workers.

The Proponent has a preference for transporting monazite in bulk as it minimises the required manning operations per tonne of material, consequently reducing the risk of potential worker exposure to gamma radiation.

The Proponent will incorporate procedures in the plant design for both bulk and bag input of monazite as the form of packaging has yet to be finalised with the Titanium Mineral Producers supplying the monazite.

2.4.1.2 Mode of Transport

Due to the lack of a suitable railway siding at Pinjarra, the Proponent's preferred alternative is to transport the monazite from the mineral sands separation plants located in Geraldton, Eneabba, Capel and Bunbury to the Pinjarra site by road. Monazite has been transported by road for approximately 30 years, without major incident. Until recently, when the overseas market for monazite ceased, it was transported both by road and rail from mineral sands separation plants to the ports for export. Currently, monazite from the separation plants is returned by road to the mines for disposal or temporary storage pending market developments as the monazite cannot be disposed of in the tailing operations, where available, at the plant site. Transport by road in dedicated trucks will also reduce the number of handlings due to the transfer between trains and trucks.

2.4.2 Gangue Residue

2.4.2.1 Form of Packaging

The gangue residue will be transported in heavy duty two tonne bulk bags made to the requirements of the Australian Dangerous Goods Code. The use of drums for the transport and disposal of the waste was also assessed by the Proponent.

Packaged transport in bulk bags will involve the use of "bulka bags" transported in standard shipping containers or purpose built rugged steel containers made to the relevant ISO standards. These bags are composed of heavy duty woven polypropylene with a waterproof lining and fitted with liftings straps designed to comply with transport and packaging codes. They typically have base dimensions of 900mm by 900mm and range in height from 900mm to 1,600mm. Two tonne capacity bags are currently used in the mineral sands industry in Western Australia for the transport of monazite.

Prior to 1994, monazite had been exported in bulka bags to the Proponent's plants in France and USA. The handling of these bags was found to be convenient and safe, and this form of packaging has not posed any problems.

The operations involved in loading and transporting the gangue residue into drums for disposal has been assessed by the Proponent and compared to those for the use of bulka bags. These are shown in Table 2.1.

TABLE 2.1

COMPARISON OF FORMS OF PACKAGING

	Drums	Bags
Capacity	200 litres	2 tonnes
Rate of Production (2 hours)	6-8	1
Manual Operations		
• frequency of operation	3 times per day	once per day
• persons involved	3 per day (1 person per shift)	2 per day
• method (estimate time)	receive 32 drums and remove lids (2 hrs) load 32 drums (1 hr) replace lids on full drums (1 hr) transfer pallets of full drums to storage area (1 hr)	load 12 empty bags (½ hr) load full bags (2½ hrs)
• man hours per day	15	6
Loading onto trucks (2 containers)	5 hours every 2 days	2½ hours every 2 days

To summarise Table 2.1, the use of bulka bags allows a saving in time of approximately 60% in man hours. This is a significant reduction in potential radiation exposure to the workers as replacing and tightening the lids requires time and close contact with the drums filled with gangue residue.

The only potential advantage of using drums is as a possibly more robust container in the event of an accident in which bags may be pierced. Nevertheless, the gangue residue will be in the form of a moist clay and therefore in such scenarios the spill will be limited. There is still a potential for the seal of drums to be weakened and lids may be torn off. Therefore, there is no significant advantage in the use of drums for this scenario.

Transport in bulka bags is currently preferred from both an economic and occupational health point of view. Compared to drums, packaging in bulk bags has the following advantages:

- 60% time saving in handling operations in exposed areas (at both the plant site and disposal site);
- reduction in radiation exposure as drums require manual operations at a closer range; and
- 80% reduction in packaging cost.

2.4.2.2 Mode of Transport

Road and a combination of road and rail have been evaluated to assess the health, environmental and economical aspects of transporting the gangue residue from the Pinjarra plant site to the IWDF. The scenarios have been assessed by the Proponent, Westrail and Main Roads Western Australia.

Three transportation scenarios have been assessed and a schematic diagram of the three scenarios is presented as Figure 2.1. The existing railway system between Pinjarra and the Eastern Goldfields is shown on Figure 2.2 together with the road transport route alternatives.

- **Scenario 1: Rail to Eastern Goldfields and Road to IWDF Site**
  Scenario 1 involves the direct railing of the gangue residue from a new siding in Pinjarra to the Forrestfield marshalling yards where the containers would be transferred from narrow gauge to standard gauge carriages. Three siding options were assessed at Pinjarra which were:

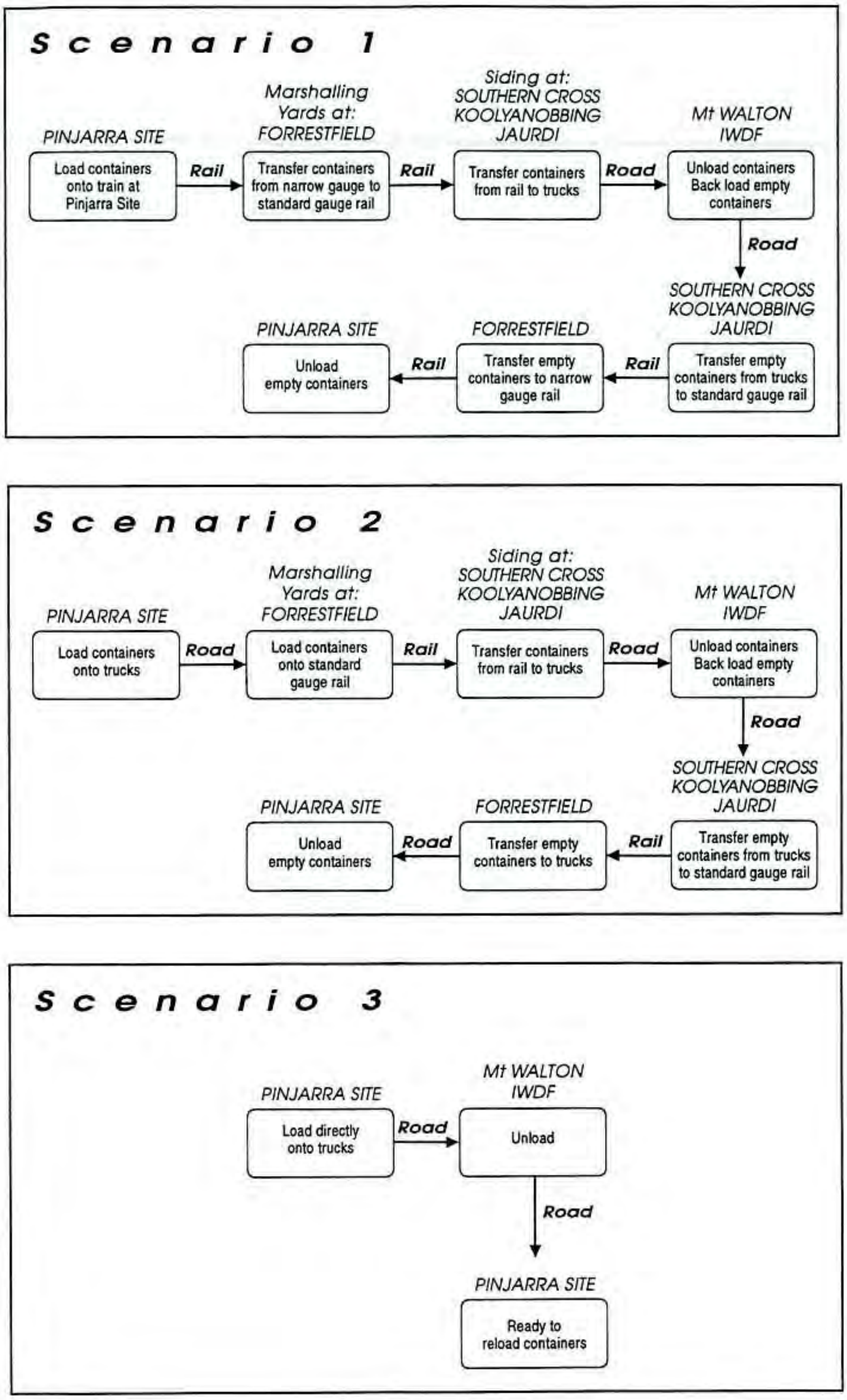
  - at the plant site;
  - on the main line near Pinjarra-Williams Road; and
  - on Alcoa's line.

  A new siding at Pinjarra requiring significant capital (in excess of $2 million) would need to be constructed to cater for the movement of the waste and there is currently no suitable existing rail service.

  The containers would then be transported to a siding at one of three siding destinations (see Figure 2.2):

  (a) Southern Cross;
  (b) Koolyanobbing; or
  (c) Jaurdi.

  Under option (a) the containers would be unloaded from the trains and put into short-term storage at the Southern Cross siding from where they would be loaded onto trucks and transported by road along Great Eastern Highway to Boorabbin. Access will then be via the IWDF access road, which requires upgrading to facilitate year-round access.



Rare Earth Plant - ERMP

Figure 2.1
MODE OF TRANSPORT SCENARIOS

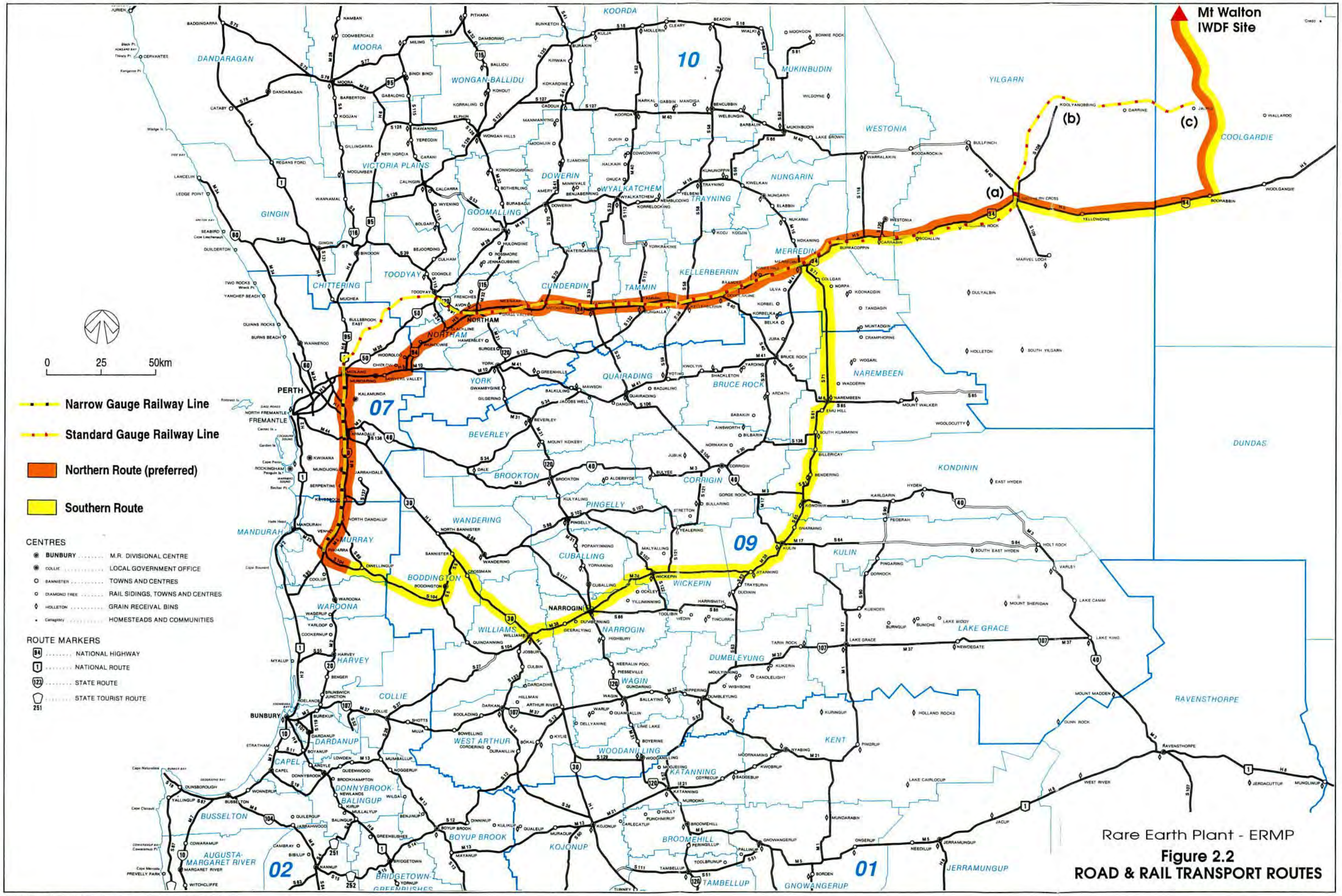


Figure 2.2
ROAD & RAIL TRANSPORT ROUTES

SOURCE: MAIN ROADS Western Australia, DRG. No. 8824-06.

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A crane or a side-lifter would be required for the transfer of containers from train to truck. It is unlikely that a crane would be available but there is the option of hiring a side-lifter for the operations.

The Koolyanobbing siding (option b) is used extensively for servicing the salt operations from Lake Deborah. The most appropriate method of transporting the waste would be to coincide with scheduled movements of the train service transporting the salt. A lifter would be required to transfer the containers from the train to either trucks or to a short-term storage area.

Trucks would then transport the waste along Westrail's railway access road (approximately 85km) to the IWDF access road, both of which would require significant upgrading and ongoing maintenance. The railway access road is currently not suitable for frequent truck access.

Significant infrastructure modifications would be required at Jaurdi (option c) to enable the loading and unloading of the containers. Again, a lifter and a suitable short-term storage area would be required. Trucks would then travel along the railway access road (approximately 15km) to the IWDF access road.

Westrail have advised that this is the most impractical of the three scenarios as there is no adequate existing rail service that could be used for the project. Therefore, significant new infrastructure and a new service would need to be established for a relatively small amount of material.

- **Scenario 2: Road to Forrestfield, Rail to Eastern Goldfields, Road to IWDF Site**
  Scenario 2 involves the road delivery of containers containing residue from the Pinjarra site to the Forrestfield marshalling yards and then the rail transportation from Forrestfield. The siding options (a, b and c) are the same as for Scenario 1.

  Under this scenario, 2-4 carriages could be added to the train servicing the salt operations at Koolyanobbing. This service runs three times a week and movements of the gangue residue could coincide with this service. The advantage of Scenario 2 is that a new rail line at Pinjarra would not be required.

- **Scenario 3: Road to IWDF Site**
  The third scenario is for trucks with standard steel shipping containers or purpose-built containers to be used for transporting gangue residue from the Pinjarra site directly to the Mt Walton IWDF site. The trucks will travel along the major roads to the IWDF access road (Figure 2.2). The access road will require upgrading to allow for year round truck access.

A comparison of the three scenarios is presented in Table 2.2.

TABLE 2.2

COMPARISON OF TRANSPORT MODES

	Scenario		
	1	**2**	**3**
Infrastructure and Equipment Required	New siding at Pinjarra. Hardstand area and extra track at Jaurdi. Short term storage area at sidings. Lifting equipment at site, sidings and IWDF. Upgrading of Westrail and IWDF Access Roads.	Hardstand area and extra track at Jaurdi. Short-term storage area at sidings. Lifting equipment at site, sidings and IWDF. Upgrading of Westrail and IWDF Access Roads.	Loading equipment at the site and IWDF. Upgrading of the IWDF Access Road.
Environmental Issues	Rail Transport along the existing railway system from Pinjarra to the Goldfields siding passing through country and metropolitan areas. The railway passes through many regions including river valleys and water catchment areas.	Road transport along the existing main roads from Pinjarra to Forrestfield passing through the metropolitan area. Rail transport from Forrestfield to the Goldfields siding following the river valley for a section of the route and passes through water catchment areas.	Road transport along the existing major highways and roads, passing through many country towns and the metropolitan area. The route crosses rivers and passes through water catchment areas.
Risks Associated with Accidents	If there was a derailment there is a 40m wide rail reserve in which any spillage is likely to be contained. However, there is not likely to be any spillage as the waste material will be in bulk bags stored inside containers. Mobilisation time for emergency response teams will be longer if the accident occurs in an area away from the main roads.	Potential risk of road accidents for the road sections of the route, and potential derailment for the railway section as discussed for Scenario 1.	Potential risk of road accident along the route. The waste material will be in bulk bags stored in locked containers therefore the potential for spillage is low. Even if there is spillage the risk of harmful exposure to those involved is small.
Transfer Handling of Waste	Five transfer handlings: 1. Load containers onto truck if new siding is off the Proponent's property. 2. Transfer on to rail at the new Pinjarra siding. 3. Transfer from narrow gauge to standard gauge at Forrestfield. 4. Transfer from rail to road at the Eastern Goldfields siding. 5. Unload containers at the IWDF.	Four transfer handlings: 1. Load containers onto trucks at site. 2. Transfer from road to rail at Forrestfield marshalling yards. 3. Transfer from rail to road at the Eastern Goldfields siding. 4. Unload containers at the IWDF.	Two handlings: 1. Load containers on to trucks at site. 2. Unload containers at the IWDF.

TABLE 2.2
(continued)

	Scenario		
	1	**2**	**3**
Occupational Health Issues	Minimal potential exposure to train drivers. Multiple handling of the containers increases the risk of accidental spillage and potential exposure to a greater number of people due to transfer operations.	Potential exposure to truck drivers for a short period of time. Minimal potential exposure to train drivers. Multiple handlings of the containers increases the risk of accidental spillage and potential exposure to a greater number of people due to transfer operations.	Potential exposure to truck drivers, however, trucks will be designed with a shield to reduce the potential dosage. Minimum number of handling operations therefore reducing potential exposure to the least number of employees. All persons involved in the handling of the waste will be health monitored.
Public Health (Normal Operations)	Minimal potential exposure to the general public. Perceived impact if containers are stored at sidings.	Minimal potential exposure to the general public. Perceived impact if containers are stored at sidings.	Minimal potential exposure to the general public.
Public Health (Accident Scenario)	Depending upon location of the accident and ease of access. Response time may be slower than for road options. Risk to public health in the event of an accident is small.	Response time of emergency crews will be shorter if accident occurs in close proximity to main roads. It may take longer to reach the accident if it occurs along the section of railway in the valleys. Minimal risk to public health in the event of an accident.	Emergency teams will be located along the route. Therefore, response time will be short further reducing the risk to public health.
Scheduling and Management	A dedicated train would be required to transport a relatively small quantity of material. Inefficient use of Westrail resources. Transport time could be in excess of 24 hours depending on time for transfer operations.	Movements of waste would need to coincide with existing train services to the Eastern Goldfields. Transport time could be in excess of 24 hours depending on time for transfer operations.	Proponent has greater control and management of transport of waste including scheduling of movements and control of contractors. Transport time would be around 10 hours from Pinjarra to IWDF.

New Pinjarra Siding

Scenario 1 requires the construction of a new siding in Pinjarra.

A siding at the plant site would entail the upgrading and construction of approximately 8km of track as well as a hardstand area at the siding. The capital involved in this option would be well in excess of $2 million.

Establishing a siding on the existing Pinjarra railway near the intersection with Pinjarra-Williams Road would reduce the cost associated with the new track but would still involve significant capital (around $1.4 million) to upgrade the track and establish a siding.

The third option was to establish a siding on the Alcoa line. Westrail has indicated that this option would have several restrictions due to the flow of Alcoa's own material.

Establishing a siding at the plant would have an advantage over a new siding on the existing Pinjarra line as it would eliminate the need for road transport from the site to the siding. However, the relatively small quantity of materials requiring transport does not justify a dedicated rail spur and rail service to the plant. This is an opinion shared by Westrail.

Upgrading of the IWDF Access Road

The access road to the IWDF site was constructed in 1992. It is owned by the Health Department of Western Australia and its maintenance is currently managed, on behalf of the Health Department, by the DEP's Waste Management Division. The road has been used by trucks for transport of wastes to the site for disposal. It is also used regularly by mining companies as access to mining operations in the general area.

The Health Department recognises that the road needs to be upgraded to provide safer access and facilitate access under most weather conditions. Such upgrading will include raising the formation, placement of unsealed gravel pavement and flattening of hill crests.

The Proponent will contribute together with other road users such as mining companies, to the cost of road maintenance during the life of plant operations.

Comparison of Risks and Hazards for Road and Rail

The risks and hazards associated with road and rail transport of the low level radioactive residue, have been evaluated with the aim of proposing a mode of transport which minimises potential human health and environmental impacts.

It is pertinent to note that the nature of the material is not as hazardous as other materials which are transported daily on metropolitan and country roads and that there will be only 3 truck movements of waste per week.

The comparison is based on studies conducted on far more hazardous materials, such as sodium cyanide, chlorine, ammonia, LPG and motor spirit and hence can be conservatively applied to the transport of the low level radioactive residue. A summary of these study findings is presented as Appendix D. These studies include:

- an analysis of risk of fatalities for road transport vs rail transport for LPG in New Zealand (TNO, 1984);
- an extensive Quantified Risk Assessment (QRA) on the analyses of the transport of Dangerous Gods by road and rail throughout the United Kingdom (HSC, 1991);
- a review to determine the validity of applying conclusions from overseas studies to the transport of Dangerous Goods in Western Australia;
- an assessment of the risk of transporting Dangerous Goods by truck and rail (Institute of Risk Research, 1988); and
- a discussion on the transport of Dangerous Goods within the Brisbane area (Queensland Transport, 1992).

The studies reported in Appendix D have indicated that a general conclusion cannot be made as to rail being the safer mode of transport than road or vice versa. Therefore, other factors such as occupational health and route selection must be considered when evaluating modes of transport in relation to minimising potential impacts for a particular operation.

Occupational and Public Health

Occupational and public health matters relating to the transport of the waste are due to the potential radiation exposure to the drivers, workers at the railway sidings and IWDF, and the general public.

Truck drivers have a greater potential to exposure than train drivers due to the distance between the drivers and the waste materials. Doses in the truck cabin will be measured and a shield will be constructed between the cabin and the containers carrying the waste to ensure that levels reaching the driver are well below the acceptable limits described in Section 6.4.

Transferring the containers of waste from either road to rail or rail to rail poses a potential risk of exposure to workers involved in the transferring operations, therefore, the least number of handlings of the waste is beneficial in terms of limiting potential exposure.

Potential exposure to the general public will be extremely small for both road and rail transport options. The only potential public exposure is in the event of a road or rail accident, even then the emergency response procedures described in Section 6.2.2.3 and Appendix H will ensure that public exposure is kept to a minimum.

Rail transport has the advantage of reducing the exposure to drivers, however, transfer operations of the waste at rail sidings increases the number of workers with the potential to receive radiation doses. For both road and rail options public exposure due to the normal transport of waste operations will be insignificant.

Preferred Option

Road transport of the waste residue has occupational health, management and economical advantages over the other two scenarios as indicated on Figure 2.1 and Table 2.3. Both road and rail transport routes follow through similar environmental areas. There are fewer handling operations of the containers if the transport is directly by road reducing the potential risk of accidents occurring during the transfer of containers. Direct road transport also reduces the number of people involved in the transport operations, thereby minimising the number of workers with potential radiation exposure. The Proponent, together with the transport contractor, will have control over the container movements for the entire route. Road transport would also eliminate the need to establish both a siding on the Pinjarra line and a suitable hardstand area at a goldfields siding.

The public perception of rail being the only safe option for the transport of waste materials has been identified during the community consultation programme.

After assessing the transport options the Proponent has selected road as the preferred mode of transport. The Proponent will develop an appropriate transport strategy including truck configuration, haulage procedures and management procedures in conjunction with the transport contractors.

2.4.2.3 Transport Route

Route Selection Criteria

The selection of a route for the road transport of the waste was based on the following criteria:

- the safest route;
- minimisation of the potential impact on communities and traffic;
- Category 1 and Category 2 roads (as defined by DOME) wherever possible as the waste is classified as a Dangerous Good;
- four lane roads in preference to two lane roads, where possible;
- roads of suitable width and condition for truck usage;
- the availability of Emergency Response Teams to minimise response time; and
- preference for roads that have already been approved by Main Roads Western Australia for B-double use.

Road Transport Route Alternatives

The two alternative transport routes considered for the road transport of gangue residue are shown on Figure 2.2. Plans of the road network around Pinjarra and Perth are shown on Figures 1.2 and 2.3, respectively. The preferred route (northern route marked in orange on Figure 2.2), selected on the basis of safety considerations, is via:

- Napier Road;
- Pinjarra-Williams Road;
- South Western Highway;
- Albany Highway;
- Tonkin Highway;
- Roe Highway;
- Great Eastern Highway; and
- IWDF Access Road.

The advantages of the northern route are:

- the route is along "highway" standard roads (as defined by Main Roads Western Australia) and, Category 1 and Category 2 class of roads preferred by DOME for the transport of Dangerous Goods;

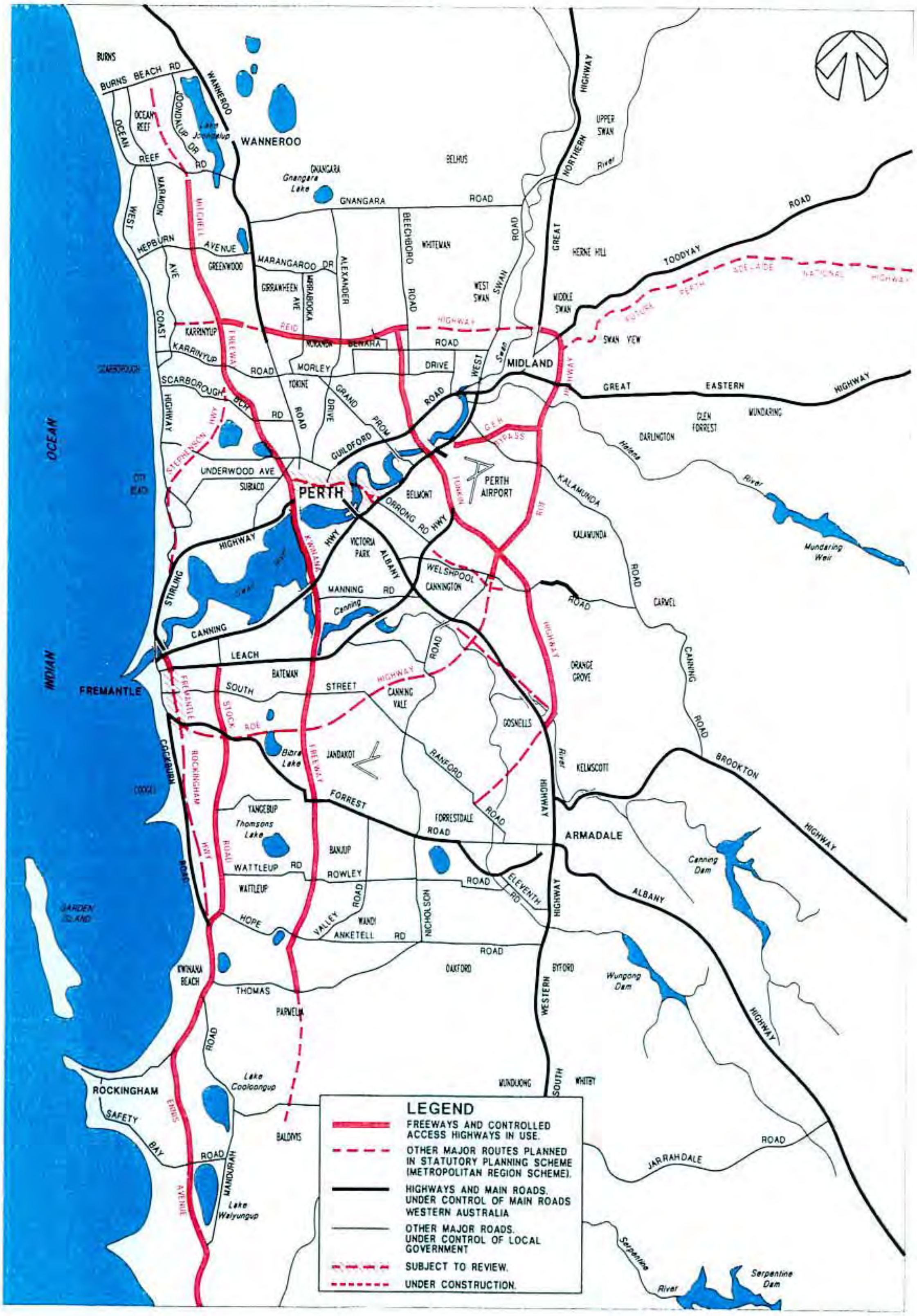
- significant sections of the route comprise four lane roads which are safer than two lane roads;

- a significant part of the route (Roe and Tonkin highways) in the metropolitan area is divided road;

- the major intersections along the route in the metropolitan area are controlled by traffic lights;

- it is more readily accessible by a specialist emergency response team than the southern route; and

- the majority of the route has already been approved by Main Roads Western Australia for the use of B-doubles and therefore considered safe for B-double operations.



Rare Earth Plant - ERMP

Figure 2.3
PERTH'S ROAD NETWORK (1994)

SOURCE: MAIN ROADS Western Australia, DRG. No. 34894104-107.

The southern route, shown in yellow on Figure 2.2, follows:

- Napier Road;
- Pinjarra-Williams Road (south of Napier Road);
- Marradong-Bannister Road;
- Albany Highway;
- Williams-Kulin Road;
- Kulin-Kondinin Road;
- Kondinin-Narembeen Road;
- Narembeen-Merredin Road;
- Great Eastern Highway; and
- the IWDF Access Road.

The southern route was considered to offer the following advantages:

- minimisation of the amount of truck traffic along the Pinjarra-Williams Road (north of Napier Road); and
- avoidance of more heavily populated areas.

This route would facilitate access to and from the plant site via Napier Road and the Pinjarra-Williams Road south of Pinjarra without going near the township of Pinjarra. Although the route would not pass through the Perth metropolitan area, it passes through many country townships on lower class roads. The major portion of this route is not designed for truck traffic as most of the roads are very narrow (<6m) with some having a seal width as low as 3.7m (Main Roads, 1995 pers. comm.). No section of this route option from the plant site to Merredin is along four lane or divided highway, with the exception of the passing lanes along the Albany Highway portion between Bannister to Williams. Approximately 50% of the Pinjarra to Merredin section is along "secondary" class roads which are of a lower standard (in terms of width and other dimensions) than main roads and highways. Approximately 15% of the route (Bannister to Williams) is along Albany Highway whilst the remaining 35% (Williams to Kulin) is via a main road. Of particular concern is the section between Boddington and North Bannister as the road is of poor quality and very steep. The trucks would also be required to make a right hand turn into Albany Highway.

The advantage of the southern route not passing through the Perth metropolitan area is more than offset by the disadvantages of the suitability of roads along this route, hence, the safety of transporting in B-doubles. Therefore, the northern route is preferred.

2.5 THE 'NO DEVELOPMENT' ALTERNATIVE

If the proposed development did not proceed, the following consequences would arise:

- monazite would continue to be dumped or stored as a waste product with no current economic value at various minesites rather than at one location selected and designed to accept radioactive waste;

- the mineral sands industry would continue to incur costs associated with the storage and subsequent transportation and disposal of monazite from the separation plants to the mine sites;

- other countries or Australian states are likely to take up the opportunity to pursue a similar project and therefore the considerable economic benefits of a value-added mineral processing industry would be lost to Western Australia;

- the recommissioning of the Gallium Plant and downstream processing associated with gallium products would be jeopardised with the loss of economic benefits arising from the Gallium Plant; and

- all other benefits listed in Section 1.10 would be lost.

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3.0 PROJECT DESCRIPTION

3.1 PROJECT OVERVIEW

The Rare Earth Plant will be designed to receive, store and process up to 12,000tpa of monazite to produce a solid rare earth nitrate concentrate totalling 15,000tpa. It is a possibility that some of the rare earth nitrate will be produced in liquid form. The product will be transported by road to Fremantle for export to France and the USA. The product will not be radioactive.

The Rare Earth Plant will produce a neutralised slurry effluent, comprising mainly tricalcium phosphate (TCP) which is largely insoluble, and a low level radioactive solid residue (gangue residue) containing thorium, uranium and their radioactive decay products.

The solid tricalcium phosphate will be held in an evaporation pond from where the solid will be removed as a filter cake and recycled as a source of phosphate for the fertiliser industry.

The remaining effluent water will be evaporated in the ponds.

The gangue residue will be transported to and disposed of at the Western Australian Government's IWDF. The site of this facility was selected so that it could accept low level radioactive waste such as that to be produced at Pinjarra, due to its geological structure in particular the deep clay structure, the absence of potable aquifers and the remoteness of the site.

Figure 3.1 presents a diagrammatic overview of the project.

3.2 PROCESS DESCRIPTION

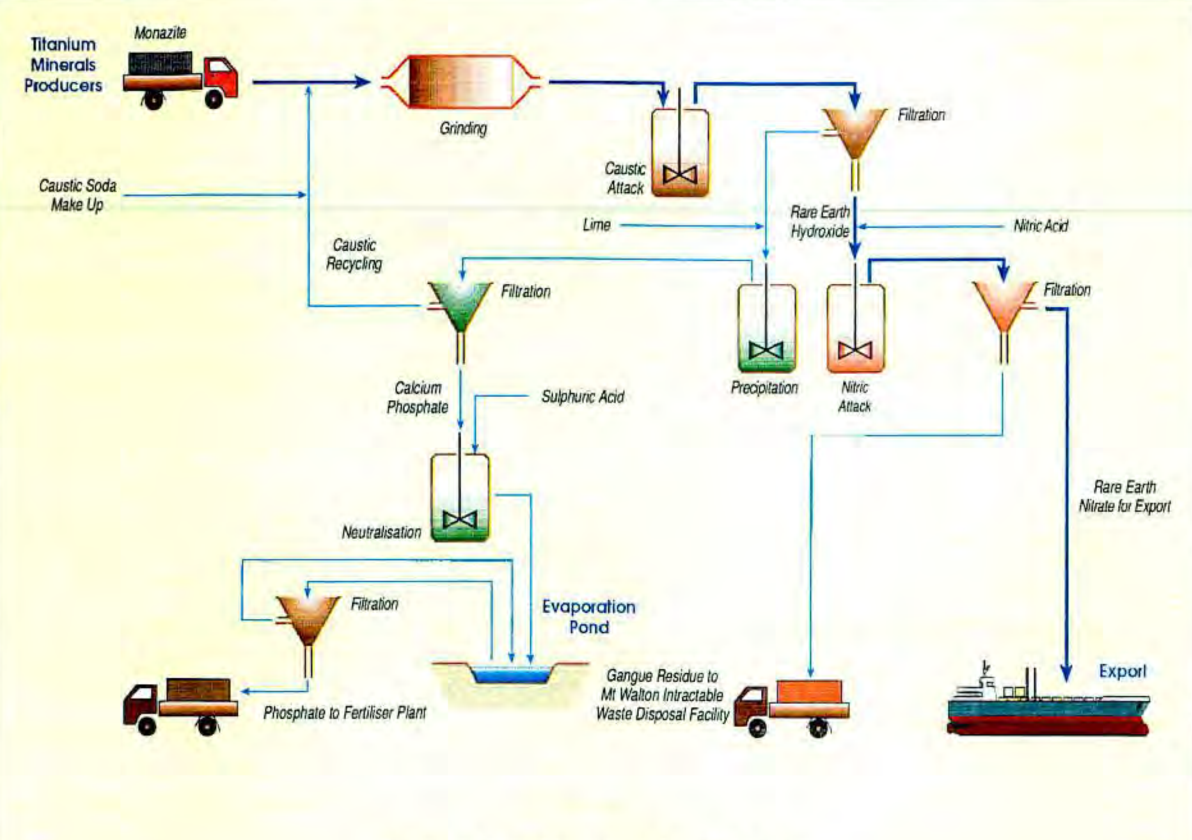
Processing extracts the rare earth elements from the monazite ore. This involves the following stages:

- **Ore attack:** the cracking of the ground monazite ore by caustic soda resulting in a slurry mixture of trisodium phosphate in solution and solid rare earth hydroxide.

- **Hydroxide separation and caustic recycling:** the rare earth hydroxide will then be separated from the trisodium phosphate solution, backwashed and filtered to form hydroxide cake. The phosphate stream will be treated with lime to recover caustic soda and to produce tricalcium phosphate as a by-product.

- **Acid attack of hydroxide:** the hydroxide cake will be dissolved in nitric acid and chemically treated to precipitate out its entire radioactive content (thorium, uranium and their decay products). The precipitated solid will be filtered out to leave a non-radioactive solution of rare earth nitrate.

A summary flow sheet for the process is shown on Figure 3.2.



Rare Earth Plant - ERMP
Figure 3.1
SCHEMATIC DIAGRAM OF THE PROJECT OVERVIEW

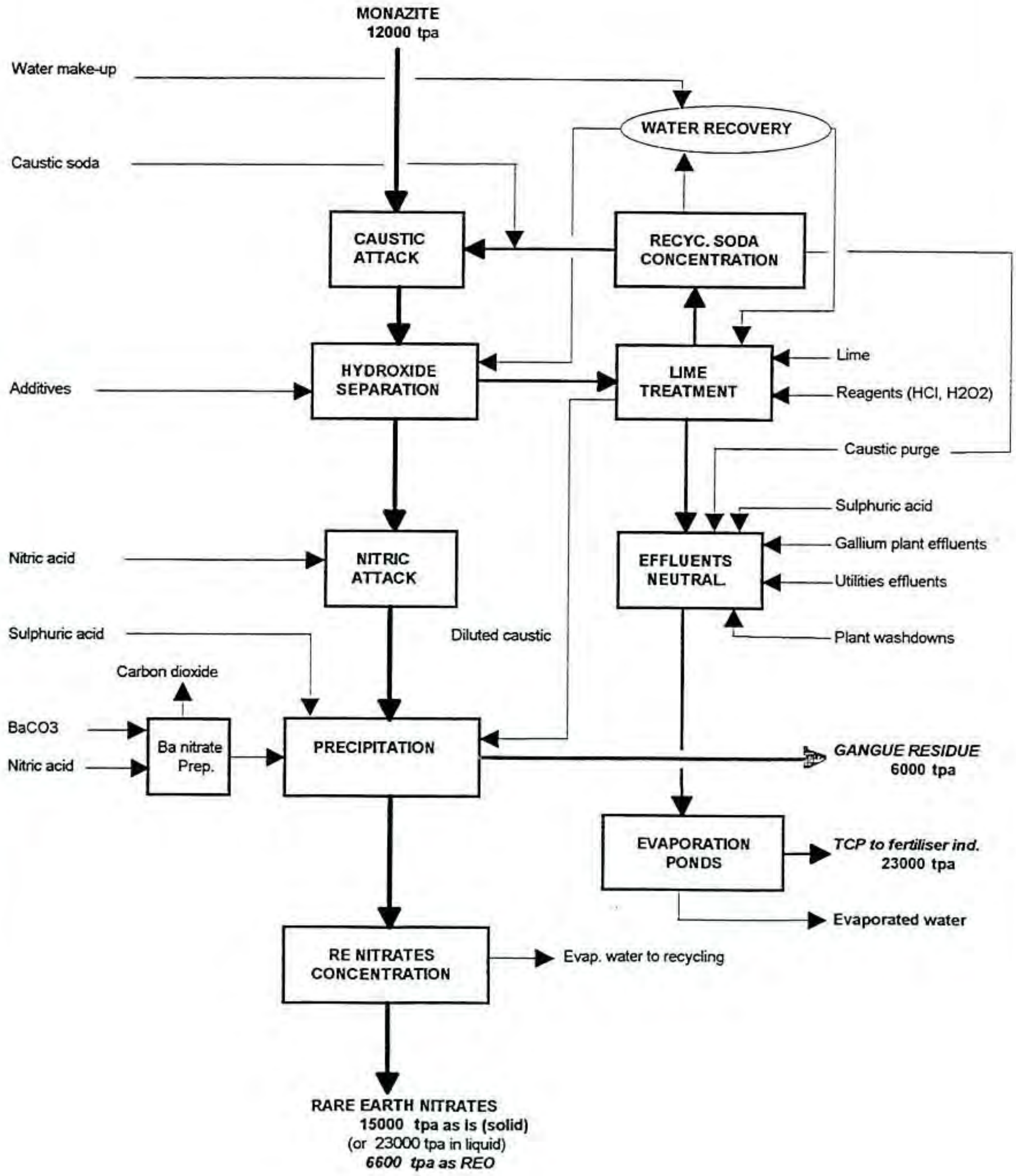
3.2.1 Ore Attack

The process begins when monazite ore is pneumatically transferred to a storage bin from where it will be sent to a grinding mill which will be a wet operation. The ground ore will then be mixed with hot concentrated caustic soda and, after attack through a set of reactors, will be converted to a slurried mixture of trisodium phosphate in solution and a solid rare earth hydroxide. The solid will contain all the constituents of the monazite, except the phosphate.

3.2.2 Hydroxide Separation and Caustic Recycling

The solid (rare earth hydroxide) will be separated from the trisodium phosphate solution. This separation will take place in a series of settlers and filters backwashed with water. The trisodium phosphate is a marketable commodity in other parts of the world and the Proponent may include a separation process if market opportunities make this option economically viable.

The liquid phase containing trisodium phosphate and excess caustic will be directed to a caustification unit where quick lime will be added, resulting in a slurry of tricalcium phosphate in caustic soda. The caustic soda will be separated from the tricalcium phosphate by filtration and reconcentrated for recycling to the ore attack unit.



Rare Earth Plant - ERMP

Figure 3.2
PROCESS FLOW DIAGRAM

The tricalcium phosphate cake will be neutralised with sulphuric acid and/or with acidic effluent from the Gallium Plant before being stored in the first evaporation pond. This pond will act as a temporary storage from which the tricalcium phosphate cake will be recovered daily via a specially designed sump facility. It will then be filtered and collected as a moist cake and transported to the fertiliser industry.

3.2.3 Acid Attack of Hydroxide

Nitric Acid Attack

The rare earth hydroxide, in the form of a cake, will be dissolved in nitric acid in a continuous reactor leading to a nitrate solution of rare earths.

A downstream chemical treatment of the nitrate solution using barium, sulphuric acid and caustic soda as main reagents separates the thorium, uranium and their radioactive decay products as well as all non-attacked compounds. These will form a solid which is filtered, washed and then placed into bulka bags. This solid, referred to as gangue residue will contain all the radioactive compounds (thorium, uranium and their decay products) from the monazite feedstock. It will then be transported to the IWDF site, which was designed and approved to accept low level radioactive residue from monazite processing and other wastes, for disposal.

Rare Earth Nitrate Concentration

The rare earth nitrate stream will be concentrated by evaporation, cooled and packaged for export as the final product of the plant.

The rare earth nitrate product will be a dry granular solid which is non-radioactive, non-corrosive and non-combustible. The product will be packed in bulk bags of 1.8 tonne capacity, and is not classified as a Dangerous Good.

3.3 FEEDSTOCK AND PROCESS CHEMICALS

3.3.1 Monazite

The principal feedstock is monazite. Monazite is a rare earth phosphate which also contains thorium, uranium, titanium and other impurities. Due to its content of thorium, uranium and associated decay products, monazite is considered as a low level radioactive ore. A typical analysis of monazite is indicated in Table 3.1. The radionuclides Thorium-232 (^{232}Th) and Uranium-238 (^{238}U) and their decay products produce the radioactivity of the monazite. Members of the ^{232}Th and ^{238}U decay series are listed in Appendix F. Data from the Titanium Mineral Producers have shown that the external radiation dose rate from a two tonne bulka bag of monazite to be in the order of 100μSv/hr at zero distance (DOME, 1995; pers. comm.).

TABLE 3.1

TYPICAL MONAZITE ANALYSIS

Name	Components	Percentage
Rare Earth Oxide	RE_2O_3	58.0%
Thorium Oxide	ThO_2	6.0%
Uranium Oxide	U_3O_8	0.3%
Phosphate	P_2O_5	27%
Calcium Oxide	CaO	1.5%
Titanium Dioxide	TiO_2	0.7%
Zirconium Oxide	ZrO_2	3.0%
Silicon Oxide	SiO_2	3.0%
Iron Oxide	Fe_2O_3	0.5%

Source: Rhône-Poulenc

The monazite ore feedstock will be transported to site by road in accordance with the Code of Practice for the Safe Transport of Radioactive Substances, 1990 (Commonwealth of Australia, 1990). The ore will be supplied either in a bulk form using dedicated bulk trailers or in two tonne bulka bags.

Bulk trucks will be unloaded directly into a 200 tonne capacity overhead storage bin using an automatic pneumatic system. The automatic nature of the system minimises workforce exposure to gamma radiation and hence reduces occupational risk. The storage hopper will be sufficiently shielded to reduce gamma radiation exposure.

The two tonne bulk bags will also be unloaded into the process storage bin using the same pneumatic equipment. All dust generated at this stage will be collected efficiently through a venting/filtering system to eliminate any internal contamination risks for workers. This system will ensure full automatic recycling of the dust recovered from the filters, with no human operation required for cleaning of the filters.

Additional monazite feedstock will be stored on-site together with the gangue in a dedicated storage area. The storage area will be surrounded by a 400mm thick concrete wall and designed for a 1,400 tonne combined total of monazite and gangue residue. Sufficient space will be allocated to allow for about one month supply of monazite and one month production of gangue. The storage building will be divided into two parts: one for the monazite and one for the gangue residue. A manoeuvring area will allow for easy fork lift access to both monazite and gangue residue storage.

Special design and operating procedures will be implemented to ensure the rigorous and fully controlled management of the monazite and gangue as well as safe operating conditions for workers.

3.3.2 Process Chemicals

Annual requirements of process chemicals are listed in Table 3.2, most of which will be sourced from Western Australia.

TABLE 3.2

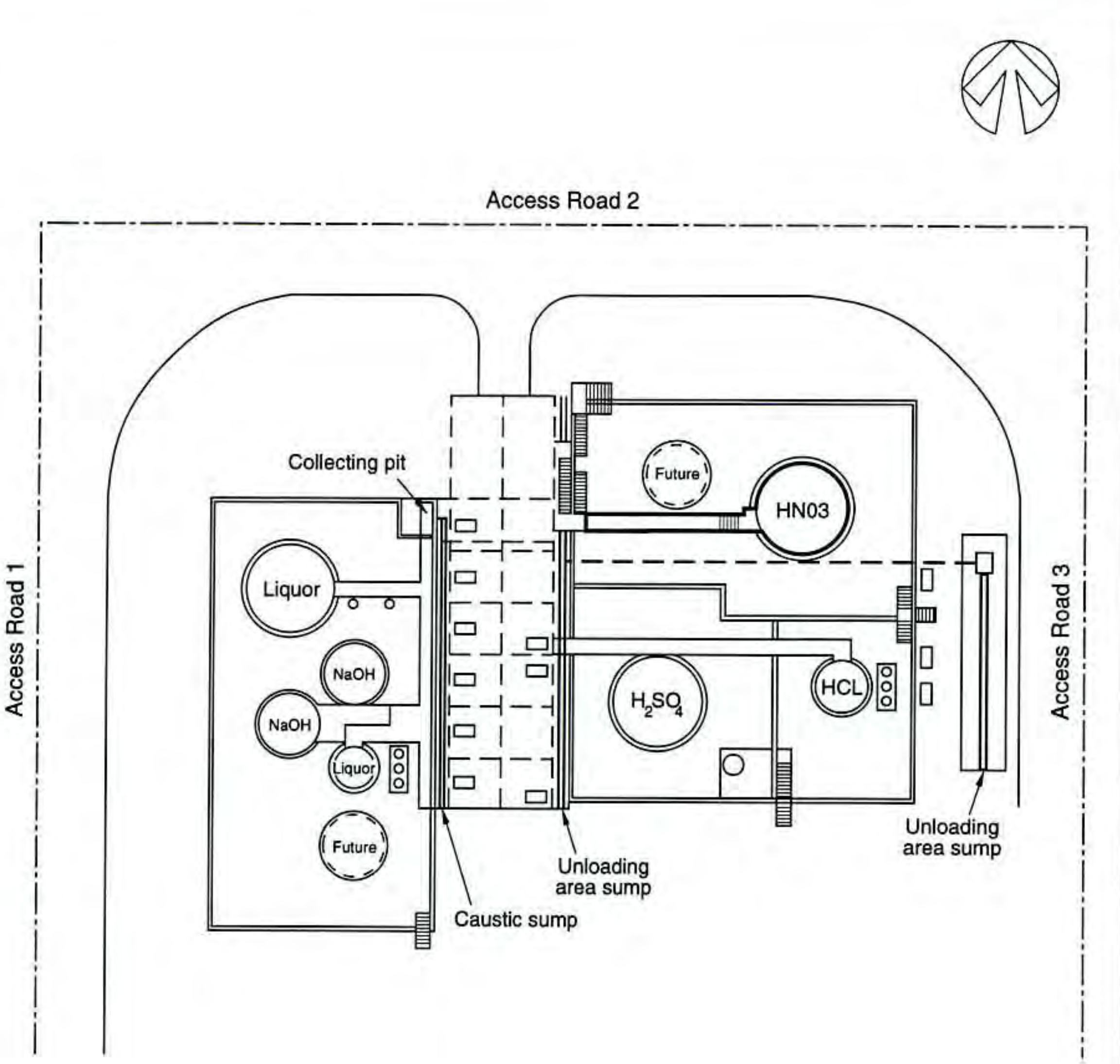
ANNUAL REQUIREMENTS OF PROCESS CHEMICALS

Process Chemicals		Annual Consumption (tonnes)
Caustic Soda	(48% NaOH)	3,500
Nitric Acid	(62% HNO_3)	15,000
Lime	(77% CaO)	7,000
Sulphuric Acid	(98% H_2SO_4)	2,000
Hydrochloric Acid	(33% HCl)	500
Barium Carbonate		1,120
Hydrogen Peroxide	(50% H_20_2)	80
Miscellaneous Chemicals		230

Process chemicals will be stored in a dedicated liquid storage area of the plant (Figures 1.3 and 3.3). Storage tanks will be provided for sulphuric acid (H_2SO_4) ($100m^3$) hydrochloric acid (HCl) ($50m^3$) and nitric acid (HNO_3) ($150m^3$). Each tank will be contained in a separate bunded area to avoid any possible mixing of chemicals in the event of an accidental spill. Storage tanks for the sulphuric and hydrochloric acids and the bunded area for the nitric acid storage tank have already been constructed for the Gallium Plant, therefore only the construction of the nitric acid storage tank is required. The design layout and storage of the acids will be in accordance with the Dangerous Good Regulations (1992). The existing storage tanks for the Bayer Liquor Streams (Input - $30m^3$; Output - $100m^3$) are located in a separate bunded area (Figure 3.3) together with the two existing caustic soda tanks ($50m^3$ each). Separate storage areas will be constructed for the reducing agents.

Separate drainage systems have been designed for each bunded area to collect and direct any spill to a special pit from which it is then directed to the process effluent collecting pit and then returned, with other effluents, to the plant effluent neutralisation facility.

Caustic soda will be delivered directly from the nearby Alcoa Pinjarra Refinery via the existing pipeline constructed for the Gallium Plant.



Rare Earth Plant - ERMP

Figure 3.3

LIQUID STORAGE AREA DESIGN

SOURCE: RP Chimie Australia, 1995.

3.3.3 Transport

Monazite and process chemicals will be transported to the Pinjarra site by road in accordance with the appropriate transportation regulations and codes (Section 6.2.2.1). Monazite will be sourced from separation plants located at Geraldton, Eneabba and the Bunbury/Capel region. Most of the other chemicals will be sourced from either Perth or Kwinana.

Assuming either 20 tonne of 40 tonnes of material per truck, the traffic volume generated by the delivery of raw materials and chemicals to the site are summarised in Table 3.3.

TABLE 3.3

NUMBER OF DELIVERIES OF RAW MATERIAL AND PROCESS CHEMICALS

Raw Material/Process Chemical	Trucks Per Week
Monazite	7**
Nitric Acid	8**
Sulphuric Acid	1**
Hydrochloric Acid	1 every 2 weeks*
Lime	4*
Other Materials	1-2*

Notes: * Assumes 20 tonne truck.
** Assumes 40 tonne truck.

3.4 PRODUCT, BY-PRODUCT AND WASTES

3.4.1 General

A rare earth nitrate concentrate will be the final product from the process. It is currently planned to produce the concentrate in solid form, however, there is a possibility that some liquid concentrate may also be required. The annual quantity of the solid rare earth nitrate product will total 15,000 tonnes. This relates to an equivalent Rare Earth Oxide (REO) content of 6,600tpa.

The rare earth process will produce tricalcium phosphate as a by-product, in the form of a solid cake derived from the processing of the phosphate solution. A summary of a typical chemical composition of tricalcium phosphate is shown in Table 3.4. Tricalcium phosphate is a source of phosphate and will be sold to the fertiliser industry.

The tricalcium phosphate produced by the plant contains traces of thorium and uranium concentrations estimated to be less than 60ppm and less than 50ppm (expressed in ThO_2 and U_3O_8 respectively). Expressed in total radioactivity (< 10Bq/g), these concentrations compare to those of natural phosphate rock which tend to have lower thorium and generally higher uranium content (up to 120ppm U_3O_8). A typical phosphate rock with 55ppm of U_3O_8 has also a total radioactivity level (due to uranium and its decay series) of about 10Bq/g.

TABLE 3.4

RARE EARTH NITRATE PRODUCT AND TRICALCIUM PHOSPHATE BY-PRODUCT

Stream	Form	Annual Quantities (for 12,000t monazite)	Typical Composition		End Use	Transport
Rare Earth Nitrate	Solid	15,000tpa	RE $(NO_3)_3$ $NaNO_3$ Water	78% 5% 17%	Export to France and the USA for further processing.	16* trucks per week from Pinjarra to Fremantle.
Filter Cake Tricalcium phosphate	Solid	23,000tpa	$Ca_3 (PO_4)_2$ Na soluble salts (Cl, SO_4) $CaSO_4$ Non-reactive lime Water	30% 2% 20% 8% 40%	Temporary storage in the evaporation ponds and direct sale to the fertiliser industry.	12** trucks per week from site to Kwinana.

Notes: * Assumes 20 tonne trucks.
** Assumes 40 tonne trucks.

As with any chemical plant, the Rare Earths plant will also generate products that currently have no commercial value and are therefore regarded as wastes. The main process wastes include:

- gangue residue containing all non-commercial insoluble compounds originally present in the monazite which will be transported to the IWDF for disposal. Among them, there will be thorium, uranium and all their radioactive products; and
- process liquid wastes comprising soluble compounds (mainly Na_2SO_4 and NaCl) and excess process water which will be directed to evaporation ponds for disposal.

Table 3.5 indicates the typical composition and proposed means of disposal of these wastes.

TABLE 3.5

WASTE PRODUCTS

Stream	Form	Annual Quantities (for 12,000t monazite)	Typical Composition		Mean of Disposal and Transport
Plant Effluent	Liquid	110,000m^3	Water with Na_2SO_4/NaCl	 <70g/l	Evaporation ponds via pipelines.
Gangue Residue	Solid	6,000t	Th $(OH)_4$ UO_2 $(OH)_2$ Insoluble SO_4: (Ba, Ra, Pb) Monazite RE (OH) Zr O_2 SiO_2 Ti $(OH)_4$ Fe $(OH)_3$ Water ^{226}Ra ^{228}Ra	13.2% 0.6% 22.8% 6% 3% 6% 6% 1% 1.4% 40% 60Bq/g 420Bq/g	IWDF. 3 x 47 tonne trucks per week.

Water from the utilities area of the plant; including water plant effluent, cooling water blowdown and boiler blowdown; will be sent to the evaporation ponds via the plant effluents neutralisation unit. Process area washdowns will either be recycled by way of a sump to the process or will be directed to equipment where solids are separated out using flocculants. If the solids contain some rare earths they will also be recycled back to the process. The remaining water is then either recycled as process water or discharged to the effluent neutralisation facility prior to being directed to the evaporation ponds together with the other liquid effluents. There will be no significant radionuclides in this wastewater as the radioactive components are insoluble and would have been filtered out with the solids to be recycled in the process. Waste waters will be monitored to confirm this. Water is recycled wherever possible in the process to reduce both the quantity required for processing and that to be disposed. A water-balance diagram is shown on Figure 3.4.

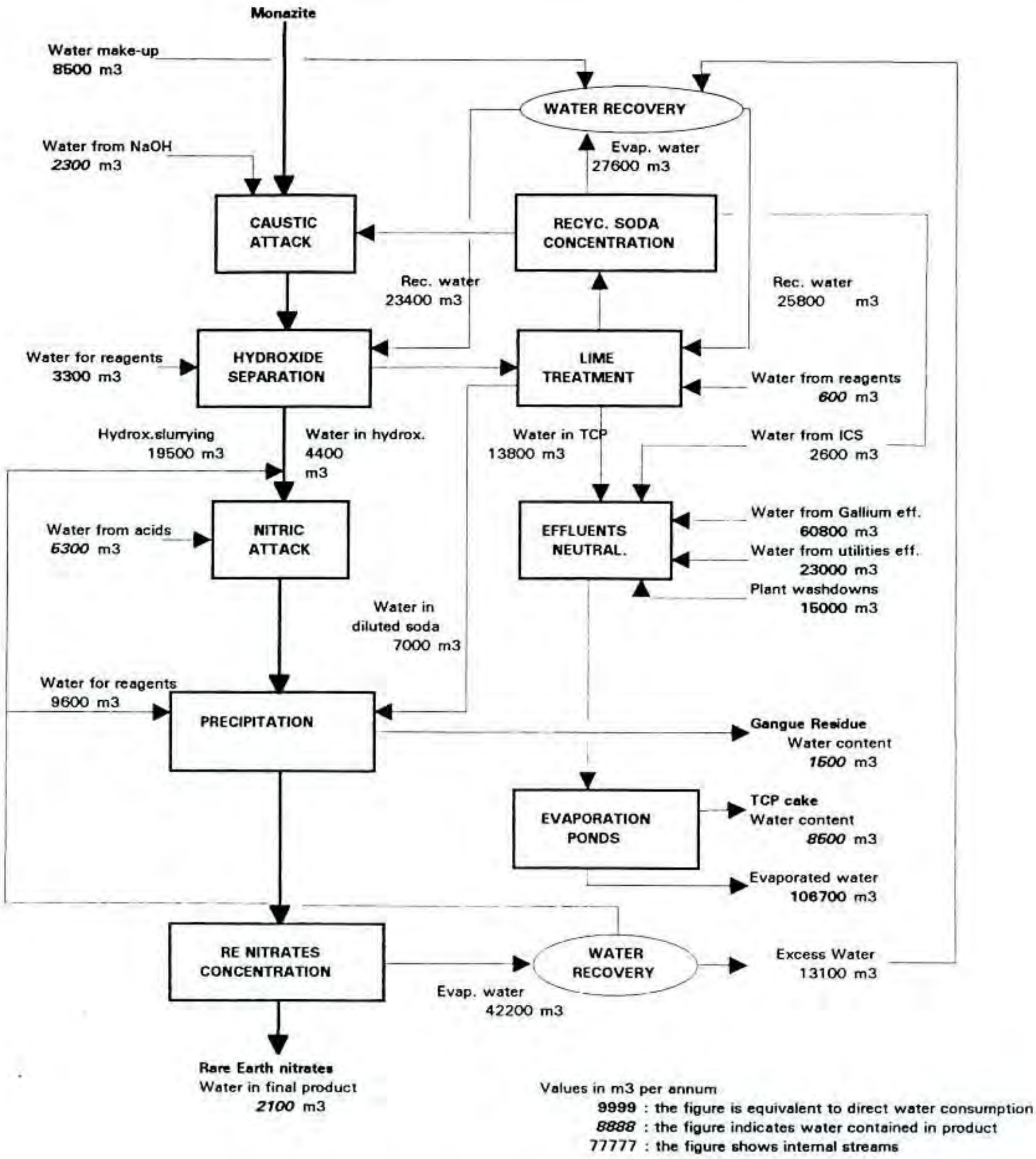
Stormwater runoff will be contained and handled separately from the process wastes by using the existing stormwater ponds. Other minor waste streams include sewage and domestic waste waters which will be discharged into leach sumps and drains that have been designed, constructed and operated in accordance with relevant Health Department and Shire of Murray requirements. Other general office and workshop wastes will be taken to the Shire tip for disposal. Steel drums in which some process reagents are supplied will be recycled.

3.4.2 Form and Description of the Gangue Residue

The low level radioactive gangue residue will be collected by a filter in the acid dissolution unit (Figure 3.1). It will comprise clay size particles and has a bulk density of around 2 tonne/m^3. The radioactivity of the waste is due to its thorium content (approximately 10% wet weight).

The gangue residue will contain:

- the non-rare earth fraction of the ore;
- some non-attacked monazite;



Total annual water requirement : 110600 m3 **(For Rare Earths and Gallium)**

Water Input (m3/a)		Water Output (m3/a)	
Water make-up	8500	Water in final product	2100
Water in NaOH	2300	Water in gangue residue	1500
Water for reagents	3900	Water in TCP cake	8500
Water from acids	5300	Water to evaporation ponds	106700
Water from Gallium effl.	60800		
Water from utilities effl.	23000		
Water from plant wash.	15000		
Total water input	118800	Total water output	118800

Rare Earth Plant - ERMP

Figure 3.4
ANNUAL WATER BALANCE FLOW DIAGRAM

- thorium, uranium, iron and titanium as insoluble hydroxides;
- insoluble barium sulphate;
- radium and lead in the form of insoluble barium sulphate co-precipitates; and
- zircon and silica.

The gangue residue will be insoluble. It will be press filtered at the Pinjarra plant and sufficient absorbent agent will be added to ensure that no draining of free liquid occurs and that it meets the specifications of a solid, as defined by both the Code of Practice for Near-Surface Disposal of Radioactive Waste in Australia (NHMRC, 1992) and the operators of the IWDF. The gangue will be sufficiently moist (around 40%) to ensure that it will not dust or flow and to allow it to be readily recoverable should accidental spillage occur. Details on the specifications of the waste are presented in Appendix E.

The radium contained in the waste material will be in the form of barium/radium sulphate. The actual mass concentration of radium in the barium sulphate will be very low as there will be less than ten grams of Radium-226 in the waste per year and less than one gram of Radium-228. Compared with the total amount of barium sulphate of about 1,500 tonnes per year, the concentration of radium in the barium sulphate is very low.

The precipitation and immobilisation of radium with barium sulphate is an established technique in the uranium mining industry where it has been used for over twenty years to reduce the radium content of the clean water effluent from uranium mines to drinking water standards.

The radioactivity of the waste is related to ^{232}Th and ^{238}U and their decay products. Members of the ^{232}Th and ^{238}U decay series are listed in Appendix F. It is expected that the external radiation dose from a 2 tonne bulk bag of residue will be around 200μSv/hr at zero distance.

The radionuclide mass balance for the process in the plant can be determined. All radionuclides will be contained in the gangue residue waste. The quantity of waste produced will be one half that of the monazite feed material, therefore radionuclide concentrations in the waste will be twice those of the monazite. The mass balance is shown on Figure 3.5.

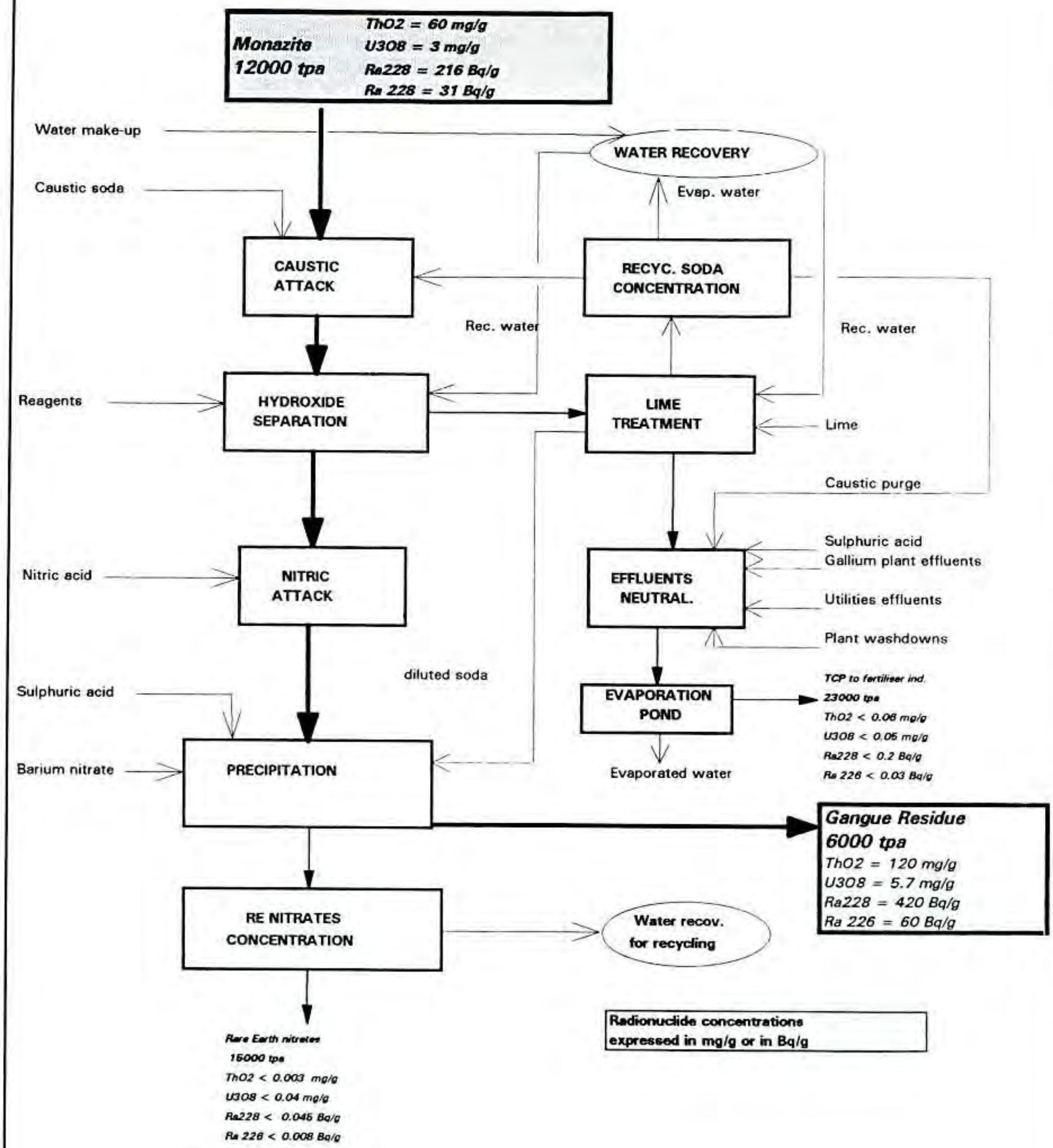
The only possibility of differing in the mass balance will be due to small scale contamination of the other products of the process. The tricalcium phosphate will contain small quantities of thorium and uranium which will be insignificant in terms of the mass balance.

3.5 DISPOSAL OF WASTE PRODUCTS

3.5.1 Slurry Effluent

Liquid wastes are commonly produced by chemical processing plants and it is equally common to dispose of such wastes into evaporation ponds. The function of an evaporation pond system is two-fold:

- to provide a means (i.e. evaporation) to eliminate the water content of the effluent; and
- to provide a means of permanent storage of the crystallised salts remaining after evaporation.



Rare Earth Plant - ERMP

Figure 3.5
RADIONUCLIDE BALANCE FLOW DIAGRAM

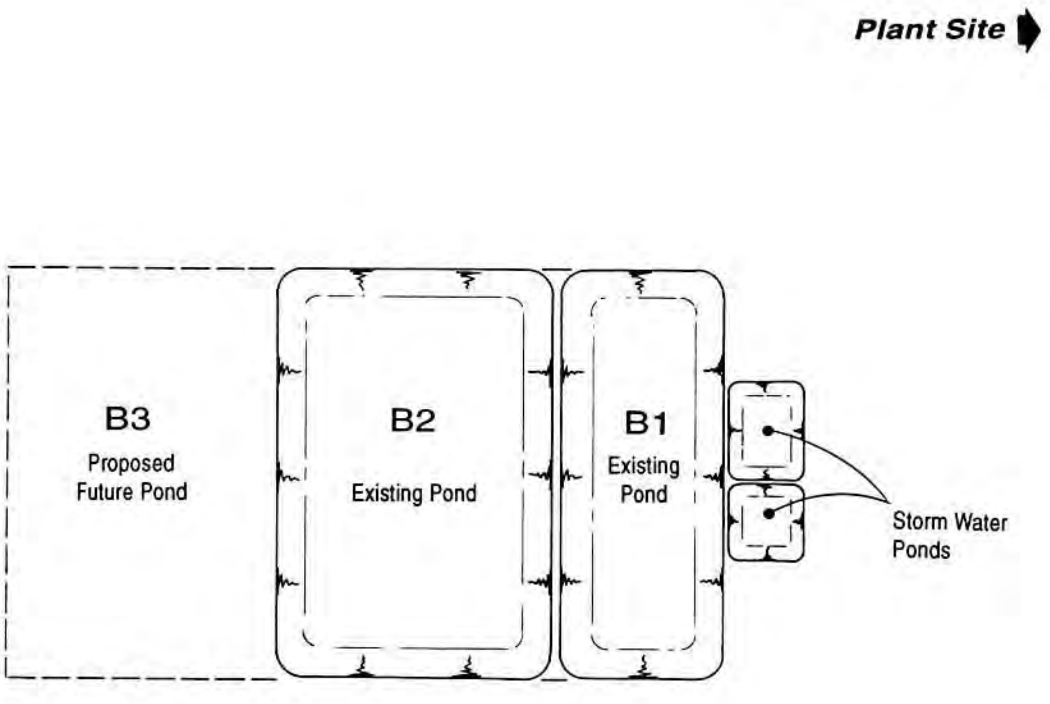
A variety of materials will be either disposed of or stored temporarily in the evaporation ponds (Tables 3.4 and 3.5), the most significant are:

- tricalcium phosphate;
- calcium sulphate;
- sodium sulphate;
- sodium chloride; and
- water.

3.5.1.1 Evaporation Pond Design

The system of evaporation ponds that was utilised for the Gallium Plant wastes was also designed and constructed to store wastes generated by the Rare Earth Plant.

The existing evaporation pond system at the Pinjarra plant site (Figure 3.6) comprises two stormwater ponds and two larger ponds (referred to as Ponds B-1 and B-2). Stormwater runoff from the plant site is directed to the stormwater ponds, which are designed to accommodate 100mm of rainfall from the plant site area. The water will be analysed and will either be discharged to the evaporation ponds or into surface drainages, depending on the chemical composition of the stormwater.



Rare Earth Plant - ERMP
Figure 3.6
CONCEPTUAL LAYOUT OF EVAPORATION PONDS

Evaporation ponds with a total area of 8ha were constructed for the Gallium Plant. For the design specifications of the pond system a mean annual evaporation rate of 2,500mm and a mean annual rainfall of 880mm were assumed. The mean net natural evaporation rate is therefore 135mm/month. This rate has been reduced to allow for less evaporation resulting from concentration of salts in the ponds. For the first pond (B-1), the net evaporation rate has been assumed as 104mm/month and for the second pond (B-2) a design net-evaporation rate of 87mm/month has been used.

The ponds are underlain by an extensive underdrain system. The system comprises 500mm of sand over a minimum thickness of 500mm *in situ* clay compacted to 98% Standard Maximum Dry Density with a design permeability of 5×10^{-9}m/s (measured permeabilities were less than the design value). The underdrains have been isolated from the pond contents by a 1m thick compacted clay liner (Figure 3.7) which also has a permeability of less than 5×10^{-9}m/s. A high density polyethylene (HDPE) liner was placed over the sides of the ponds to help prevent erosion of the clay.

The initial flow rate of effluent from the Rare Earth Plant to the ponds will be approximately $8m^3$/hr. The rate could increase to a maximum of $14m^3$/hr in the event that the Gallium Plant is recommissioned. These flow rates will be effective for 7,700hrs per year (88% of the year). Therefore, on an annualised basis, the flow rates are estimated as $7m^3$/hr and $12.5m^3$/hr, respectively.

The mean evaporation rate from the existing ponds, B-1 and B-2, is approximately $9.6m^3$/hr. Once the Rare Earth Plant is operating, an additional 5ha pond (B-3 - Figure 3.6) may be required after the restart of the Gallium Plant to allow both plants to operate at full capacity.

As pond B-1 will have a constant water level and will overflow into B-2 (Figure 3.8), most solid contents, including all tricalcium phosphate, will accumulate in B-1. Some salts are expected to crystallise out of solution in B-2 and the rest will remain in B-3.

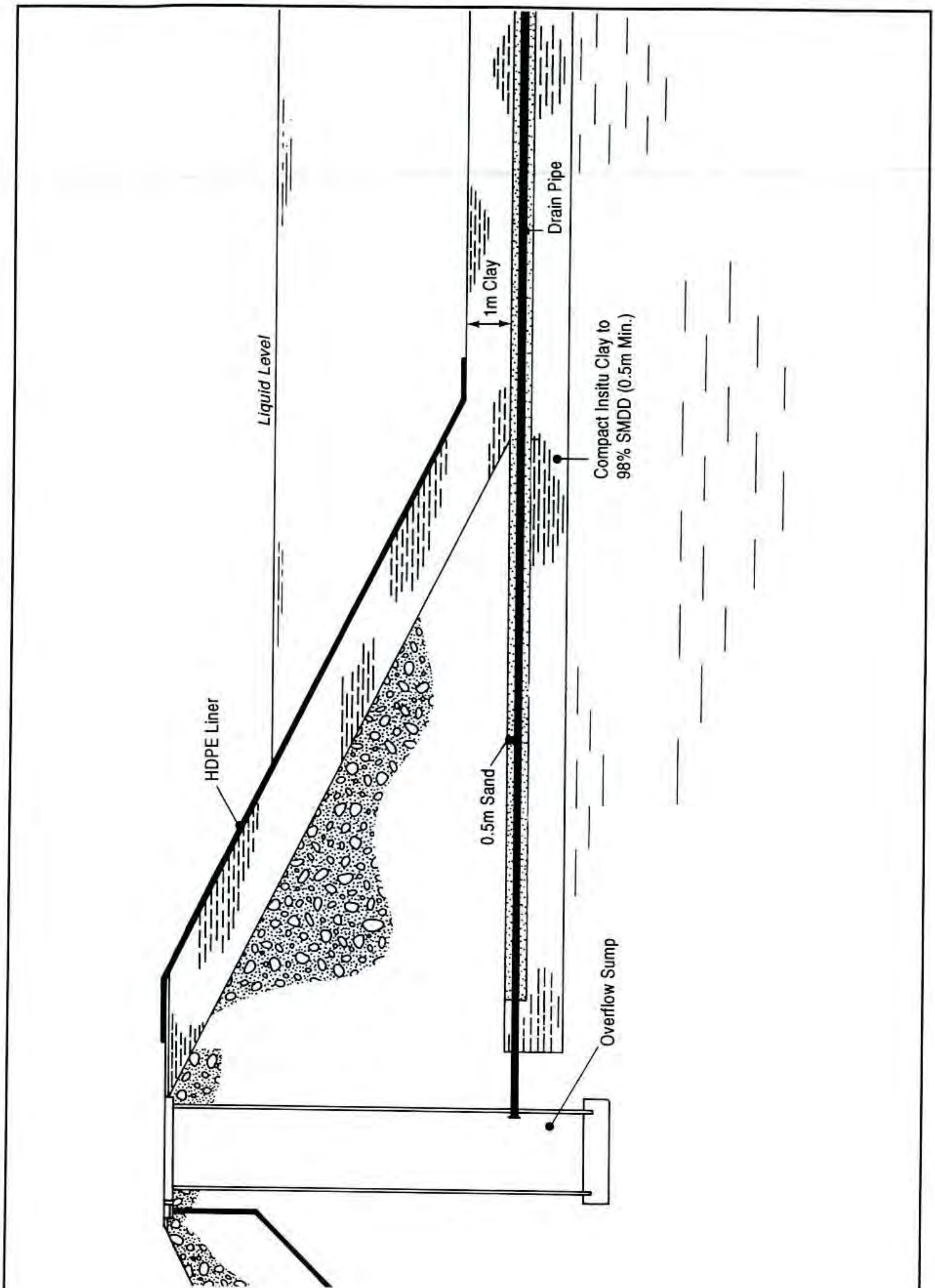
The tricalcium phosphate will be recovered daily from pond B-1 via a specially-designed sump facility. It will then be filtered and collected as a moist cake and transported to the fertiliser industry. The liquid from this filtration will be returned to the pond.

The evaporation pond system was designed and constructed following extensive consultation with appropriate Government authorities and experienced engineering consultants and has effectively been operational for the Gallium Plant effluents. The results of groundwater monitoring before, during and after Gallium Plant operations are discussed in Section 6.3.2.3.

3.5.2 Gangue Residue

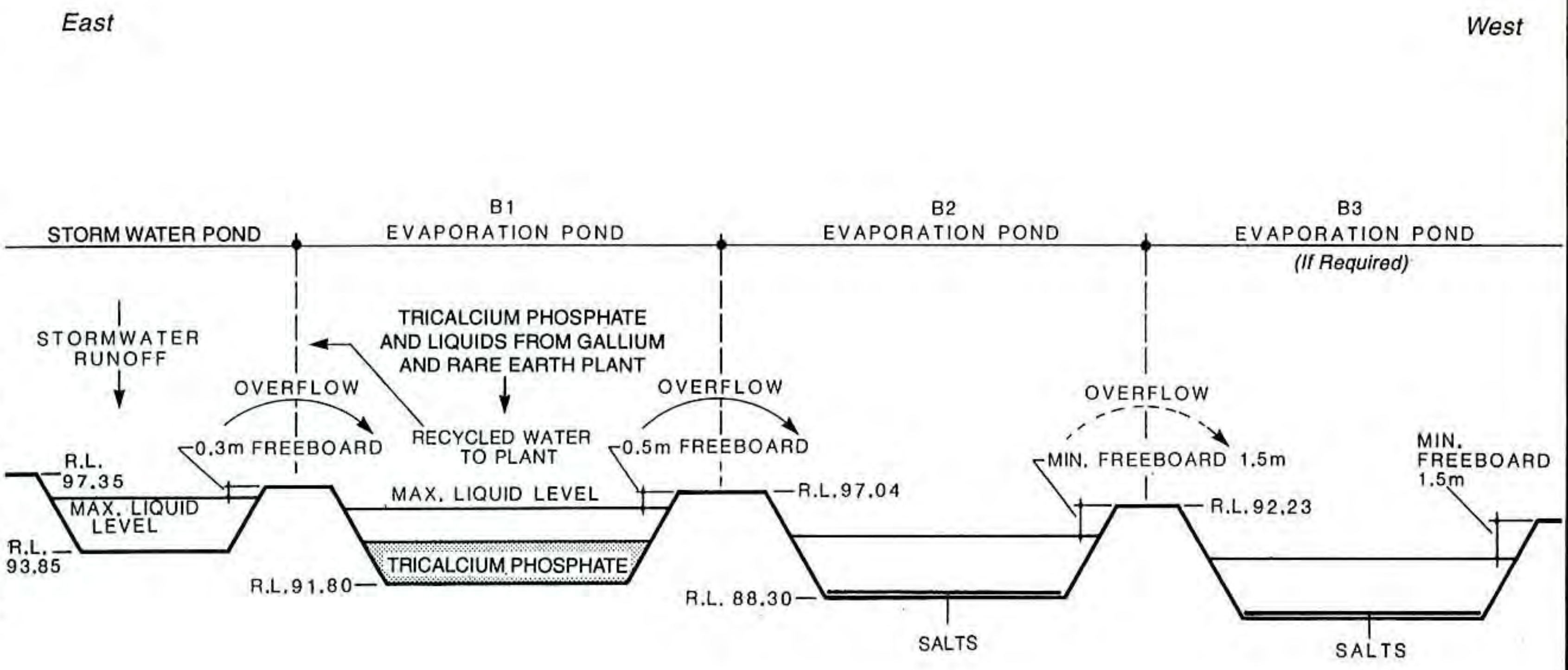
3.5.2.1 Packaging and Storage

The gangue residue will be automatically placed into heavy duty two tonne bulka bags of the type widely used for many years in the mineral sands, chemical and packaging industries. The bags are designed and made to meet the requirements of Australian Standard AS 3688-1987 "flexible intermediate containers" and Supplement 2 to the Australian Dangerous Goods Code (Federal Office of Road Safety, 1992b). They are made of woven polypropylene and are lined with 60µm thick polyethylene film and fitted with polypropylene lifting lugs. These bags were used for transport of monazite from Australia to France and the USA by the Proponent without any handling problems.



Rare Earth Plant - ERMP

Figure 3.7
CROSS-SECTION OF EVAPORATION POND WITH UNDERDRAIN SYSTEM



NOTE: Reduced levels in relation to plant site datum.

Rare Earth Plant - ERMP

Figure 3.8

SCHEMATIC SECTION THROUGH THE EVAPORATION POND SYSTEM

Information has been obtained from the Titanium Mineral Producers on their experience with the performance of bulka bags used for transport of monazite. Their experience is that bulka bags made to the appropriate standards are a reliable, efficient packaging medium and no significant problems have been experienced with breakage or spillages during transport operations.

The bags provide a convenient method to transfer the waste from the site to the IWDF site for disposal as they are able to be easily lifted and can be stacked, if necessary. The bags will eventually decompose in the trench, however, containment of the waste in the trench is provided by the surrounding clay soil.

The bags will be initially stored in a dedicated concrete area (Section 3.3.1) before being loaded directly into either standard ISO steel shipping containers or purpose built steel containers. It is proposed that up to twelve two tonne bags will be placed in each container and each truck will carry two containers, a total of up to 47 tonnes.

The EPA noted in Bulletin 352 (EPA, 1988a) that this method of packaging would allow the requirements of the Commonwealth Code of Practice for the Safe Transport of Radioactive Substances (1987) to be satisfied and it would also meet the requirements of the revised code issued in 1990 (Commonwealth of Australia, 1990).

The storage area for the gangue residue will be located in a concrete construction designed to allow manoeuvring of fork lifts. The maximum storage capacity for gangue residue will be 600t or approximately one months production. However, under normal operating conditions, owing to the rate of removal of the waste to the disposal site, a maximum of 300t of waste would be stored at any one time.

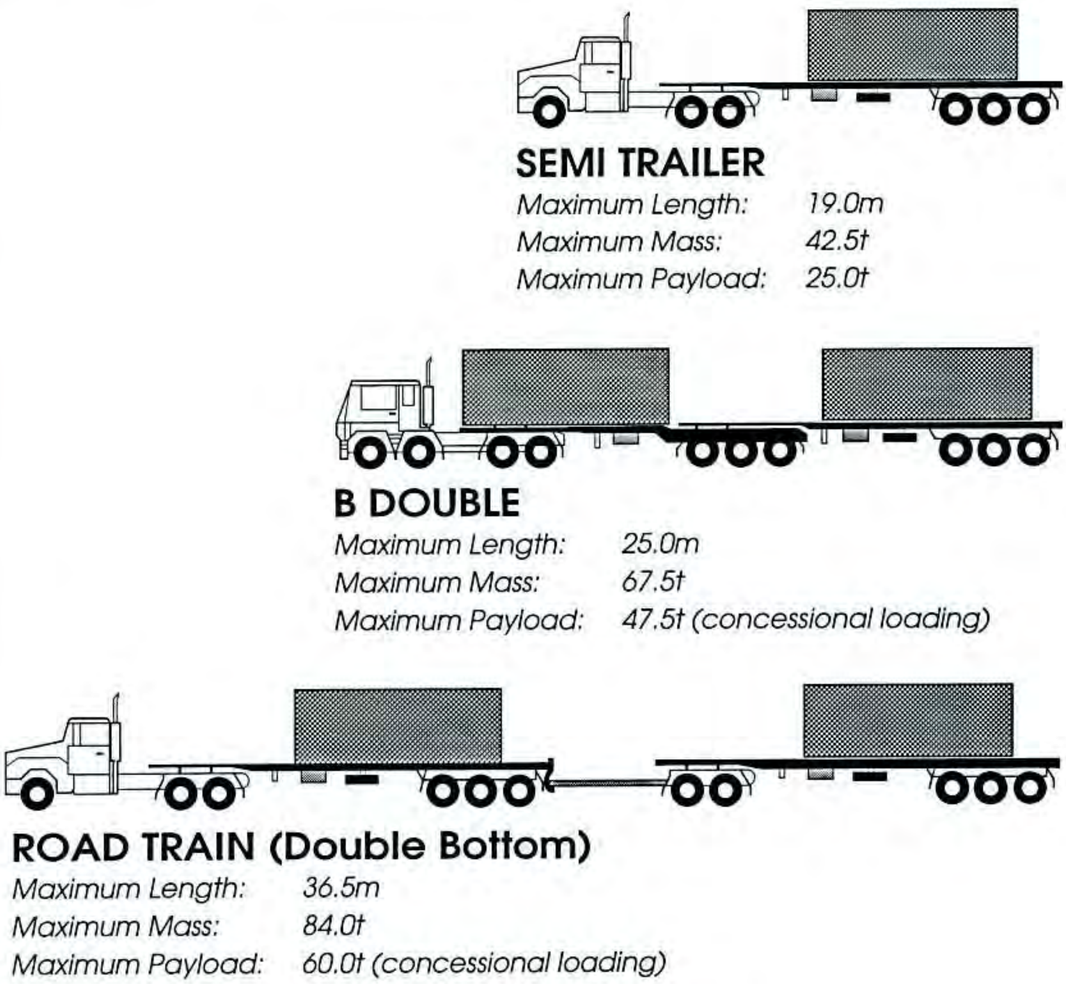
3.5.2.2 Transportation of Gangue Residue

The preferred method of transporting the gangue residue from Pinjarra to the IWDF is by truck as discussed in Section 2.4.2. It is estimated that three B-double trucks per week will be required.

B-double trucks comprise a prime mover and two trailers which are connected in a manner that provides more rigidity and safer control than a two-trailer road train. With a twin-steer prime mover, and concessional axle loadings of 23.5 tonne, a legal payload of 47 tonne can be achieved. Allowable axle loadings would limit semi-trailers to only one loaded container. Consequently, they would need double the number of trips of B-doubles.

An illustration of a semi-trailer, B-double and road train configurations is shown on Figure 3.9 for comparison purposes. It is proposed to use B-doubles for the transport of the waste.

Each truck would carry two steel containers. These would either be the same size as standard ISO shipping containers (2.4m wide, 6m long and 2.4m high) or purpose-built containers of the same width and length but with a reduced height of about 1.6m to facilitate top loading of the container. The standard ISO shipping containers would have the opening at one end and be of adequate height to allow access for a fork lift. The containers would be fully enclosed and designed and fabricated according to the relevant ISO and Australian Standards for freight containers.

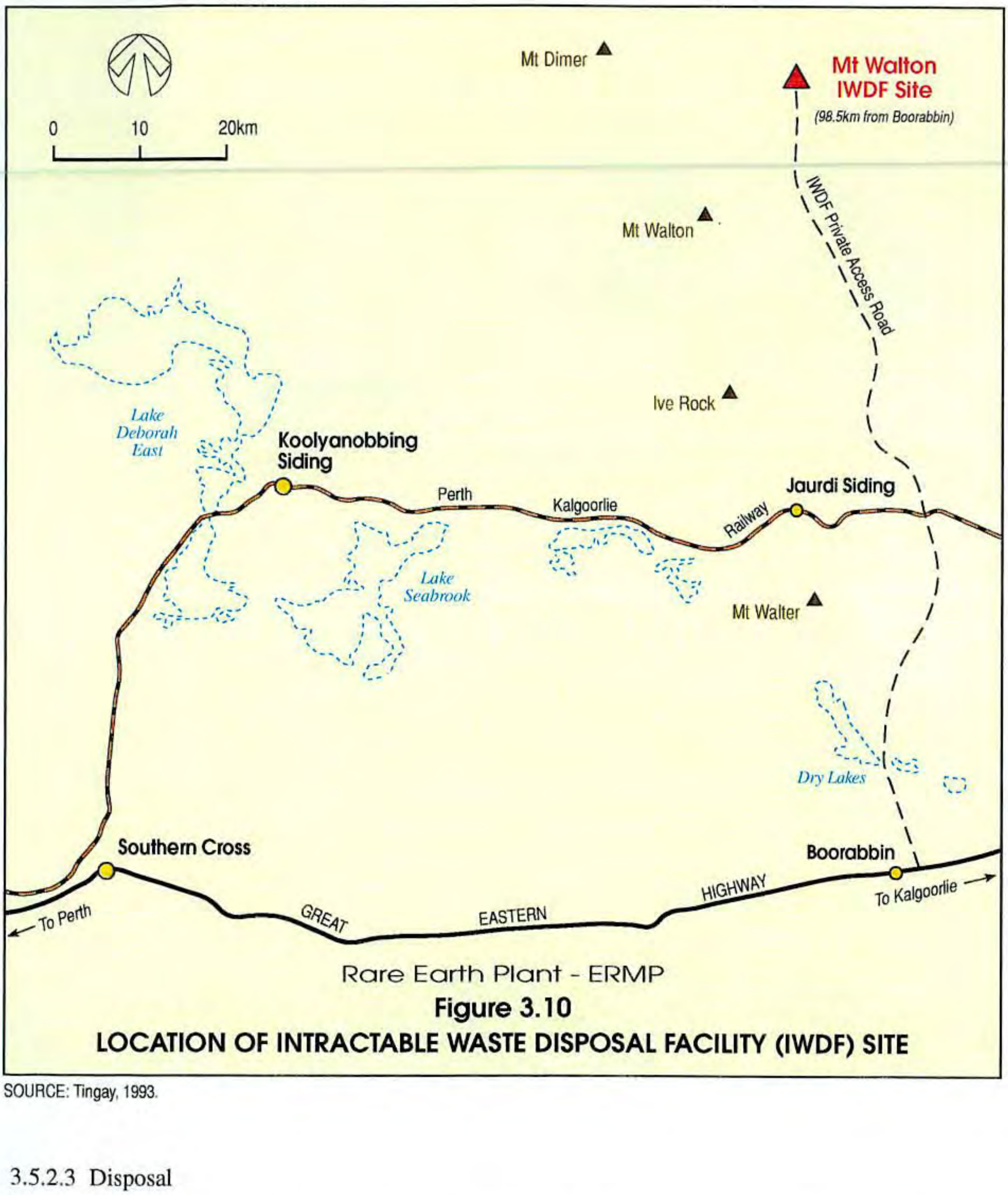


Rare Earth Plant - ERMP

Figure 3.9

SEMI TRAILER, B-DOUBLE AND ROAD TRAIN CONFIGURATIONS FOR THE TRANSPORT OF STANDARD ISO - CONTAINERS

The majority of the proposed truck route will follow major roads and highways as classified by the Main Roads Western Australia. DOME has classified the roads along the route as Category 1 and 2 (Western Australian Advisory Committee on Hazardous Substances, 1992). The proposed route is via Napier Road, Pinjarra-Williams Road, the South Western, Albany, Tonkin and Roe Highways to Midland then along the Great Eastern Highway to Boorabbin (approximately 100km east of Southern Cross) (Figure 2.2). This route is recommended by Main Roads and DOME for heavy haulage vehicles and transport of Dangerous Goods. From here the route will follow the access road to the IWDF site which is approximately 100km from Boorabbin (Figure 3.10).



Rare Earth Plant - ERMP

Figure 3.10

LOCATION OF INTRACTABLE WASTE DISPOSAL FACILITY (IWDF) SITE

SOURCE: Tingay, 1993.

3.5.2.3 Disposal

The gangue residue will be disposed of in a series of trenches at the IWDF located east of Mt Walton within the Shire of Coolgardie (Figure 3.10). This facility has been located, designed and approved by the EPA for the disposal of wastes, including those residues, arising from the processing of monazite (EPA, 1988a & b).

Disposal operations will be undertaken in accordance with the requirements of the Health Department, the Radiological Council and the State Mining Engineer and will be the responsibility of the DEP's Waste Management Division, the operator of the IWDF. Disposal operations and management will be detailed in the EMP prepared by the DEP's Waste Management Division.

3.6 CONSTRUCTION

3.6.1 Timing

Construction of the proposed plant is anticipated to take 12 months, commencing early in 1996.

3.6.2 Provision of Materials

Construction materials for the plant will be purchased locally, economic factors being taken into account. These are likely to be sourced from the Kwinana, Welshpool and Bunbury areas. Construction materials will be provided by local producers, however, there may be some surplus items of equipment from the Proponent's other Rare Earth Plants which could be imported and used at the Pinjarra plant site. Transportation of these materials will be by contractors utilising trucks along the existing major transport routes.

3.6.3 Legislative Requirements

Construction will take into account special requirements for a processing plant of this type. The legislation applicable to construction will take account of the Occupational Health, Safety and Welfare Act, 1984 and Regulations, 1988.

The transport of construction materials will comply with the regulations of the relevant transportation legislation. The majority of the trucks used will be of a standard size and capacity and will conform to the regulations and licensing requirements administered by the Western Australian Police Department. Any trucks hauling loads in excess of these regulations will be the subject of special permits that will be obtained prior to use.

3.6.4 Workforce Predictions

Up to 150 jobs will be created during the construction phase of the project. Based on experience gained during the construction of the Gallium Plant it is expected that most of the construction labour workforce will be sourced locally largely through Western Australian contractors. There is not expected to be a high demand for short-term housing, and therefore a housing programme is not considered necessary.

3.7 OPERATIONS WORKFORCE

Plant operations are expected to provide in the order of 50 permanent jobs. The final number of Rhône-Poulenc employees will depend upon the number of local contractors engaged in such duties as maintenance, janitorial and other services.

The skilled workforce groups will comprise:

- Engineers;
- Industrial Chemists;
- Management and Administration Personnel;
- Trades Persons;
- Skilled Plant Operators; and
- a Qualified Radiation Safety Officer (approved by the State Mining Engineer and the Radiological Council).

A satisfactory training programme was conducted for the Gallium Plant employees. This involved sending some of the specifically recruited Australian staff to France for training and the temporary transfer of a small experienced team from France to assist with some of the engineering, construction and commissioning aspects of the project. One French expatriate was retained after start up to provide additional experience and a communication link back into the Rhône-Poulenc technical resources in France. The Australian workforce was recruited mostly from Western Australia, with a few professional staff recruited from other States. The selection basis for recruiting was strictly on the grounds of suitability, appropriate experience and competence.

This pattern for recruitment and technology transfer will be similar for the Rare Earth project with the emphasis on multiskilling the workforce. It is likely that the majority of the workforce will be able to be sourced from the local area and preference will be given to those suitable applicants living in the Shire of Murray and Peel Region. If positions are not able to be filled by local residents then applicants will be sourced from outside the local area, preferably Western Australia. There may be a small team of international specialists (3-5 persons) required to supervise construction and commissioning and one specialist may remain.

The process plant will run 24 hours a day, 7 days a week, 46 weeks of the year. Thirty of the workers will work a 5 shift plan, based on 3 eight hour shifts a day. The remaining twenty will work in the laboratories and office and will generally work normal Monday to Friday business hours.

3.8 INFRASTRUCTURE

3.8.1 Plant Infrastructure

The majority of the plant infrastructure required for the Rare Earth Plant already exists as part of the Gallium Plant. These include:

- administration buildings and training facilities;
- service areas including stores, workshops, air compression, water treatment plant, recirculating water cooling system and boilers;
- ablution areas change rooms and laundry;
- laboratories; and
- evaporation ponds.

The Rare Earth Plant will be located along side the Gallium Plant. The site area was cleared and levelled during the construction of the Gallium Plant and its infrastructure.

In addition, the following service infrastructure has been established by the Proponent:

- **Electric Power:** A 22kV, 6,000VA connection with the Western Power system, from the Waroona Substation via an existing 132kV transmission line. The connection is shared with Alcoa.

- **Water:** Alcoa previously supplied the water for the Gallium Plant and this arrangement is expected to continue for the Rare Earth and Gallium Plants. If additional water is required it will be obtained from an underground bore. Approval to extract up to 300,000m^3/year has been issued to Rhône-Poulenc by the Water Authority of Western Australia.

- **Natural Gas:** Natural gas is supplied via a connection with the nearby Pinjarra-Waroona main of the Alinta Gas system. Gas requirements will be 493,000GJ per annum.

- **Telecommunications:** A 30 pair cable runs from Pinjarra to the plant site.

- **Roads:** Napier Road provides access to the plant. This road was upgraded and sealed by the Proponent at the western end to provide access to the plant. The Napier Road and Pinjarra-Williams Road intersection was also upgraded to accommodate the increased traffic flow.

- **Sewerage:** Septic tank and leach drains were installed to handle sewage from offices, workshops, changerooms and other work areas.

- **Fire protection facilities:** Comprehensive fire protection facilities have been installed including storage tanks, dual firewater pumps, firewater mains, sprinklers and deluge systems.

3.8.2 Off-site Infrastructure

Monazite and other process inputs will be obtained largely from existing operations. Product shipments from Fremantle will use existing facilities and transportation will be via the existing road network. Infrastructure to be established at the IWDF will be detailed in the EMP prepared by the DEP's Waste Management Division.

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4.0 COMMUNITY CONSULTATION

4.1 COMMUNITY CONSULTATION PROGRAMME

Rhône-Poulenc has given a high priority to community consultation during the planning and assessment phases of the project. Although the current project eliminates these environmental issues of concern from the previous project, it is recognised that a community consultation programme is essential to reliably inform the public and government bodies of the revised project and to obtain community input relevant to the development of the project.

The community consultation programme commenced at the initial planning stage of the project to enable the following:

- early advice to communities and interest groups;
- a genuine two-way consultative process;
- community access to the Proponent's decision-makers; and
- a flexible approach to project planning to accommodate community concerns.

An extensive programme was implemented during the preparation of the ERMP and will continue during the public review period, with follow-on programmes conducted during the construction and operation of the plant.

The consultation programme has included the following initiatives:

Workshops

- Coolgardie - 17 May 1995
- Pinjarra - 18, 20 May 1995
- Conservation Council - 23 May 1995
- Southern Cross - 14 June 1995

Proposed Workshops (September to October)

- Pinjarra
- Coolgardie
- Transport route local authorities

Briefings

- Local authorities
  - Shires
    - Murray
    - Coolgardie
    - Yilgarn
    - Serpentine-Jarrahdale
    - Kalamunda
    - Swan
    - Mundaring
    - Northam
    - Tammin
    - Cunderdin
    - Kellerberrin
    - Merredin

- Town of Northam

- City of Kalgoorlie-Boulder

- City of Armadale

- Community and Conservation Groups
    - Mount Walton Community Liaison Committee
    - Dwellingup Progress Association
    - Pinjarra Rotary Club
    - Murray Districts Aboriginal Association
    - Pinjarra Business Association
    - Mandurah Districts Rotary Club
    - WA Conservation Council
    - Goldfields Against Serious Pollution

- State Government Department and Authorities
    - Environmental Protection Authority
    - Department of Environmental Protection
    - Department of Resources Development
    - Department of Minerals and Energy
    - Westrail
    - WA Radiological Council
    - Main Roads Western Australia
    - Water Authority of Western Australia
    - Peel Inlet Management Authority
    - Peel Development Committee

- Parliamentarians
    - State Government
        - Premier
        - Deputy Premier
        - Minister for Resources
        - Minister for Environment
        - Member for Murray
        - Member for Vasse
        - Member for Wellington

- State Opposition
    - Opposition Leader
    - Shadow Minister for Resources
    - Shadow Minister for Environment
    - Shadow Minister for Transport

- Federal
    - Senator Peter Cook
    - Senator Dee Margetts

Media Releases (subjects)

- Project announcement and outline
- Workshop proposals
- Workshop results
- Pinjarra environmental management
- Management of Mt Walton
- Transport
- Radiation safety
- Product uses
- Waste disposal
- Community consultation
- Economic benefits
- Pinjarra Information Centre

Advertisements

- Rare Earth Reports
- Workshop advertisements
- Information Centre hours and contact numbers
- ERMP release and availability

Other Initiatives

- The establishment of an information centre
- The installation of a free call information line
- Direct mail distribution of project summaries and community issue papers to Murray Shire residents
- Tours of the plant site.

4.2 GOVERNMENT AUTHORITIES

Federal, State and Local

Government consultations have included meetings with appropriate officers from:

- the Commonwealth Environment Protection Agency to discuss the project and ensure its requirements are met by the ERMP process;

- the Western Australian EPA and DEP to identify the key environmental issues associated with the project and the approach to be taken in addressing these issues;

- Westrail to determine the feasibility of rail and/or road transport of the materials and waste;

- the DOME to discuss radiation, plant safety and transport issues;

- Radiation Health Section of the Health Department and the Radiological Council to ensure the appropriate codes and regulations are followed for radiation procedures;

- the DEP's Office of Waste Management to discuss disposal of the low level radioactive waste;

- Main Roads Western Australia to discuss transport route options;
- the Water Authority of Western Australia to discuss potential impacts of the project on surface and groundwater supplies in Pinjarra and along the transport route; and
- local authorities in the regions of the project, IWDF and transport routes.

4.3 SPECIFIC INTEREST GROUPS AND ISSUES IDENTIFIED

Four specific interest groups have been identified:

- residents of the Pinjarra area (including adjoining neighbours);
- the Eastern Goldfields community;
- communities in the vicinity of the transport route between Pinjarra and the waste disposal site in the Coolgardie Shire; and
- the conservation groups.

Details of the programme initiatives to identify and address the concerns of the interest groups are presented in Appendix F and summarised below.

4.3.1 Pinjarra Residents

This group comprised local residents, council executives, councillors and local business proprietors. The programme undertaken for this group includes:

- Rhône-Poulenc representatives briefing council members on the revised project;
- regular information columns in the local papers;
- detailed presentation and informal site tours;
- workshops;
- a static display; and
- an Information Centre located in Pinjarra.

Key issues identified by local residents and councillors related to:

- waste transport through the Pinjarra townsite (Section 6.2.2.3);
- mineral and product transport through the district (Section 6.2.2.1);
- emergency procedures in the event of transport accidents (Section 6.2.2.3 and Appendix H);
- changes to waste disposal arrangements at the Pinjarra site (Section 6.3);
- radiation safety (Section 6.4);
- neighbour impacts such as noise, land values etc (Section 6.11 and Appendix F);
- potential employment (Sections 1.10 and 6.14); and
- local business opportunities and other benefits (Sections 1.10 and 6.14).

Details of the questions and issues raised at the workshops are presented in Section 4.4.2 and Appendix F.

4.3.2 Goldfields Residents

Eastern Goldfields residents are involved in the community consultation programme because of the proposal to dispose of the low level radioactive waste at the WA Government's IWDF at Mt Walton in the Coolgardie Shire. This group is principally comprised of: council members of the Kalgoorlie-Boulder City Council and Shires of Coolgardie and Yilgarn, and the Mt Walton Community Liaison Committee plus local representatives.

The programme undertaken for this group is detailed in Appendix F and includes:

- briefings to the councils;
- Rhône-Poulenc representatives attending the Mt Walton Community Liaison Committee and Goldfields Against Serious Pollution (GASP) meetings; and
- workshops.

Key issues identified by the community representatives are:

- the use of the Goldfields as a "dumping ground" for State and National radioactive wastes (Appendix F);
- limited community influence over decision-making (Appendix F);
- perceived poor credibility of industry and government agencies (Appendix F);
- few local benefits had been identified by the Government or company (Section 1.10);
- the release of radioactivity through monazite processing (Section 6.4);
- concerns over emergency procedures, waste containers, handling strategies, burial techniques, dust and waste collection (Sections 6.2.2.3, 6.3.3 and 6.4.4 and Appendix H);
- training and use of emergency services personnel (Section 6.2.2.3 and Appendix H); and
- opportunity for support from the Proponent to fund emergency services, equipment and training (Section 6.2.2.3 and Appendix H).

4.3.3 Authorities along the Transport Route

Transport modes and route assessments form part of this project, therefore, all local authorities on the transport routes were contacted and advised of the project. This was followed by:

- the distribution of a background information publication; and
- company representatives briefing the authorities.

Key issues identified during consultation with these authorities include the following:

- heavy vehicle transport through the towns;
- need for bypass around towns;
- lack of funding for transport infrastructure and emergency services;
- emergency response procedures and planning;
- protection of waterways; and
- radiation safety for motorists and pedestrians along the transport route.

A workshop for local authorities along the transport route is planned to be held in October 1995.

4.3.4 Conservation Groups

Conservation groups such as the Conservation Council of Western Australia, Australian Conservation Foundation and the Senator of the Greens Party were consulted as a part of the Consultation Programme. Details of these meetings are presented in Appendix F.

Major issues identified by conservation group representatives are:

- the long-term implication of waste disposal at Mt Walton (Appendix F);
- radiation safety during processing (Section 6.4);
- safety procedures for transport of monazite and waste (Sections 6.2.2 and 6.4.4);
- public involvement in the transport proposal (Appendix F);
- general process environmental management (Section 6.16);
- emergency response procedures and training (Section 6.2.2.3 and Appendix H);
- responsibility/liability for the waste (Section 6.3.3.3);
- preference for rail transport (Section 2.4.2 and Appendix D); and
- transport via country routes in preference to metropolitan routes (Section 2.4.2).

A workshop was held for conservation council representatives to discuss aspects of the ERMP. The questions and issues raised at the Conservation Council workshop are listed in Section 4.4.3.

4.3.5 Addressing Community Concerns

Key issues raised by community groups fall into five principal categories:

- transport;
- plant site safety;
- environmental management at both the Pinjarra site and the IWDF site;
- social issues; and
- philosophical concerns.

Transport

Transport issues and management are detailed in Section 6.2. The Proponent has conducted an assessment of the transport methods and routes for materials requiring transport due to the project. Public perception is that the radioactive waste to be transported posed a high hazard and danger to the public. In reality, the hazard level is low and for radiation exposure to reach public limits would require contact with the waste for an extended period of time (Section 6.4.4.8).

Plant Site Safety

The Proponent's aim is to ensure that the health and safety of its employees and the general public will not be impaired by the operation of the project. The project will conform to all relevant codes and safety requirements. Safety procedures are documented in Sections 6.4.4 and 6.16. The Proponent has committed to setting an operational dose constraint to reduce radiation levels to half the acceptable limits for plant personnel. The plant has been designed to enhance plant safety measures and to reduce radiation exposure.

Environmental Management

Environmental management is documented in Section 6.0. Issues relating to specific environmental management were presented and discussed during the workshops, thereby allowing the Proponent to incorporate any additional issues identified during these workshops in the ERMP.

Social Issues

The principal social issues relate to the local economic benefits of the project. These are documented in Sections 1.10 and 6.14. As part of the consultation programme, methods of maximising local economic benefits will be addressed both for the Pinjarra area and the Goldfields area.

Philosophical Issues

Philosophical issues such as the transfer of waste from one region to another, the IWDF as being a national waste repository and the credibility of Government and Industry are issues not detailed in the main text of the ERMP, although such issues are an integral part of the community concerns. The Proponent has responded to these issues in Appendix F. The Proponent is hoping to resolve some of the concerns by ensuring that reliable and accurate information regarding the project is readily available to the public. Information sources on details of the project have been established to achieve this. The Proponent will provide open access to information in relation to waste specifications and recording of waste shipment. Plant operations will be subject to an independent audit. Community liaison committees at Pinjarra and Coolgardie will have access to company records and personnel.

4.4 WORKSHOPS

4.4.1 Coolgardie Workshop

A community workshop was held the Coolgardie Shire Hall on 17 May 1995 and was the first of a series of public forums (or workshops) to discuss the proposal for the Rare Earth Plant project.

The workshops were arranged at the suggestion of the WA Conservation Council and local community representatives to provide a forum for local residents to raise their concerns and ideas relating to the project. In addition, the workshop provided the Proponent with an opportunity to explain the technical aspects of the project.

Participants at the Coolgardie workshop sought answers to specific questions relating to the project. In addition, community representatives raised several issues of general concern, these being:

- community objections to the transfer of wastes from one region to another;
- the prospect of Mt Walton becoming a national waste repository;
- changes to data provided for an earlier Rhône-Poulenc rare earths proposal in 1988;
- questions about the accuracy of groundwater information at the IWDF documented by the Government; and
- lack of confidence in records kept by the Government with regard to actual waste buried at the IWDF.

The Proponent responses to these concerns are presented in Appendix F.

Specific questions raised at the Coolgardie workshop have been grouped into areas of concern and are listed in Table 4.1. Responses to all questions are detailed in Appendix F. Many of the issues are also detailed in the ERMP and the relevant section indicated in Table 4.1. Details relating to waste disposal operations will be presented in the DEP's Waste Management Division's EMP which will be issued for public comment during the ERMP public review period.

TABLE 4.1

QUESTIONS AND ISSUES RAISED AT THE COOLGARDIE WORKSHOP

Question/Issue	Response
TRANSPORT	
How will volunteer groups on the transport route be trained and equipped to deal with accidents?	Section 6.2.2.3 and Appendix H
Will the company investigate more rail options - including the prospect of "piggyback" or dual purpose road-rail vehicle?	Appendix F
Will the company examine a worst case scenario for transport - say, a waste truck colliding with a tourist bus?	Section 6.2.2.3
What is likely to happen if an accident occurs during heavy rain?	Section 6.2.2.3
How would the company deal with a bogged truck on the Mt Walton access road?	Appendix F
What happens if someone takes waste away from the scene of an accident?	Appendix F
Will the company lobby for more passing lanes on Great Eastern Highway?	Appendix F
Will trucks be clearly marked to identify the load?	Section 6.4.4.6
How will Rhône-Poulenc avoid unnecessary emergency response to unscheduled stops which are not emergencies?	Section 6.2.2.3
How will Rhône-Poulenc control panic driving by truck drivers to meet deadlines?	Appendix F
Why are previous arguments in favour of rail transport no longer considered valid?	Section 2.4.2 and Appendix D
RADIATION SAFETY	
What is the definition of low level radioactive waste?	Appendix F
Why are workers' exposure limits higher than public limits?	Appendix F
How do Australia's exposure limits compare to international standards, including world's best practice?	Section 6.4.4.1
WASTE DISPOSAL AT IWDF	
Will the specifications of the waste comply with the requirements for disposal at the site?	Sections 3.4.2 and 6.3.3
Can the waste be cast in concrete?	Appendix F
What happens to storm water and surface run-off at the Mt Walton site?	Appendix F
What are the risks of continuous disposal compared to occasional disposal campaigns?	Appendix F
Will the company research waste mixing at the site?	Appendix F
Will the bulka bags burst on impact or rupture in the trenches?	Appendix F
How will the company deal with human error during production, transport or disposal?	Section 6.3.3.3
How can the company guarantee the specification of the waste?	Section 6.3.3.3
Can Rhône-Poulenc undertake a waste minimisation program to reduce the tonnage of waste?	Appendix F

TABLE 4.1
(continued)

Question/Issue	Response
MANAGEMENT	
What happens to the waste management after Rhône-Poulenc has closed?	Appendix F
Will Mt Weld Rare Earth project waste be added to the Pinjarra waste?	Appendix F
Could the waste be hijacked and used for blackmail?	Appendix F
Local residents want 24-hour security at the Mt Walton site.	Appendix F
Rhône-Poulenc's responsibilities at the site are not defined. The company should have some responsibilities in case of Government mismanagement.	Section 1.4
There is no provision for community control over the site.	Section 6.16
Is there any possibility of waste retrieval to fuel a thorium nuclear reactor?	Appendix F
Will Rhône-Poulenc be subject to a bond for rehabilitation?	Section 1.4
What is Coolgardie Shire Council's position?	Appendix F
Will the council support community opposition to the waste disposal site?	Appendix F
GENERAL	
Why is this project subject to a Public Environmental Review, not a more comprehensive Environmental Review and Management Program?	Appendix F
Will the level of detailed information be equivalent to an ERMP?	Appendix F
Have criticisms of the company's previous ERMP been addressed?	Appendix F
How long will the project last?	Section 1.5
The community was promised the site would be used only for waste stored at QE2.	Appendix F
What is the company's response to claims that a beach was polluted by Rhône-Poulenc in France?	Appendix F
Residents don't trust either Government or companies. There is a suspicion of collusion or even corruption.	Appendix F
Is there insurance to cover farmers against damages?	Appendix F
What are Rhône-Poulenc's intentions in relation to a proposed plant at Port Pirie?	Appendix F
Western Australia should get more value adding and downstream processing as a compensation for keeping the waste.	Appendix F

4.4.2 Pinjarra Workshops

Two community workshops were held at the Pinjarra Senior High School, the first on 18 May 1995 and the second on 20 May 1995. These workshops are part of a series of public forums to discuss the Rare Earth Project.

Participants at the two Pinjarra workshops sought responses to specific questions relating to the project. In addition, community representatives raised several issues of general concern these being for the first workshop:

- the impact of transport operations;
- management of radioactivity and the potential risk to workers and the community;

- concern for Goldfields residents over radioactive waste disposal;
- the need for independent monitoring and public access information; and
- the need for preference policies to ensure local benefits from the project,

and from the second workshop:

- the potential risk of community exposure to radiation;
- occupational health and safety of workers at the plant;
- the transport of raw materials, products and wastes;
- environmental management at the Pinjarra site; and
- the need for training and employment of local people.

Proponent response to these concerns are presented in Appendix F.

Specific questions raised at the Pinjarra Workshops and from subsequent calls to the Proponent's free call telephone line have been grouped into areas of concern and are listed in Table 4.2. Responses to all questions are detailed in Appendix F and where appropriate Table 4.2 indicates the relevant sections of the ERMP relating to the question.

TABLE 4.2

QUESTIONS AND ISSUES RAISED AT THE PINJARRA WORKSHOPS

Question/Issue	Response
TRANSPORT	
What happens if the waste containers rupture during transport?	Section 6.2.2.3
What happens in the event of a spillage; how is it managed; what are the long-term impacts?	Section 6.2.2.3 and Appendix H
How will the trucks be scheduled - in the mornings, or evenings?	Section 6.2.2.1
How will emergency response teams be organised and equipped - who pays?	Section 6.2.2.3 and Appendix H
Will the local emergency crews be aware of the transport movement from Pinjarra to Mt Walton?	Section 6.2.2.3
How will tourists and other motorists be able to recognise waste trucks?	Sections 6.2.2.3 and 6.4.4.8
What labelling is required for the vehicles?	Sections 6.2.2.3 and 6.4.4.8
What will B-doubles be used to transport?	Sections 6.2.2.1 and 6.2.2.3
Will B-double units be able to negotiate all of the corners en-route to the plant?	Appendix F
Why is road the preferred option?	Section 2.4.2
Why won't the company use rail - possibly the line to Alcoa?	Section 2.4.2
Rail is the preferred option of some community representatives: - safer; - fewer trips; and - the built-in safety zone of the rail reserve.	Section 2.4.2 and Appendix D
Why can't Alcoa's spur line be used for rail transport?	Section 2.4.2
Why isn't Westrail keen to carry the waste?	Appendix F

TABLE 4.2
(continued)

Question/Issue	Response
Would the company consider a separate forum on transport?	Appendix F
Will the company spell out a disaster scenario - possibly an accident victim trapped in spilled waste?	Section 6.2.2.3
Workshop participants urged the company to run the transport operations - in preference to the employment of a contractor.	Section 6.2.2.3
Will there be an escort vehicle with the trucks?	Appendix F
Large quantities of nitric acid are required. Where do they come from? How is it transported?	Sections 3.3.2 and 6.2.2.1
What route will the company use to transport acid?	Section 6.2.2.1
What problems will occur in the event of an acid spillage?	Section 6.2.2.1
Will the company detail the schedule, numbers and movements of all workforce and service vehicles?	Section 6.2.2.2
Where is the monazite produced and how will it be transported?	Section 6.2.2.1
Will the company explain its "endeavour" to control truck routes; will the company make bypassing Pinjarra townsite a condition of its transport agreement?	Appendix F
What happens if an accident contaminates private land? Will there be adequate compensation from the company?	Appendix F
What is the proposed transport route for each of the raw materials? What is the breakdown of truck loads?	Section 6.2.2.1
Is Napier Road/Pinjarra-Williams Road intersection adequate?	Appendix F
Is there a certain distance the public will need to be away from trucks? Particularly during stops.	Appendix F
Rail is the preferred option from the Pinjarra plant site.	Section 2.4.2
RADIATION SAFETY	
Can the company guarantee the safety of local workers' and residents' children and grandchildren?	Section 6.4.4.4
What kind of exposure can emergency workers expect at accident scenes?	Appendix F
Has the company considered the potential for accidents during loading and unloading?	Appendix F
Is there a risk of waste attaching to the wheels and exteriors of vehicles?	Appendix F
Will the company consider a public education program to address concerns over radiation?	Appendix F
Will the solubility of radiums contained in the waste, pose a problem to the environment, such as groundwater at the disposal site and surface water during transport?	Appendix F
Will the workforce have a say in occupational health and safety?	Appendix F
Will there be any restriction of the employment of women, in particular those of child bearing age?	Appendix F
Has there been any research on the effects of radiation on male reproduction?	Appendix F
What is the difference in the effects of radiation on children and adults?	Appendix F
What is a lethal radiation dose?	Appendix F
What are Australia's exposure limits; how do they compare with international levels?	Section 6.4.4.1
How will radiation levels affect neighbours in the long-term?	Appendix F
Why do workers have the highest level of exposure?	Appendix F
Will transport containers absorb radiation?	Appendix F

TABLE 4.2
(continued)

Question/Issue	Response
Will the fertiliser material contain low level radiation?	Section 3.4.1
On a global scale can this plant be put into perspective compared to an operating nuclear power station?	Appendix F
How would the one millisievert level to the public be checked?	Appendix F
What constitutes radiation levels - low, medium high?	Appendix F
What is the radioactive level of monazite and the waste?	Sections 3.3.1, 3.4.2 and 6.4.4.8
DISPOSAL AT IWDF	
Will this mean that IWDF will be a national waste deposit?	Appendix F
Who is responsible for the waste once it reaches Mt Walton?	Section 1.4
How is the waste disposed of at Mt Walton?	Appendix F
How long will the waste be monitored at Mt Walton and who will pay?	Appendix F
Why are bags preferred over drums for waste disposal?	Section 2.4.2
What is the performance record of bulka bags - and how long before they break down after disposal?	Section 3.5.2.1
What happens if the waste dries out after an accident - will the dust be contained?	Sections 6.2.2.3, 6.4.4.8 and Appendix H
Why was the IWDF site chosen and who chose the site?	Appendix F
What is the geology of the site including details on aquifers and seismic risk?	Appendix F
SOCIAL AND ECONOMIC ISSUES	
What is the company's policy on local employment?	Section 3.7.3
How will the company define "local" people?	Appendix F
How many workers will be recruited locally?	Section 3.7.3
What percentage of the workforce will be skilled people "imported" for the project?	Section 3.7.3
Will local workers be trained - and will they be competent to manage all radiation issues?	Appendix F
Will the company consider a comprehensive social analysis, identifying positive and negative impacts, including: - Aboriginal issues; - property values; - business; and - tourism.	Appendix F
Aboriginal communities should have been contacted before the workshops.	Section 5.4.5
Will the company consider sponsorship of local organisations?	Appendix F
What is the company's track record in terms of corporate citizenship?	Appendix F
Isn't there enough industry in Pinjarra, already?	Appendix F
Are there any alternatives to the Pinjarra site?	Section 2.1
Will Rhône-Poulenc provide medical and hospital support services?	Appendix F
Will the company's management live in the Murray shire?	Appendix F

TABLE 4.2
(continued)

Question/Issue	Response
Would the company release details of its feasibility studies to provide information on what the company can afford?	Appendix F
Will the company consider compensation for nearby landowners?	Appendix F
This project has been added to the area recently, unlike the Alcoa refinery which has been here for thirty years. Therefore a consultative group would be an important community benefit.	Appendix F
What industrial awards would be applied to the workforce?	Appendix F
Will the company address any impact on property values - especially close properties?	Appendix F
Will the company encourage the workforce to live in Pinjarra?	Appendix F
Are there any plans for further investment in "clean" industries in Pinjarra?	Appendix F
Is there a market for tricalcium phosphate?	Section 3.4.1
ENVIRONMENTAL MANAGEMENT	
Can the company identify what might happen in abnormal plant operations?	Appendix F
How will the evaporation ponds be used and what will they contain?	Sections 3.5.1 and 6.3.2
Will there be any radioactive material in the ponds?	Sections 3.4.1 and 6.3.2
Will there be dust suppression on the ponds?	Section 6.3.2
Will the waste be packed into bags immediately and how is it stored prior to transporting?	Section 3.5.2.1
Will the company detail its "walkaway" plan for decommissioning?	Section 7.0
Who will be at the plant to ensure that the company complies with all of the regulations?	Appendix F
Do any future extensions or modifications have to go through a separate environmental assessment involving the Environmental Protection Authority?	Appendix F
Should the community opt for the Mt Weld project - involving a site closer to the disposal area?	Appendix F
Based on the experience with the Gallium Plant, some residents are concerned about noise levels from the project.	Section 6.11
Will the company consider buying out affected properties?	Appendix F
What will be the short/long-term effects to the Peel-Harvey Estuary System?	Section 6.3.2 and Appendix J
When the plant is decommissioned what can it be used for if there is radiation left on the site?	Section 7.0
Will the company outline environmental monitoring arrangements for noise, radiation (including radon gas) and baseline studies?	Sections 6.11, 5.5 and 6.4.4.6
What has changed so that the company is no longer producing ammonium nitrate?	Sections 1.3 and 3.2
Does the pipeline from Alcoa pose any threat to the environment - in particular the waterways?	Section 6.5
Is any material returned via pipelines to Alcoa?	Appendix F
If monazite is returned to its original location does this pose a problem for the environment and future residential developments?	Appendix F
Will the company be prepared to make its monitoring results available to the public - and will these be sent to the neighbours?	Appendix F
Does the project have any effect on the district horse trail?	Appendix F
Has there been any contamination from the company's plant in La Rochelle?	Appendix F

TABLE 4.2
(continued)

Question/Issue	Response
What air emissions will be produced, i.e. dust, any other?	Section 6.4.4.4
Is there likely to be any leaching from the ponds? If there is what is the impact on groundwater?	Sections 3.5.1.1, 6.3.2 and Appendix J
GENERAL	
Will the company establish a local consultative committee to monitor the project?	Section 6.16
Will all monitoring results be published?	Appendix F
Why were the workshops organised without alternative experts - to balance the company viewpoint?	Appendix F
Some community representatives urged the appointment of a panel of independent experts to represent the community.	Appendix F
Is the company aware that Belmont is a nuclear-free zone and might not allow the transport of radioactive waste through its district?	Appendix F
Will the company consider epidemiological studies of workers?	Appendix F
Can Rhône-Poulenc provide information on the company's industrial track record?	Appendix F
Will the company consider arrangements for bonds and penalties to address any future compensation requirements?	Appendix F
The company was asked to incorporate the workshop findings in a formal policy and action plan - rather than a list of questions and answers.	Appendix F
Some workshop participants said that mining and mineral processing companies had poor reputations for environmental management and community relations.	Appendix F
What is gallium?	Appendix F

4.4.3 Conservation Council Workshop

The Proponent and its consultants met with representatives of the Conservation Council of Western Australia on 23 May 1995 to identify some of the key issues to be addressed in the environmental document for the project.

The main issues to emerge from the discussion included:

- the need for effective public participation in project planning and assessment;
- concerns over the long term role of the IWDF as a waste disposal site;
- responsibility for the waste at the IWDF site;
- the significance of changes to the plans for monazite processing;
- transport;
- radiation safety for:
  - employees;
  - transport operators;
  - Pinjarra residents;
  - residents on the transport route;
  - people at the IWDF site; and
- the Proponent's French associations.

Representatives of the Conservation Council raised the issues and questions listed in Table 4.3. Responses to each of these questions are detailed in Appendix F. Table 4.3 indicates, where appropriate, the relevant section of the ERMP where the issues are also addressed.

TABLE 4.3

QUESTIONS AND ISSUES RAISED AT THE CONSERVATION COUNCIL WORKSHOP

Question/Issue	Response
TRANSPORT	
Who is responsible for management of the waste in transit?	Section 6.2.2.3
What kind of contingency plans are in place to deal with accidents?	Section 6.2.2.3 and Appendix H
Radium will be added to the waste in new proposals. How radioactive will this make the waste?	Appendix F
How much radiation will the truck drivers receive each year?	Section 6.4.4.8
What material will be transported to Fremantle?	Section 3.4.1
WASTE DISPOSAL	
Does the company believe it has permission to dispose of radioactive waste at Mt Walton?	Appendix F
The State Government has warned that no new industry can expect approval to dispose of waste at Mt Walton. Is the company aware of government commitments to limit the waste disposal at the site?	Appendix F
What levels of radiation are acceptable for materials to be buried at the Mt Walton site?	Sections 3.4.2 and 6.4.4.9
What happens to materials that are too radioactive for Mt Walton?	Appendix F
Who will have responsibility for the waste until it reaches the pit at Mt Walton?	Appendix F
What steps have been taken to manage a flash flood at the disposal site?	Appendix F
Will the disposal fees cover the costs of dealing with a misadventure at Mt Walton?	Appendix F
Who will unload the waste at Mt Walton?	Appendix F
How will containers be unloaded from the trucks?	Appendix F
SOCIAL AND ECONOMIC	
How will the Rare Earth Project facilitate a restart of the Gallium Plant?	Appendix F
How will the proposed consultative committees be structured?	Appendix F
Why did Rhône-Poulenc abandon its previous project so quickly after China began producing rare earth?	Appendix F
If the project has been stopped once, will it be stopped again?	Appendix F
If this project is so fragile economically, should it be considered at all?	Appendix F
Is Rhône-Poulenc a French Government owned company?	Appendix F
What is the present international distribution of the company's shareholdings?	Appendix F
ENVIRONMENTAL MANAGEMENT	
What provision has been made for decommissioning the plant?	Section 7.0
Is there a risk of evaporation ponds overflowing during heavy rainstorm?	Section 6.3.2 and Appendix J
What provision has been made for a pond rupture in the event of an earthquake?	Appendix J
Will the company publish a full table of all radioactive elements - their half lives and biological effects?	Appendix F
What quantities of reagents and other hazardous materials will be stored on site?	Section 3.3.2
Will there be any radioactive cross-contamination of fertiliser material?	Section 3.4.1

4.4.4 Southern Cross Workshop

A community workshop was held at the Southern Cross Recreation Centre on 14 June 1995 as part of the community consultation programme.

Participants at the Southern Cross workshop sought answers to specific questions relating to the project. In addition, community representatives raised the following issues of concern:

- community objections to the transfer of wastes from the South West to the Goldfields;
- the prospect of increased waste disposal at the IWDF;
- management of the IWDF operation; and
- transport safety.

Questions and Issues raised at the Southern Cross Workshop have been grouped in areas of concern and are listed in Table 4.4. Responses to these questions and issues are presented in Appendix F. Further details are provided, where appropriate, in the relevant sections noted in Table 4.4.

TABLE 4.4

QUESTIONS AND ISSUES RAISED AT THE SOUTHERN CROSS WORKSHOP

Question/Issue	Response
TRANSPORT	
Rhône-Poulenc's waste transport operations face a high risk of accidents because of heavy transport on the Great Eastern Highway.	Section 2.4.2
Who decides the transport option?	Appendix F
What is the company's attitude to putting an emergency/safety unit in the Shire?	Section 6.2.2.3
What are the potential benefits to the Southern Cross community - perhaps a new ambulance?	Appendix F
What will be the effect of rain on a waste spillage?	Section 6.2.2.3
Will the Government or the company be responsible for upgrading the Mt Walton access road?	Sections 1.4 and 2.4.2
Wouldn't the company save money by building a rail link to Mt Walton site?	Appendix F
The company should keep trucks off the road in the interests of the district's tourist industry.	Appendix F
What happens if the global positioning system fails?	Appendix F
Does the company have insurance cover for the impacts of a waste spill on or near farms?	Appendix F
If a B-double unit overturns and blocks Great Eastern Highway, how long would motorists have to wait before a team of radiation specialists clear the road?	Appendix F
Are emergency service volunteers at risk if the waste adheres to clothing or skin for long periods?	Section 6.4.4.8
Is the Southern Cross workshop part of the Public Environmental Review - or is the forum a public relations exercise?	Appendix F
Can any members of the public inspect the site?	Appendix F
Is monazite processed anywhere else in the world - to allow the community to make some comparisons between existing practice and Rhône-Poulenc's plans?	Appendix F

TABLE 4.4
(continued)

Question/Issue	Response
WASTE DISPOSAL	
If Rhône-Poulenc is only concentrating natural radiation why not return the material to its native site?	Appendix F
Why should the Southern Cross community have local ground contaminated with waste from another region?	Appendix F
Wouldn't it be more prudent to leave the monazite where it is?	Appendix F
What is the half life of the radioactive waste?	Appendix F
Will the disposal site be affected by mine blasting ten kilometres away?	Appendix F
Why not take the waste to Maralinga?	Appendix F
What is the particle size of the waste?	Appendix F
Will radioactive waste spread through the soil at the site?	Appendix F
What heavy metals will be contained in the waste?	Section 3.4.2
Will the company detail: - the trench construction techniques; - the volume of material removed; - expected swell factors; - compaction techniques; and - the expected height of overburden mounds?	Appendix F
What area of land will be disturbed by the waste disposal?	Section 6.3.3.2
How does the company classify a "remote site"?	Appendix F
Is the material colloidal?	Appendix F
Does 6,000 tonnes a year of waste represent the maximum capacity of the plant?	Appendix F
Originally the waste was to be encased in concrete. Why has this proposal been dropped?	Appendix F
Is any future use envisaged for the waste?	Appendix F
How much geological data has been produced to provide information on the Mt Walton site. Can the company guarantee the stability of the area?	Appendix F
Can the company guarantee the specification of the waste?	Sections 3.4.2 and Appendix E
Could the community arrange for an independent expert to test the specification of the waste?	Section 6.3.3.4
Will Rhône-Poulenc undertake a waste minimisation program to reduce the material for disposal?	Appendix F
What is the long-term stability of the waste?	Appendix F
RADIATION SAFETY	
Is the waste proposed for Mt Walton expected to be more radioactive than the waste described in a previous company proposal?	Section 1.3
If the radioactivity levels are low, why is there a need for a water shield behind the cabin of the road transport units?	Section 6.4.4.8
What protects people who are loading and unloading bulka bags?	Section 6.4.4.5
How radioactive is the waste?	Section 3.4.2
Will people unloading the waste be subjected to initial bursts of high level radiation?	Appendix F
Will the containers become radioactive?	Appendix F

TABLE 4.4
(continued)

Question/Issue	Response
If the waste dries out will the dust become airborne and possibly inhaled by people at the scene?	Section 6.4.4.8
What is the background radiation level of places like the Capel beach front?	Appendix F
What are the long-term results of limited doses of radiation?	Appendix F
What happens if a person ingests some of the waste during an accident or emergency?	Section 6.4.4.8
Can expert views be trusted given recent changes in medical opinion on breast X-rays?	Appendix F
ASSESSMENT AND MANAGEMENT	
What approval process is required to allow monazite waste disposal at Mt Walton?	Appendix F
Mt Walton has never been approved for a burial site for monazite waste. The only materials approved for disposal is waste from the QE2 medical centre. In this case why isn't the company doing a full ERMP instead of a PER?	Appendix F
What is Rhône-Poulenc's credibility? Can the community expect the company to honour its commitments?	Appendix F
How many years will the project last?	Section 1.5
Will the company guarantee to fix any problems at the site?	Appendix F
In view of experiences at Maralinga, will Rhône-Poulenc put up enough money to remove the material if necessary?	Appendix F
What waste burial records will be kept?	Appendix F
Will an overall plan of waste burial be produced?	Appendix F
How can the public check that Rhône-Poulenc's technical answers are correct?	Section 6.3.3.4
What will the company do if Mt Walton is declared a sacred Aboriginal site?	Appendix F
Will the company detail the disposal schedule - and how long waste bags will remain uncovered?	Appendix F
What is the on-site management structure for Mt Walton?	Appendix F
Will the public be involved in the management of the site?	Appendix F
Australia should get more benefits - in the form of value adding - in return for keeping the monazite waste.	Appendix F

5.0 DESCRIPTION OF THE EXISTING ENVIRONMENT

5.1 GENERAL

The existing environment of the Pinjarra area has been well described as a result of the various developments proposed for the area. The climate is temperate mediterranean with a substantial excess of evaporation over precipitation. The plant site lies in the foothills of the Darling Scarp and extensive site studies have been undertaken to assess and describe the climate, geology, hydrogeology, biology, radiology, heritage, ethnography and archaeology of the site. These studies are described in detail in the previous ERMP/EIS (Dames & Moore, 1988a) for the previous project. Aspects of the existing environment, relating to potential environmental issues for this project, are summarised in the following sections.

5.2 PHYSICAL ENVIRONMENT

5.2.1 Evaporation

Pan evaporation data were collected, on a monthly basis from the weather station at the Alcoa Pinjarra Refinery during the period 1978 to 1983. The mean annual evaporation was estimated at 2,532mm/year with mean maximum monthly evaporation in January (394mm/month) and mean minimum monthly evaporation in July (65mm/month). These data were converted statistically in 1981, for comparison purposes, and the pan-derived lake evaporation for freshwater was estimated as follows:

Lowest	-	2,275mm/year
Mean	-	2,503mm/year
Highest	-	2,890mm/year

The period 1978 to 1983 was a relatively dry spell so the mean evaporation is slightly higher than a revised estimate of 2,289mm/year (Alcoa of Australia; 1995, pers. comm.).

5.2.2 Geology

The plant site lies west of the projected location of the Darling Fault which demarcates the Perth Basin to the west from the Yilgarn Block to the east. The Perth Basin is a deep trough filled with Phanerozoic sedimentary rocks and covered with a surface mantle of Quaternary deposits (Playford *et al.*, 1975). The Quaternary and Recent deposits immediately underlying the site comprise colluvium, Bassendean Sand and Yoganup Formation (Figure 5.1).

Cores taken of the deeper rocks under the site (Dames & Moore, 1987b) have shown the presence of units comprising predominantly weak sandstones, shales, siltstones and claystones. These units are tentatively correlated with the South Perth Shale and/or the Leederville Formation, and are considerably stronger and more indurated than the overlying Quaternary sediments. Further details of the geology of the site are given in the ERMP/EIS (Dames & Moore, 1988a).

5.2.3 Soils

The soils at the proposed site comprise the Lotons and Gwindinup Series of the Ridge Hill Shelf, which forms part of the Piedmont Zone physiographic unit. The Lotons Series is developed on the undissected parts of the Ridge Hill Shelf and is predominantly composed of sand to sandy loams. Lateritic gravel is present in all or part of the upper horizons. A soil map for the area is presented as Figure 5.2. The Gwindinup Series forms the western boundary of the laterite soils, although lateritic gravel may occur to a metre or more below the surface. The soils of this Series are typically grey-brown sand, gradually merging to a yellow sand at a depth of about 0.3m.

5.2.4 Hydrogeology

As described in the previous sections, the plant site is located near the Darling Scarp on the eastern boundary of the Perth Basin. At this location both the Leederville and Cockleshell Gully Formations subcrop within 50m of ground surface and have a gentle dip to the west.

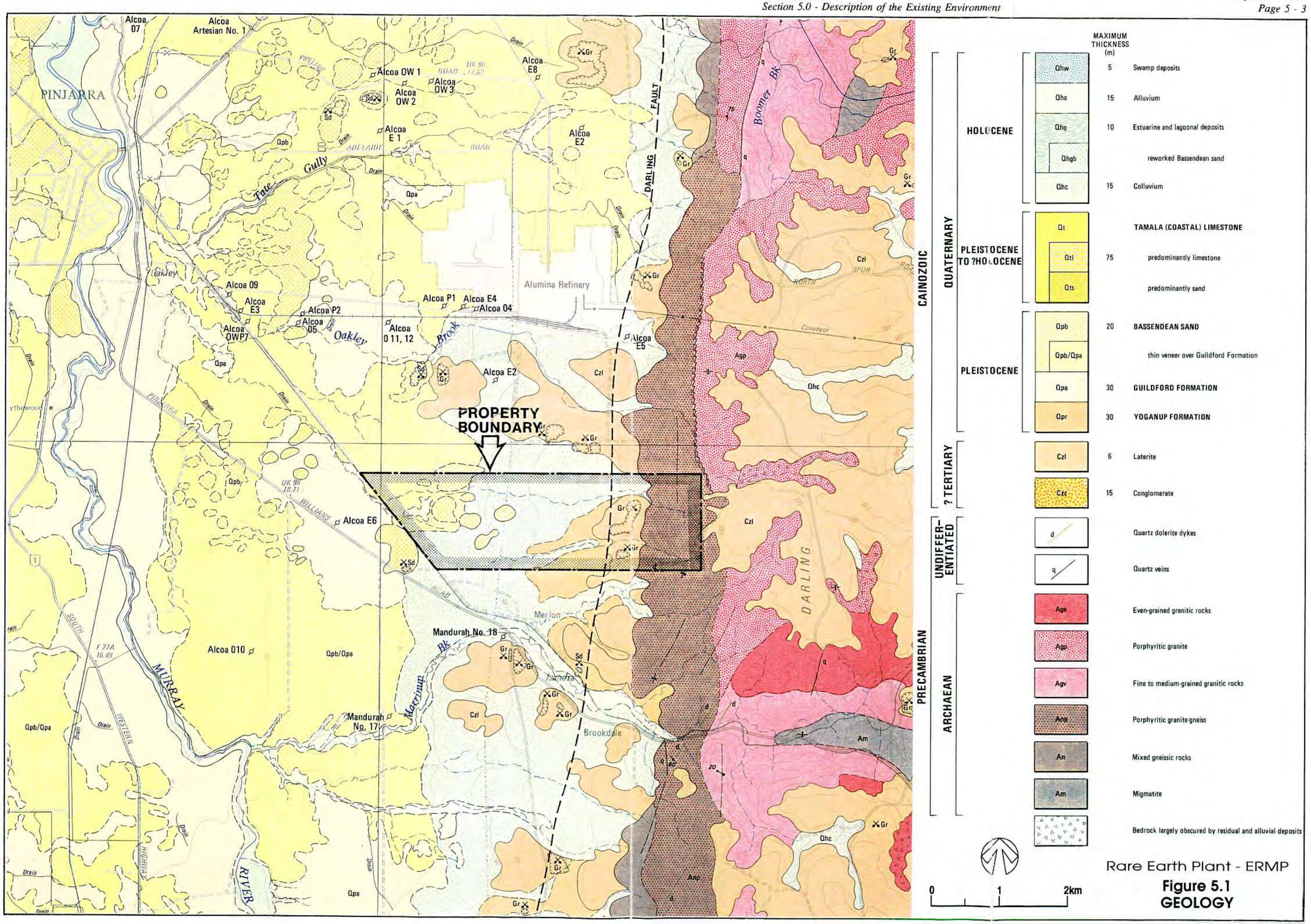
These Mesozoic formations are mantled by clayey Quaternary sediments which contain thin, discontinuous, unconfined to confined sand aquifers, and minor amounts of marginal quality groundwater. The Leederville Formation, an important aquifer further west, is thin (80-100m) and poorly developed in the area, and contains moderate amounts of reasonable quality groundwater in thin confined sandstone aquifers. The Cockleshell Gully Formation contains important confined shallow sandstone aquifers. The Alcoa refinery, located 4km north of the plant site, obtains industrial groundwater supplies from this formation.

Regional groundwater flow is to the west and northwest in both the Mesozoic and Quaternary sediments. Due to the elevated topography, the area near the Darling Scarp forms the main recharge area for these formations. Local groundwater flow is therefore downward near the scarp and deflected laterally to the west in the uppermost Quaternary sediments.

5.2.5 Hydrology

The site is located within the Murray River drainage basin. Surface drainage near the site area is via two westward-flowing streams, one flowing towards the Murray River, approximately 6km to the west of the site, the other flowing into surface sands near the western end of the site. Major streams in the area include Oakley Brook, about 3km north of the site, and Marrinup Brook, about 1km south of the site. Details of surface drainage are shown on Figure 5.3.

The Murray River has a catchment area of approximately 8,300km^2. Flow in the river is highly seasonal, with zero surface flow usual in summer, though subsurface flow continues through shallow alluvial sediments under the riverbeds. Typically 90% of the annual flow in the Murray River occurs in the four months from June to September.



Rare Earth Plant - ERMP

Figure 5.1
GEOLOGY

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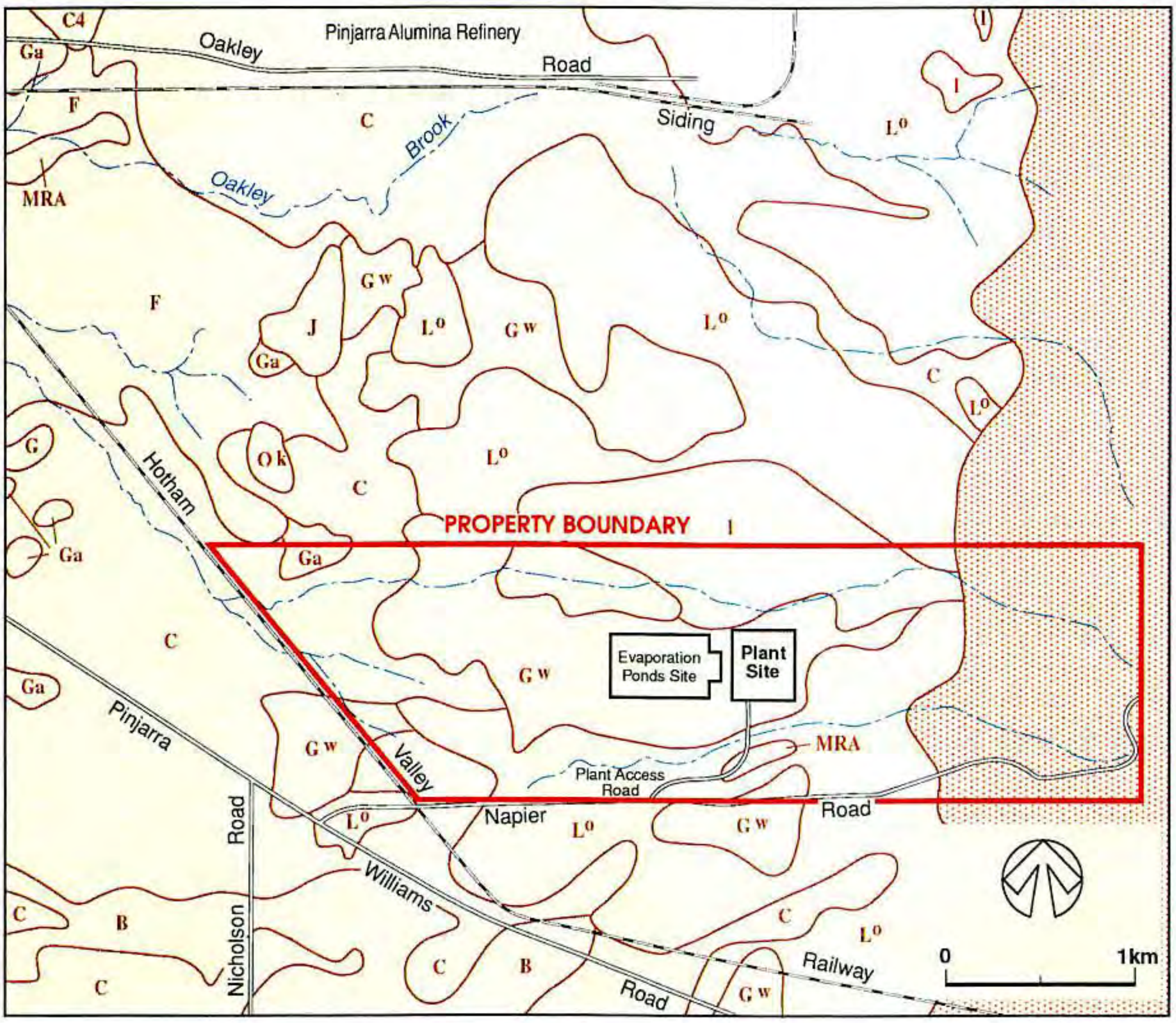


I SOILS OF THE DARLING PLATEAU AND SCARP

- Darling Scarp Soils. Steep and rocky brown soils of the Darling Scarp

II SOILS OF THE RIDGE HILL SHELF

- L⁰ — Lotons Series. Grey-brown gravelly sand or sandy loam over a mottled sandy clay
- G w — Gwindinup Series. Grey-brown sandy surface becoming yellow with depth
- I — Isandra Series. Grey-brown or brown sand over a compacted gritty sandy clay

III SOILS OF THE RIVERINE PLAIN

- C — Coolup Series. Grey sand. Sandy loam or loam over strongly mottled sandy clay at about 0.5m
- F — Fairbridge Series. Grey becoming yellow-grey sand with a faintly mottled sandy clay at about 0.75m

III SOILS OF THE RIVERINE PLAIN (Cont.)

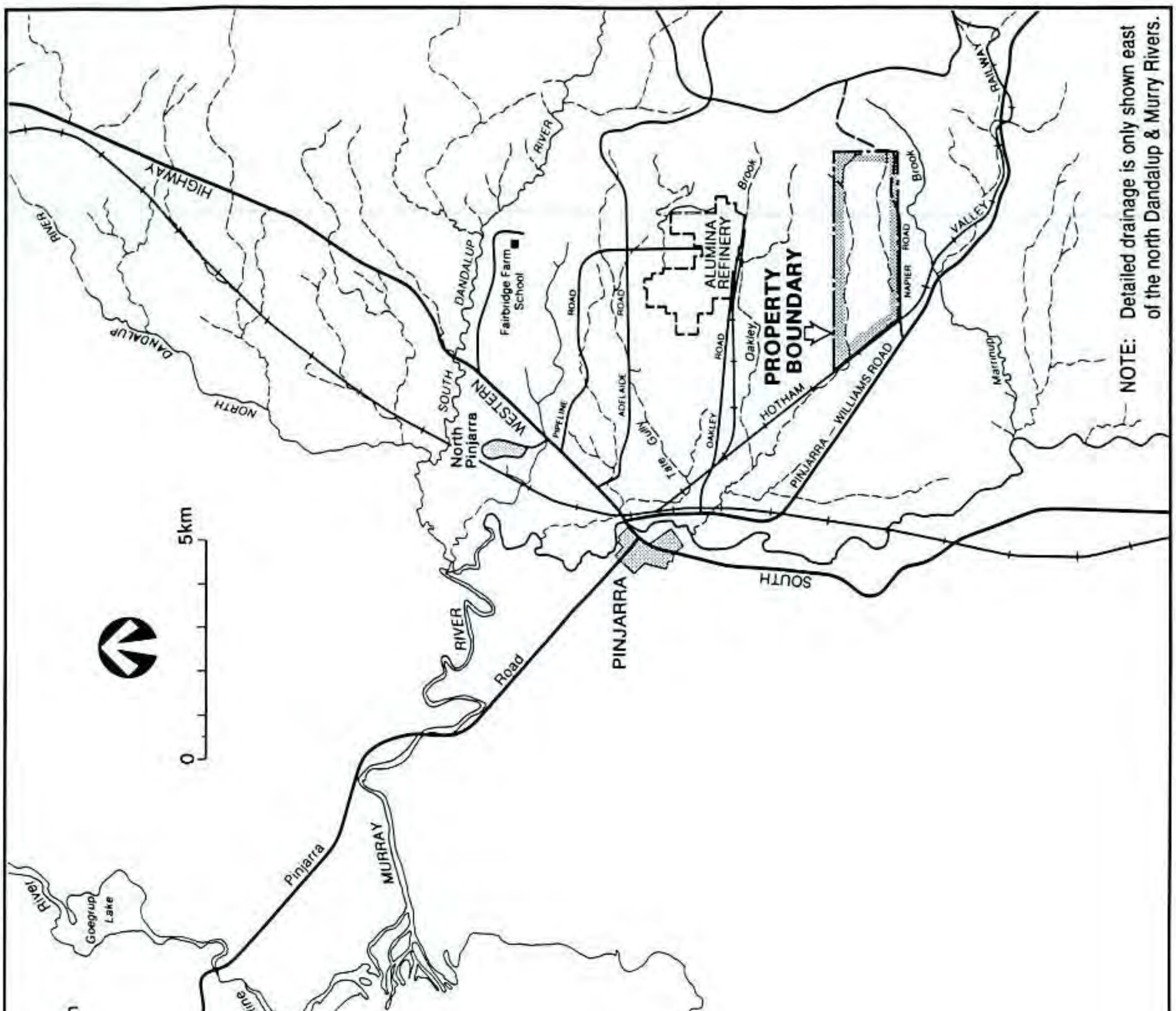
- Ok — Oakley Series. As Fairbridge series but with zone of organic staining above clay horizon
- B — Boyanup Series. Grey-brown sand, sandy loam, loam or clay over a yellow-brown friable sandy clay
- S1 — Swamp Series 1. Light brown sand overlying grey and yellow-brown B horizon at 0.3-0.5m
- C4 — Complex 4. Complex of small hills of Gavin sand and mixed drainage line soils
- MRA — Mixed Riverine Alluvium. Recent variable alluvial deposits near present stream courses

IV SOILS OF THE LOW DUNES

- Ga — Gavin Series. Grey sandy dune soils with organic or iron-organic pan at depth
- J — Joel Series. Grey swampy soils with organic pan at about 0.75m

Rare Earth Plant - ERMP

Figure 5.2
SOILS MAP



Rare Earth Plant - ERMP

Figure 5.3
SURFACE DRAINAGE

5.2.6 Seismic Risk

Records for the Australian Geological Survey Organisation (formally the Bureau of Mineral Resources) indicate that only nine earth tremors above II on the Modified Mercalli Scale (MMII) have occurred at the Pinjarra site since 1941. MMII is classified as the level at which tremors may be felt by a few persons at rest indoors, especially on upper floors (Standards Association of Australia, 1979). The highest intensity was in 1968 (the Meckering earthquake) where an intensity of MMV was experienced in Pinjarra.

The peak ground intensity contour map (Gaull, B.A. *et al.*, 1990) indicates that Pinjarra has a risk of an intensity MMVI to MMVII for a 1:500 year return event. From the definition of Modified Mercalli intensities, it is not until tremors reach an intensity of MMIX that dam structure may be seriously damaged (Standards Association of Australia, 1979).

5.3 BIOLOGICAL ENVIRONMENT

5.3.1 Vegetation and Flora

Prior to construction of the Gallium Plant, there was virtually no native vegetation remaining on the sites of the evaporation ponds, processing plant, storm lake, the plant access road - or on the downslope between these facilities and the Hotham Valley Railway. The ground layer of existing vegetation was a mixture of pasture grasses, lupins and other legumes and a variety of weeds. Jarrah (*Eucalyptus marginata*) trees and, to a lesser extent, Marri (*E. calophylla*) trees are scattered through the property.

No rare, geographically restricted or poorly known species of plants are known to or are likely to occur on the project site.

Approximately 190ha of trees have been established on the property to serve two main objectives. Firstly, approximately 20ha of a variety of native trees and shrubs were planted around the southern border of the site to act as a visual screen. Secondly, CALM has developed a 170ha hardwood plantation of Blue Gums (*Eucalyptus globuli*) in the southwestern section of the site (Figure 5.4).

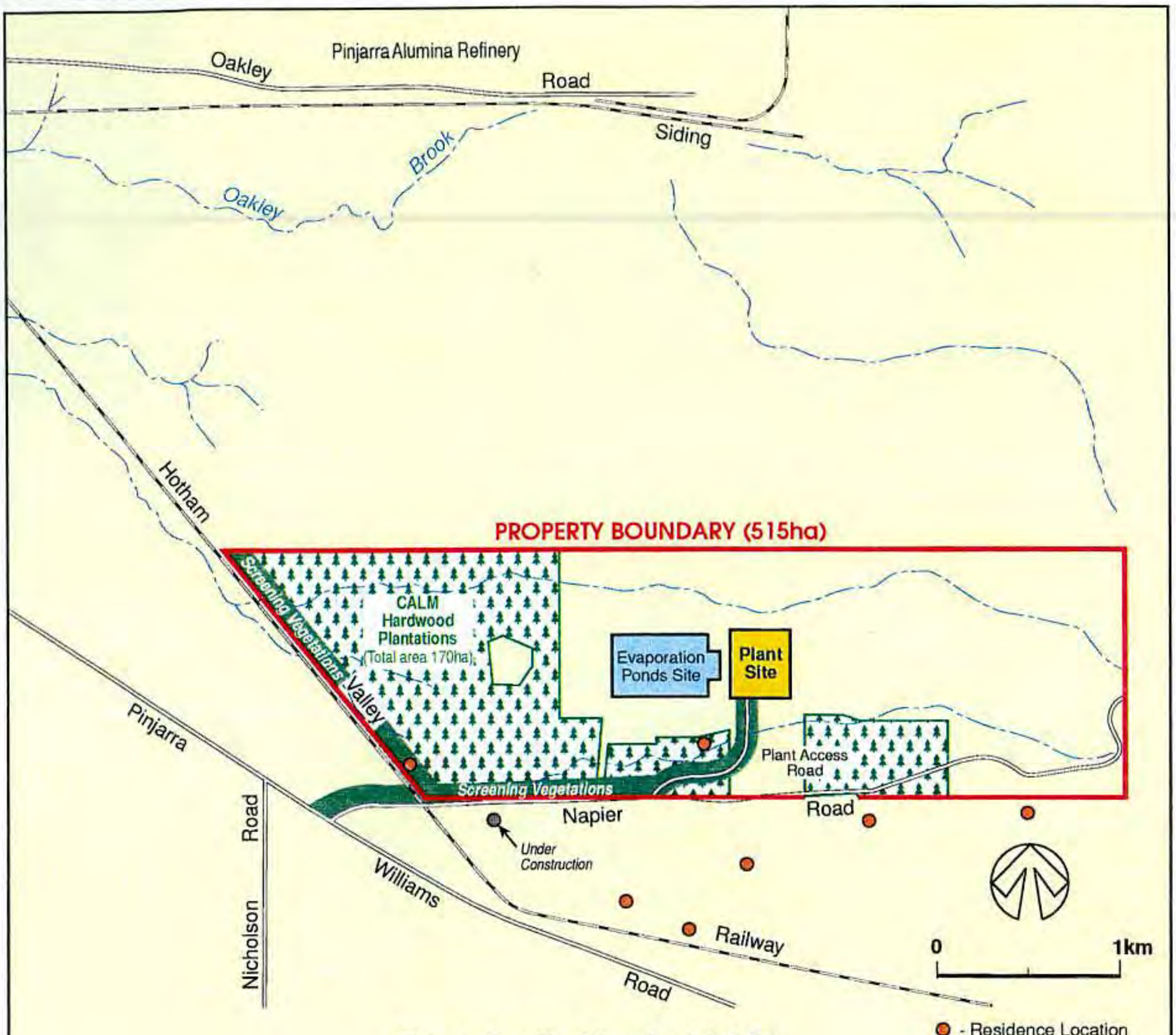
5.3.2 Fauna

The only mammals recorded on the project site are feral rabbits and domestic cattle and sheep, all of which have had severe impacts on the environment. It is unlikely that any of the native mammals, or other native vertebrate and invertebrate animals living in the project area is rare, restricted or endangered.

5.4 SOCIAL ENVIRONMENT

5.4.1 General

The social environment has been well described in the ERMP/EIS (Dames & Moore, 1988a) and only those aspects which may be impacted upon by this project have been updated. These are summarised in the following sections.



Rare Earth Plant - ERMP

Figure 5.4

LOCATION OF NEAREST RESIDENCES IN RELATION TO PLANT SITE

5.4.2 Regional Land Use

The 515ha plant site is located on land previously within the boundary of Alcoa of Australia Ltd's Pinjarra Alumina Refinery and is owned by the Proponent.

The primary land use of the region is farming, forestry and mining with some urban development in the Mandurah Shire. East of the Darling Scarp, land use is primarily Crown Reserves, State Forest, National Parks and Public Uses, and the hill areas are used primarily for forestry, bauxite mining and surface water supply catchments.

Major urban areas in the region are Pinjarra, Carcoola (North Pinjarra), Mandurah and Waroona, all have planned Future Urban Land areas, in particular the Shire of Mandurah.

Areas of human habitation in the vicinity of the site occur mainly to the south and southwest. These consist of single houses situated on rural properties. There are seven occupied residences to the south of the plant and within two kilometre of the project area. Two of these are on the Proponent's property and are leased to tenants. Many of these properties are accessed from either Williams or Napier Roads. An eighth residence fronting Napier Road is currently under construction. The location of these residences are shown on Figure 5.4.

5.4.3 Demographic Profile

For the purpose of the demographic study, data from the Shires of Murray, Mandurah and Waroona have been selected (Figure 5.5) and these shires are referred to as the study region. Demographic profiles are presented for these three shires in the following section.

5.4.3.1 Population Levels

Existing and projected population levels are shown in Table 5.1. These are based on Australian Bureau of Statistics Census counts up to 1991 and projections supplied by the Ministry for Planning since 1991 (ABS, 1991; Ministry for Planning, pers. comm.).

TABLE 5.1

POPULATION LEVELS AND PROJECTIONS

	1986[1]	1991[1]	1996[1, 2]	2001[2]	2006[2]
Murray	7,180	7,670	9,700	10,900	12,200
Mandurah	16,760	20,250	35,100	41,600	48,900
Waroona	2,660	2,760	3,500	3,900	4,300
TOTAL	26,600	30,680	48,300	56,400	65,400
WA	1,406,929	1,586,825	1,795,400	1,955,500	2,118,200

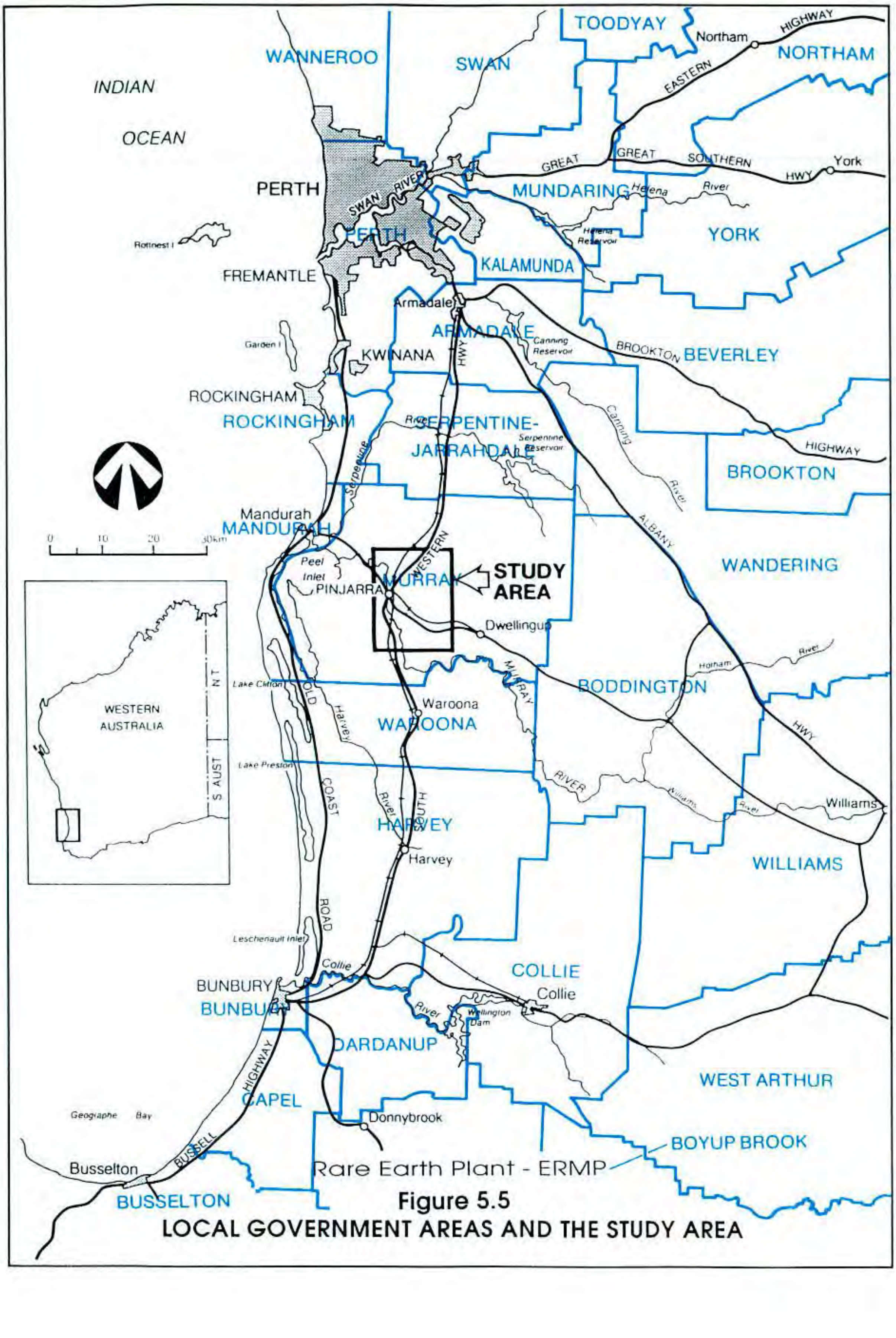
Source: 1 Australian Bureau of Statistics Census of Population and Housing (1991).
2 Ministry for Planning, pers. comm.

Figure 5.6 shows a comparison of growth rates for each of the local authorities in the study region with the State as a whole. While both Murray and Waroona experienced relatively low growth rates between 1986-1991, population projections beyond 1991 indicate higher levels than Western Australian average growth rates. While much of this can be attributed to Mandurah which is a regional centre and is a popular location for retirement. Mandurah has projected rates of around 20% over a five year period. Murray and Waroona are both also expected to grow at above the Western Australian average rate. Obviously these growth projections will be dependent upon the region's ability to foster economic development which will attract people to the area.

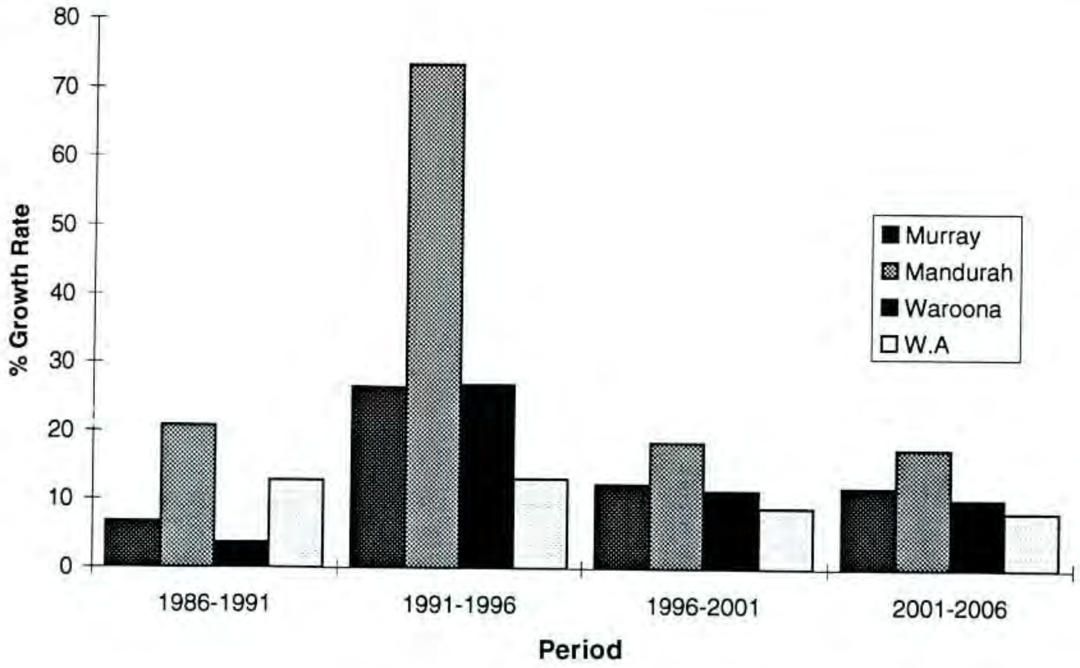
Age Distribution

The age profile of the three local authority areas and the Western Australian average is shown on Figure 5.7. In relation to the state average, the study region generally reflects the statewide age structure, however, the following variations should be noted:

- Mandurah has a particularly high representation in the 65+ age group, resulting from Mandurah's popularity as a retirement location;
- the study region has a lower than average representation in the 15-24 age group, most probably due to the relative lack of educational and employment opportunities available in rural areas; and
- the study areas have a higher than average representation in the 55-64 age group.

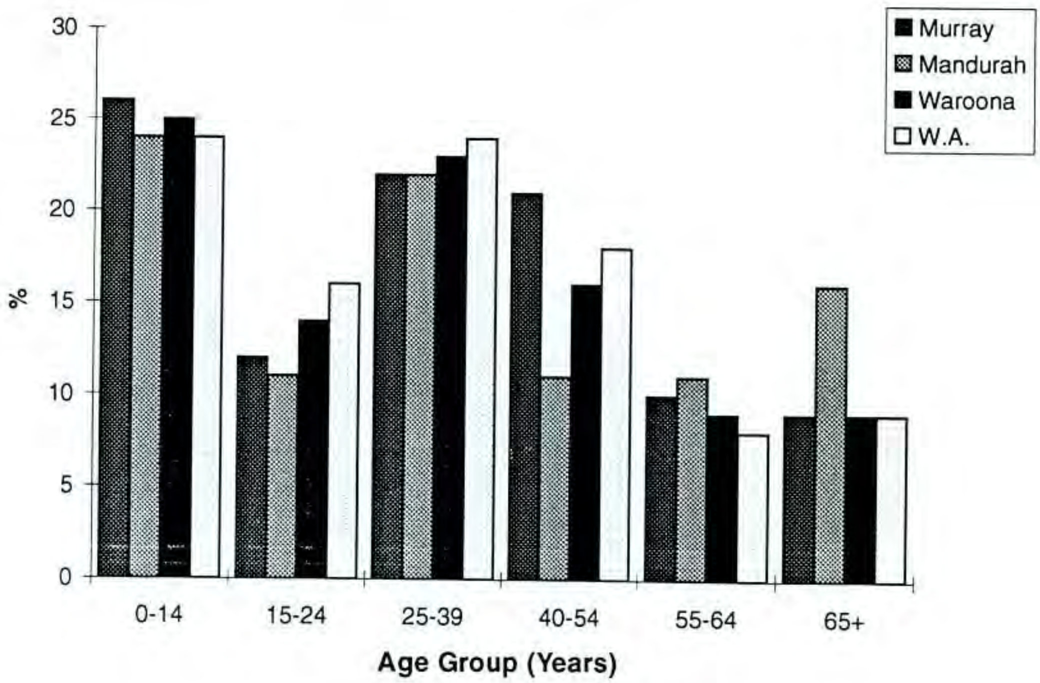


Rare Earth Plant - ERMP
Figure 5.5
LOCAL GOVERNMENT AREAS AND THE STUDY AREA



Rare Earth Plant - ERMP

Figure 5.6
POPULATION LEVELS - EXISTING AND PROJECTED



Rare Earth Plant - ERMP

Figure 5.7
AGE DISTRIBUTION

SOURCE: Ministry for Planning, Australian Bureau of Statistics.

Employment

The study region has a total workforce of 21,007 (DEET, June Quarter, 1994). Figures supplied by the ABS indicating employment levels in industry groups demonstrate a bias towards primary and secondary industries. The Peel Region Profile also acknowledges this, noting that "in recent years the area has become increasingly reliant upon mining and mineral processing as a primary source of economic development and job creation" (Peel Development Commission, 1993).

The most significant industry groups in the study area are Manufacturing (employing 16% of the workforce), Community Services (14%), Construction (9%), Agriculture, Forestry, Fishing and Hunting (6%) and Mining (6%). Compared with statewide averages, these industry groups employ a higher than average proportion of the workforce, with the exception of Community Services which is 4% below average (Peel Development Commission, 1993).

Unemployment

Unemployment in the study region was 10.5% for the June quarter 1994, compared to the State average of 8.4%. This figure, however, is largely attributable to the Mandurah workforce which comprises 70% of the workforce with an unemployment rate of 11.5%. Unemployment rates in Murray and Waroona were 8.3% and 7.4% respectively (DEET, 1994).

5.4.4 Historical Sites

Discussions with the Heritage Council of Western Australia revealed that there are no areas listed on the National Estate existing in or near the process plant site. The nearest areas listed are natural landscapes around the Peel Inlet.

5.4.5 Ethnography and Archaeology

An Aboriginal site survey of the plant site was conducted in August 1987 and comprised ethnographic and archaeological components.

The ethnographic survey was aimed at locating and consulting with the traditional Aboriginal custodians of the area to ensure that the proposed development did not pose a threat to Aboriginal sites, as defined by the Western Australian Aboriginal Heritage Act (1972-80). This survey revealed a now disused Aboriginal camp located close to the southern bank of the small creek which runs through the plant site. This site was occupied by an Aboriginal couple (now deceased) for approximately 20 years during the 1930s and 1940s. There is now no physical sign to mark the site of this camp and its mapped location is based totally on memory of the Aboriginal people consulted. No disturbance is planned near the temporary campsite.

The archaeological component of the survey was aimed at:

- the assembly of data from previous work in the region to form a framework for the survey;
- a systematic survey of the project area to cover at least 10% of the total area;
- an investigation of those areas considered the most likely to contain archaeological sites, such as the margins of watercourses; and
- the location and recording of archaeological sites within the designated survey area.

Previous archaeological research conducted near the project area recorded only one site, a surface artefact scatter (Pickering, 1982; Quartermaine, 1986). Results from a North Dandalup survey gave a density of archaeological sites of 1.25/km^2 (Anderson, 1981).

No archaeological material was recorded as a result of a systematic survey of the plant site. It is considered that any major concentrations of artefacts would have been discovered by the survey strategy employed.

5.5 RADIOLOGICAL ENVIRONMENT

A survey of baseline radiation levels at the plant site was carried out in 1988, and included measurements of the following:

- gamma radiation levels;
- airborne dust concentrations (TSP levels) and gross alpha activities;
- groundwater concentrations of Th, U, ^{226}Ra and ^{228}Ra; and
- radionuclide content in underground clays (Th, U, ^{226}Ra).

Details of the measurement procedures and results are given in the ERMP/EIS (Dames & Moore, 1988a), whilst a summary of the survey results is given in Table 5.2.

TABLE 5.2

BASELINE RADIATION DATA FOR THE PINJARRA PLANT SITE

Measurement	Mean Value	Range
Gamma Level (μGy/hr)	0.16	0.08 - 0.28
Airborne Dust		
- concentration (TSP) (μg/m³)	8	6 - 10
- gross alpha activity (Bq/m³)	$<7.5 \times 10^{-4}$	$<7.5 \times 10^{-4}$
Groundwater		
- Th (mg/L)	<5	<5
- U (mg/L)	<1	<1
- ^{226}Ra (Bq/m³)	63	0 - 137
- ^{228}Ra (Bq/m³)	<400	<400

The radon emanation rate over the Proponent's property which is a measure of the radiation emanating from natural sources, has been estimated at 167 x 10^3Bq/s. This value is based on the world average emanation of soils of 0.03Bq/s/m² over the site area of 1.3 x 4.3km (DOME, 1995; pers. comm., Radiation Health, 1995; pers. comm.).

The survey results suggests that the site already has natural levels of radiation which are above those of world average levels but are within the range of natural background radiation levels found in Western Australia. Gamma radiation levels at the site range from 0.08μGy/hr to 0.28μGy/hr. These levels can be compared with those measured on the Swan Coastal Plain of 0.02-0.03μGy/hr and on the Darling Scarp of up to 0.04-0.35μGy/hr (Yeates and King, 1973), although higher levels have been recorded in the Darling Scarp.

Measurements of radionuclide content of clays from the Pinjarra site confirm that the area has levels of natural activity which are above world averages (Table 5.3). The actual emanation rate may be higher based on the fact that levels of radioactivity in the soils are above world averages.

TABLE 5.3

RADIOACTIVITY IN CLAY FROM THE PINJARRA SITE COMPARED WITH WORLD AVERAGE LEVELS

	Pinjarra Clay[1]	World Average[2] (range)
ThO_2	90 - 155ppm	7 (2-14) ppm
U_3O_8	11 - 24ppm	(1-6) ppm
^{226}Ra	120 - 250Bq/Kg	25 (8-50) Bq/Kg

Source: 1. Dames & Moore, 1988a.
2. UNSCEAR, 1977.

A further survey of the plant site and surrounding areas for radiation levels relating to radon and radon daughters will be undertaken prior to commissioning of the plant.

5.6 EXISTING TRAFFIC

The existing road network for the project area is shown on Figures 1.2 and 2.2. Traffic counts for the major roads most likely to be affected by the transportation relating to the project are presented in Table 5.4 and on Figure 5.8.

TABLE 5.4

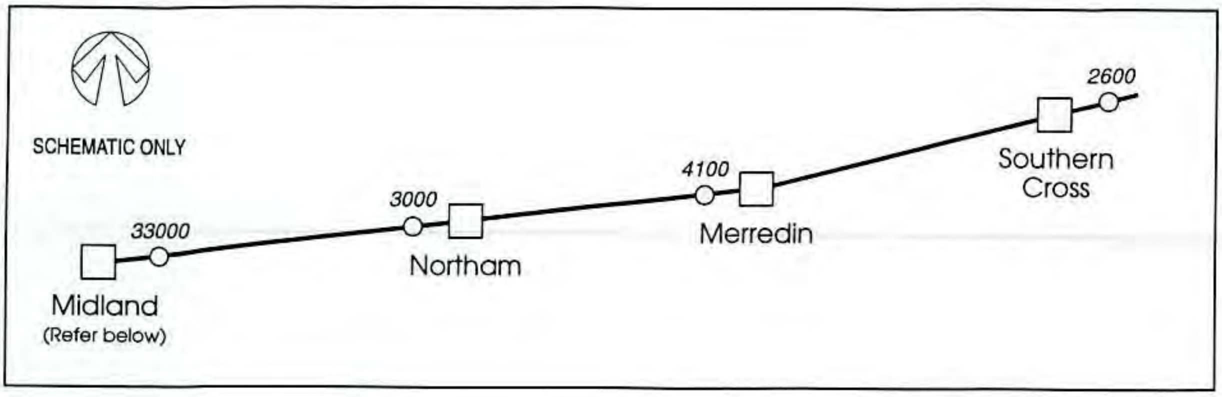
TRAFFIC COUNTS - ANNUAL AVERAGE DAILY TRAFFIC (AADT)

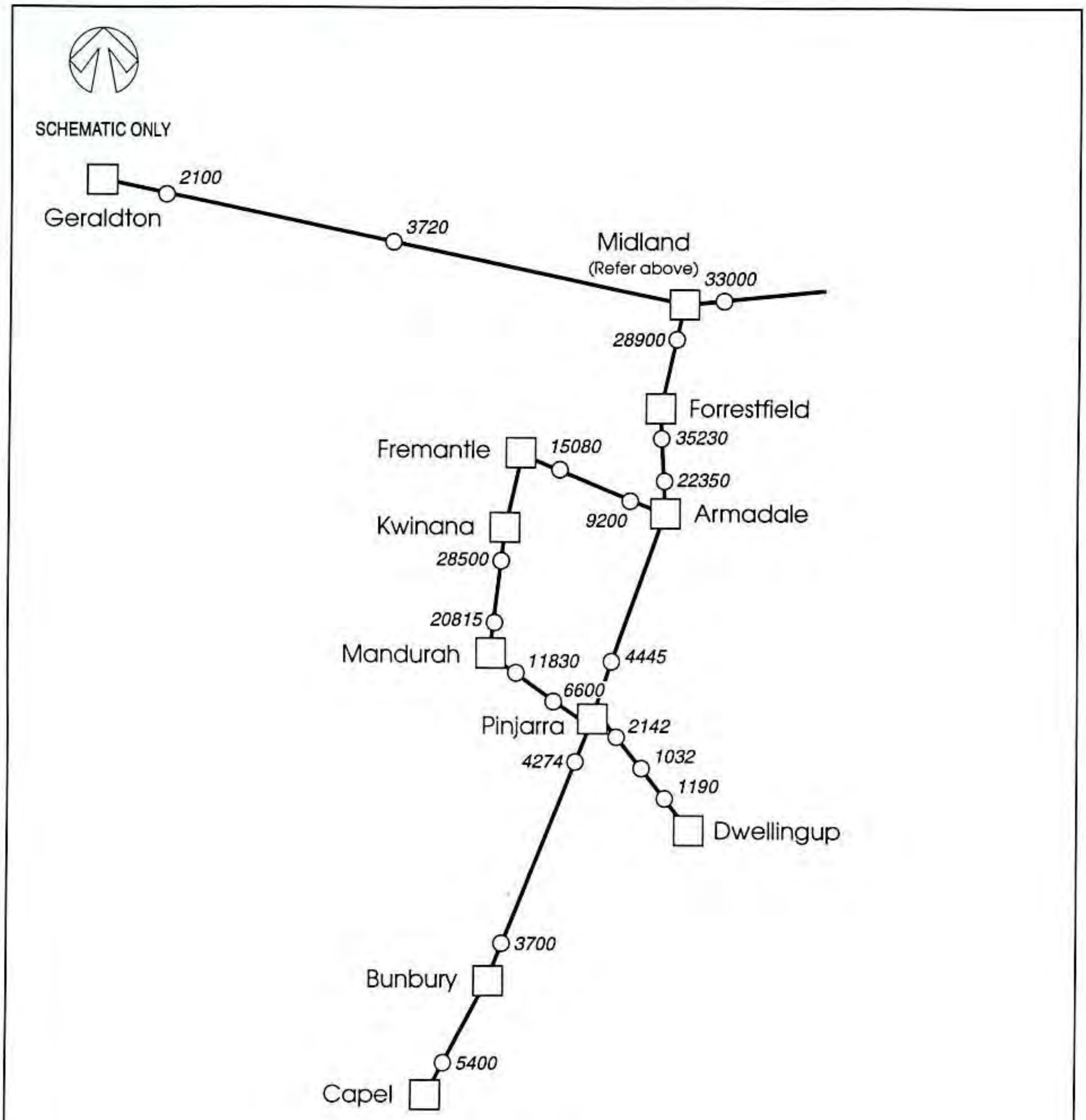
Location	Year	AADT
Brand Highway south of Gingin access road	1993	2,100
Great Northern Highway north of Neaves Road	1993/94	4,213
Great Eastern Highway east of Roe Highway	1993/94	33,000
Great Eastern Highway east of Northam	1993	3,000
Great Eastern Highway east of Merredin	1993	4,100
Great Eastern Highway east of Southern Cross	1993	2,600
Roe Highway south of Great Eastern Highway	1993/94	28,900
Tonkin Highway south of Roe Highway	1992/93	35,230
Tonkin Highway north of Fremantle Road	1993/94	22,350
Forrest Road east of Fremantle	1995	15,080
Armadale Road west of Armadale	1994	9,200
Patterson Road south of Office Road	1992/93	28,500
Mandurah Road north of Mandurah	1993/94	20,815

TABLE 5.4
(continued)

Location	Year	AADT
Pinjarra Road east of Mandurah	1993/94	11,830
Pinjarra Road west of Pinjarra	1992/93	8,232
Pinjarra-Williams Road south of South Western Highway	1992	2,142
Pinjarra-Williams Road near Mclary Road	1992/93	1,032
Pinjarra-Williams Road north of Dwellingup	1992	1,190
South Western Highway north of Pinjarra	1993/94	4,445
South Western Highway south of Pinjarra	1993/94	4,274
South Western Highway north of Bunbury	1992	3,700
South Western Highway north of Capel	1992	5,400

Source: Main Roads Western Australia





Rare Earth Plant - ERMP

Figure 5.8

AVERAGE ANNUAL DAILY TRAFFIC

SOURCE: MAIN ROADS Western Australia.

6.0 ISSUES AND MANAGEMENT

6.1 GENERAL

Section 6.0 addresses the environmental and social issues relating to the project and the proposed management strategies. The overall management strategy is for an environmentally sound project. The principal environmental management objective is to ensure that the safety and health of the Proponent's employees and the general public will not be impaired by the project and that the project will not lead to any long term, irreversible and unacceptable impacts on the biophysical environment.

The environmental and social issues and management associated with the Rare Earth Plant have been documented in the ERMP/EIS (Dames & Moore, 1988a, b) and the Stage II ERMP (Dames & Moore, 1989). Therefore only specific issues considered to have potential significant impact will be discussed in detail in this ERMP such as transport, waste disposal and radiation levels. Other issues considered to have negligible or minimal impact will be discussed only briefly.

Management of the waste disposal operations of the low level radioactive waste at the IWDF will be the responsibility of the operator of the IWDF and will be described in detail in an EMP prepared by the DEP's Waste Management Division. The EMP will be issued for public comment during the ERMP public review period.

The environmental issues and management which relate to transport are discussed in Section 6.2 and include:

- construction traffic (Section 6.2.1);
- transport of raw materials and products (Section 6.2.2.1);
- workforce traffic (Section 6.2.2.2); and
- transport of gangue residue including driver training, emergency response and clean-up procedures (Section 6.2.2.3).

Waste disposal issues and management are discussed in Section 6.3 and these relate to:

- effluent disposal into evaporation ponds (Section 6.3.2); and
- solid waste disposal at the IWDF (Section 6.3.3).

Radiological issues associated with the plant and with the transport and disposal of the gangue residue are discussed in Section 6.4. These include:

- potential radiation exposure (Section 6.4.3); and
- radiation protection and management (Section 6.4.4).

Other issues and their management addressed are:

- pipeline from Alcoa's Refinery (Section 6.5);
- storage and handling of process chemicals (Section 6.6);
- plant maintenance, inspection and contingency planning (Section 6.7);
- impact on vegetation and flora (Section 6.8);
- impact on fauna (Section 6.9);
- impact on Reserves in the area (Section 6.10);
- noise during the construction and operation of the plant (Section 6.11);
- buffer area (Section 6.12);

- visual impact (Section 6.13);
- economic benefits (Section 6.14);
- impact on historical, ethnographical and archaeological sites (Section 6.15); and
- general management (Section 6.16).

Over the last two decades Rhône-Poulenc has been implementing action plans designed to improve plant and employee safety standards and to enhance environmental safeguards.

Rhône-Poulenc is committed to devoting its skills and professional resources to making environmental stewardship an integral part of progress. The company has implemented a disciplined environmental stewardship plan which is based on the Environmental Plans developed for each country. As a vital corporate priority, environmental protection will be managed with professional methods.

Rhône-Poulenc has set out Guidelines for Action in terms of its vision, values and management principles and these are detailed in Appendix G.

Rhône-Poulenc Environmental Policy is based on five guiding principles:

- taking environmental protection into consideration at every stage in the life of a product;
- develop clean technologies;
- strictly manage the elimination of waste and effluents;
- control technological hazards and accidental pollution; and
- strengthen communications.

A discussion on each of the principles and the facilities that have been established to meet them is presented in Appendix G.

COMMITMENT 1

During all phases of the project, the Proponent will comply with all applicable standards and regulations pertaining to and appropriate for a chemical and mineral processing plant and for waste disposal.

6.2 TRANSPORT

6.2.1 Construction

The construction stage will involve the haulage of construction materials and the movement of the workforce between their residences and the site. The nature of the construction stage means that the associated transport activity will have a short term but concentrated impact on the existing transport network.

The roads that will experience the greatest impact due to construction will be the Pinjarra-Williams Road and Napier Road. Napier Road has already been upgraded by the Proponent and it will be adequate to cope with the construction traffic. Pinjarra-Williams Road is a good quality, sealed secondary road.

There are currently 43 residences fronting Pinjarra-Williams Road between the Pinjarra siding and the intersection with Napier Road. The increase in traffic due to the construction of the plant may have an impact on these residences in the form of increased traffic noise and volume of traffic. However, this impact will be short lived. The traffic volumes will vary throughout the construction period of 12 months and then reduce during the operational phase.

6.2.2 Operations

6.2.2.1 Raw Materials and Products

All materials will be hauled along the existing road network (Figures 1.2, 2.2 and 2.3). The existing traffic counts for these roads are presented in Table 5.4. Detailed quantities of materials to be transported by road to and from the plant site are shown in Tables 3.2, 3.3, 3.4 and 3.5. A summary of these materials is presented in Table 6.1. The proposed transport routes for the materials are shown on Figure 6.1.

TABLE 6.1

SUMMARY OF RAW MATERIALS AND PRODUCTS TRANSPORTED BY ROAD TO AND FROM THE PLANT SITE

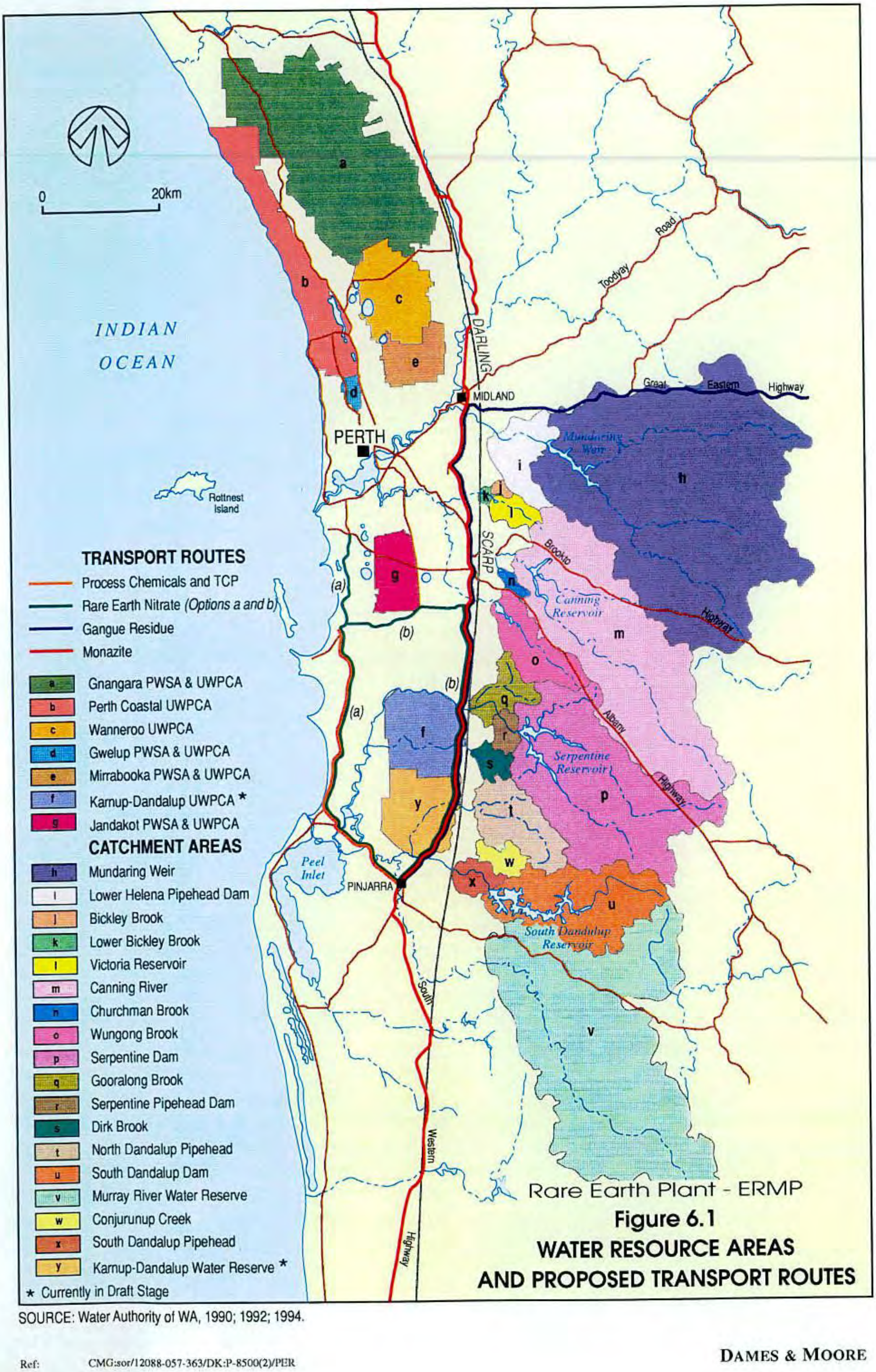
	Tonnage (per annum)	Origin/Destination	Frequency of Transport Trucks/Week
Monazite	12,000	Geraldton, Eneabba, Bunbury, Capel/Pinjarra	7**
Other Raw Materials	29,430	Kwinana/ Pinjarra	15***
Product - Solid	15,000	Pinjarra/Fremantle	16*
Tricalcium Phosphate	23,000	Pinjarra/Kwinana	12**
Gangue Residue	6,000	Pinjarra/Mt Walton IWDF	3**
TOTAL	85,430	-	53 2,438 trucks per annum (based on 46 weeks)

Source: Rhône-Poulenc, pers. comm.

Notes:
* Assumes 20 tonne trucks.
** Assumes 40 tonne trucks.
*** Mixture of 20 tonne and 40 tonne trucks.

Traffic Impacts

Most of the truck movements are expected to occur during normal business hours Monday to Friday. The truck transporting the waste to the IWDF will be scheduled to leave the Pinjarra site at a time most appropriate to avoid peak traffic times in Pinjarra and the Perth Metropolitan Area. The greatest concentration of traffic will occur along the South Western Highway in Pinjarra and the Pinjarra-Williams Road as vehicles and trucks converge on or leave the plant site. Table 6.1 indicates that a total of 53 trucks/week, or 106 heavy vehicle movements/week will result from the operations of the plant. This is approximately 22 truck movements per day, 11 carrying full loads and 11 empty trucks returning to their source. All of these truck movements would be along the Pinjarra-Williams Road, increasing the current use of this road by around 2% based on the existing traffic counts presented in Table 5.4.



Rare Earth Plant - ERMP

Figure 6.1
WATER RESOURCE AREAS AND PROPOSED TRANSPORT ROUTES

SOURCE: Water Authority of WA, 1990; 1992; 1994.

To place this increase in road usage in context, the daily heavy vehicle component along the Pinjarra-Williams Road will increase from approximately 122 (12%) to 144 (14%), based on the AADT information obtained in the Pinjarra Region Origin/Destination Survey conducted by Main Roads in 1992/93. This results in an 18% increase in heavy vehicles. This increase in road usage will have a low impact on the road pavement of the Pinjarra-Williams Road. The intersection of Napier Road and Pinjarra-Williams Road was upgraded by the Proponent to cater for increased road usage resulting from the operations of the Gallium Plant.

Occupants living in the 43 residences which front the Pinjarra-Williams Road between the Napier Road intersection and the Pinjarra siding may be impacted upon by the increase in truck traffic during the operation of the project. The 18% increase in truck traffic would be expected to result in a relative increase in traffic noise. Most truck movements will occur during normal business hours, therefore the impact to these residents arising from the increase in traffic due to the project is expected to be low.

A small number of trucks transporting monazite may originate from the Bunbury/Capel area. The most direct route for these trucks is via the South Western Highway, Coolup Road, Burnside Road, Pinjarra-Williams Road to Napier Road (Figure 1.2). The actual number of truck movements along these roads will depend upon the quantity and type of packaging of the monazite sourced from the mineral sands separation plants in Bunbury and Capel. Assuming that 40% of the monazite will be sourced from this area, a maximum of three trucks per week will be required. The remainder of the monazite will be sourced from Eneabba and Geraldton resulting in four trucks per week travelling via Great Northern, Roe, Tonkin, Albany and South Western Highways to Pinjarra-Williams Road and then along Napier Road to the site. The small number of truck movements relating to monazite is unlikely to impact significantly on the local communities. However, there may be some concern with heavy haulage through populated areas such as Armadale. The trucks transporting monazite will be restricted to a B-double configuration (Section 3.5.2.2).

The most direct route for trucks transporting materials to and from Kwinana to the site is via Russel Road, Stock Road, Mandurah Road, Mandurah Bypass, Pinjarra Road and the Pinjarra-Williams Road. This route follows dual 2-lane roads for the major portion of the route. The alternative route for these trucks is to travel along Russel Road, Thomas Road, South Western Highway and Pinjarra-Williams Road which are single carriageways for the most of the route. Main Roads have identified the improved safety aspects of heavy vehicles travelling along dual 2-lane roads compared to single carriageways. Therefore, it is likely that the companies transporting materials to and from Kwinana and will use the Mandurah-Pinjarra route. This will result in approximately 12 truck movements per day through the town of Pinjarra, 6 carrying loads of raw materials and 6 returning empty. This represents a 0.1% increase in vehicle movements.

An estimated 16 trucks per week would be required to transport the solid rare earth nitrate product from the Pinjarra site to Fremantle for export. The trucks may travel from the plant site along Napier Road, Pinjarra-Williams Road, South Western Highway and Thomas Road to Fremantle. However, the trucks may use the same route as the process chemical movements to Kwinana and then travel along Stock Road to Fremantle. If this western route is preferred, an additional 6 truck movements per day would result from the transport of the product through Pinjarra.

The heavy vehicle component of the Mandurah-Pinjarra Road as recorded in the Main Roads Pinjarra Region Origin/Destination Survey 1992/93, is 472 (6%) therefore 18 additional truck movements would be a 3.8% increase in heavy vehicles.

Main Roads Western Australia is in the early stages of planning a bypass for Pinjarra. The exact alignment of the bypass around the Pinjarra townsite is currently not known. The bypass will relieve the existing heavy traffic and allow for future heavy vehicles, to avoid the town.

The frequency of truck movements relating to the transport of waste will have little significant impact on traffic volumes on the roads. However, it is expected that there may be some concern due to the additional heavy haulage through populated areas such as Armadale and Northam.

Total truck movements likely to occur in the Armadale area due to the project is in the order of 14 per week resulting from four 40 tonne trucks carrying monazite and three 40 tonne trucks transporting the gangue residue.

Transport Safety Measures

Titanium Mineral Producers supplying the monazite for the project will be responsible for the monazite transport operations. Monazite is classified as a Dangerous Good and will be transported according to the requirements of the Dangerous Good Regulations, 1992. Monazite has been transported by road in Western Australia for the last 30 years without major incident and is currently being returned to the minesite with other waste materials from mineral sands processing.

The monazite feedstock will have the same Dangerous Good Classification as the gangue residue and therefore the discussion on the transport requirements detailed in Section 6.2.2.3 could also apply to the monazite. Although, it is up to the monazite suppliers and their transport contractors to comply with the appropriate legislation and regulations.

Radiological impacts associated with the transport of monazite are presented in Section 6.4.4.3.

Approximately 3 trucks per day will transport acid to the plant site (Table 3.3) from Kwinana using the most direct and safest route described above. These acids (nitric, sulphuric and hydrochloric) are classified as Dangerous Goods and will be transported in purpose-built trucks of 20-40 tonne capacity. Sulphuric and nitric acid are likely to be transported in either 20 tonne or 40 tonne stainless steel tankers on a B-double truck configuration. Hydrochloric acid will probably be transported in a tanker of 16-20 tonne capacity. Industries supplying the chemicals will have the ultimate responsibility for the transport. However, the Proponent will be sourcing materials from reputable companies with safe transporting practices.

Transport handling methods for the acids will conform to the requirements of the Dangerous Goods Regulations, 1992, minimising the risks of accidental spillage during transport. Suppliers of these goods have a 24-hour emergency service with an emergency response plan based on the Western Australian Hazardous Materials Emergency Management Scheme (WAHMEMS) (Section 6.2.2.3). Drivers contracted to these companies are specifically trained in accordance with the Australian Code for Transport of Dangerous Goods by Road and Rail (ADG Code) (Federal Office of Road Safety, 1992a) (Section 6.2.2.3).

There is a good safety record for all these materials being transported on metropolitan and country roads in large quantities. The increase in the number of truck movements of these materials due to the project will be small.

The rare earth nitrate product will be in the form of dry granular solid which is non-radioactive, non-corrosive and non-combustible. The product will be packaged in bulka bags of approximately 1.8 tonne capacity. The bags will be transported in containers on trucks from the plant site to the Fremantle Port for export. It will not be classified as a Dangerous Good.

Environmental management and safety aspects relating to the transport of the gangue residue are described in Section 6.2.2.3.

Drinking Water Resource Areas

This section examines the concerns of the unlikely occurrence of a spill of materials impacting on drinking water resource areas such as water catchments, suitable groundwater resource areas, and also the impact on underground water pollution control areas (UWPCA). These areas are shown on Figure 6.1.

Assessing the proposed transport routes together with the potential drinking water resource areas, the only section of proposed route which traverses the catchment resource areas is the transport of gangue residue travelling east along Great Eastern Highway as the road is located in the northern section of the Mundaring Catchment (Figure 6.1). Potential impact of a spill in this area is discussed in Section 6.2.2.3.

6.2.2.2 Workforce and Service Vehicles

The operations workforce will be in the order of 50 with the majority working shift hours. These will comprise three shifts of eight hours per day, seven days a week. The workers are all expected to live in the local region. In a worst case situation where every worker drives a vehicle to and from work, 100 vehicle movements a day can be expected. These will be concentrated into three main time periods, at the beginning and end of shifts. This maximum vehicle movements represents an increase of 5% in existing traffic conditions on the Pinjarra-Williams Road. It is estimated that at the most there may be a maximum of 25 vehicles on the Pinjarra-Williams Road at any changeover time period.

Service vehicles, such as those used for maintenance, cleaning, lunches, supplies etc. will also be required for the operations of the plant. The frequency of these vehicles cannot be accurately determined but has been estimated to be between 4-6 movements per day.

6.2.2.3 Gangue Residue

Gangue residue generated by the Rare Earth Plant will be radioactive due to its thorium content and the presence of the decay products of the thorium decay chain. It will be approximately twice as radioactive as the monazite feedstock for the plant. No additional radioactive material will be generated but the process concentrates the radioactive materials by that factor.

The waste will be insoluble and will mostly be comprised of ground rock material, unreacted monazite, barium sulphate and water. It will be non-toxic and will not be a chemical hazard. A typical composition of the waste is indicated in Table 3.5. It will be classified as Low Specific Activity type I (LSA-I) material for the purpose of transport which is the lowest category of hazard for the transport of radioactive materials. The hazard of the material is very low when compared with other radioactive materials regularly transported throughout the state such as; industrial radiography sources, radio-pharmaceuticals and some industrial sources. Such sources are capable of delivering very high doses to people exposed to them, however, gangue residue cannot deliver doses which could cause immediate harm. It is also low in hazard when compared with the transport of other common hazardous materials such as LPG, petrol, sodium, cyanide, chlorine and chlorine compounds or many other chemicals regularly transported by road.

The "Code of Practice for the Safe Transport of Radioactive Substances, 1990" (Commonwealth of Australia, 1990), referred to hereafter as the Code for Transport, which is derived from the International Codes on transport, assesses the worst case situations and assumes that accidents involving the radioactive materials have occurred. Packaging requirements are designed to retain the radioactive materials so that the risk from any exposure is low.

Radiation dose rates are known from the transport of monazite, therefore these rates can be applied to estimate exposure level dose rates from the waste. For example a distance of one metre from a large volume of the waste a dose of 20 to 50μSv/hr is predicted depending on the quantity of the source present and its geometry. Using these predicted levels, it would require 20 to 50 hours of exposure to such levels of radiation to reach the annual limit of exposure that applies to a member of the general public (1mSv) and 400 to 1,000 hours to reach the designated limit for a radiation worker.

Emergency workers will not be designated as radiation workers and the applicable limits of exposure will be those for the general public. Any clean-up operation will be completed in a period of much less than twenty hours as the operation of any emergency plan will not be complex as the waste is not a high risk material. The transport arrangements and any emergency plans will be consistent with the low hazard of the material.

The material is in the form of a moist clay so it will not flow or dust even in the event of a spill. There is a perceived risk to the public of hazards associated with the low level radioactive waste. However, there is only a potential risk of persons receiving a hazardous radiation dose if they are in contact with the residue for long periods of time. Special management measures will be incorporated in the transport and disposal operations to ensure exposure levels are well within regulatory limits for employees and the public.

Emergency and clean-up procedures will be implemented, as for any accident, with teams trained in safety procedures involving low level radioactive material. The Proponent will incorporate detailed emergency and clean-up procedures in the emergency plans which will ensure that hazards to team members and the public are minimal. Procedures will be relatively straightforward as any spill can be easily retrieved in comparison to a liquid spill and if any has been dispersed from the immediate vicinity of the spill it can be located by a radiation detector and retrieved.

On average three 47 tonne truck loads of the gangue residue, will be transported from the plant site to the IWDF each week. As discussed in Section 3.5.2.2, the trucks would be B-double combinations (Figure 3.9). B-doubles are considered the safest truck combinations (Main Roads pers comm). The trucks are subjected to a Main Roads brake test prior to the issue of a road licence, which involves a hydraulic pressure test of the coupled vehicle. In addition, the engines of the B-doubles are speed restricted to 105km/h and it is likely that this restriction will be reduced to 100km/h in the near future. B-doubles have been operating in Western Australia since 1983 and have a very good safety record.

In addition to the initial Main Roads testing and licensing of B-doubles, the trucks would be subject to a formal safety inspection each year in accordance with the Dangerous Goods permit. The Proponent would also require that the trucks be maintained in a roadworthy condition. This will be detailed in a contract with the transport operators.

Trucks would be loaded within a bunded area in order to enable easy collection of waste and washing of truck tyres in the unlikely event of spillage of waste during loading. Trucks would also be unloaded in a bunded area for the same reason. Wash waters from these areas will be either recycled or directed to the evaporation ponds as discussed in Section 3.4.1.

Transport of the gangue residue will be in compliance with the Code for Transport (Commonwealth of Australia, 1990) and any future revision of that Code. The Code is a Commonwealth Government publication which precisely follows the International Atomic Energy Agency's Regulations for the Safe Transport of Radioactive Substances. The code is thus approved internationally for the transport of Radioactive Substances.

Radiological issues associated with the transport of gangue residue are presented in Section 6.3.4.5.

An emergency response plan including driver safety training requirements will be prepared by the Proponent. The procedures in the plan help to minimise the risk of spillages of waste and, in the unlikely event of an accident, stipulate procedures to minimise any human health risks and clean-up any spilt material. An outline of the emergency response plan is presented in Appendix H.

COMMITMENT 2

The Proponent will transport the low level radioactive gangue residue in compliance with the Code of Practice for the Safe Transport of Radioactive Substances (1990) and will develop an Emergency Response Plan to deal with an accident.

Driver Training

Driver competence is one of the fundamental factors likely to affect the risk levels from the transport of Dangerous Goods. Driver instructions are detailed in the Australian Code for the Transport of Dangerous Goods by Road and Rail (referred to hereafter as the ADG Code) (Federal Office of Road Safety, 1992a). From these instructions and other sections of the ADG Code, it is a requirement for drivers to have adequate knowledge in the following areas:

- the nature and hazardous properties of Dangerous Goods being transported;
- the actions to be taken to ensure the prevention of accidents, injury or damage to persons or property;
- to assist in any emergency that may arise in the course of transporting the goods;
- the designation and description of Dangerous Goods;
- the packaging, handling and marking of goods; and
- safety issues relating to the goods and their transport.

In addition to the knowledge on Dangerous Goods matters, the driver must conform with legislative requirements relating to:

- the vehicle (including licensing, insurance etc.);
- marking of the vehicles transporting Dangerous Goods;
- stowage and segregation;
- appropriate documentation;
- responsibilities of drivers and others involved with the transport of Dangerous Goods; and
- competence and fitness to drive a Dangerous Goods vehicle.

The Proponent will ensure that the drivers are qualified according to the requirements of the ADG Code by a condition of contract. These qualifications will include medical fitness tests and the drivers having passed an approved training course such as those organised by Road Transport Training Council or Hazsafe. A high standard is required to pass this course with the minimum pass mark being 75 percent. However, potential contractors have indicated to the Proponent that their drivers achieve around the 90 percent mark.

After passing the approved training course the drivers will also be required to complete and pass a supplementary course specifically designed for those drivers involved in the transporting of radioactive materials. This supplementary course will be delivered by a suitably qualified radiation expert and will cover the properties of the waste material, use of safety equipment, Dangerous Goods regulations, loading and unloading procedures, and emergency response procedures.

The driver training course, will consist of initial training courses followed by subsequent refresher course conducted at least yearly. Training requirements detailed above will be written into the contract between the transport company and the Proponent.

Selection and Control of Contractors

Transport contractors will be selected on the basis of an extensive set of criteria, namely:

- company organisation (levels of management including Quality, Safety and Emergency Response Officer);
- equipment quality and replacement policy;
- emergency response capability;
- adoption of AS 3902 or ISO 9002;
- vehicle inspections and maintenance procedures;
- tyre replacement policy;
- maintenance audits; and
- driver requirements and training policy (as described in previous section).

COMMITMENT 3

The Proponent will ensure that drivers attend approved Driver Training Courses including specific training for the transport of radioactive materials prior to any transport of waste materials. Refresher courses will be conducted at least yearly. This will be a condition of contract with the transport operators. The companies transporting radioactive material shall, under the Radiation Safety Act, hold an appropriate licence.

Emergency Response and Clean-up Procedures

The proposed form of packaging of the waste is in bulka bags carried in steel containers constructed to ISO Standards or in dedicated trucks, hence, it is unlikely that any spillage of the material will occur. If, for some reason, there is some spillage there is very little chance of the material dispersing into the environment due to its moist cake form and its insoluble nature. The material does not pose any immediate hazard to the public or environment compared with a spill of liquid chemicals such as petrol or LPG. The gangue material could be easily recovered and replaced into suitable packages for transport to the disposal site. If any spillage escapes the immediate location, it could be easily located by a radiation detector and recovered.

The immediate priority of the emergency crews is the safety of any persons involved in the accident. Any persons who may require medical treatment will be attended to as a priority as there is no risk of emergency crews or the injured person receiving harmful levels of exposure in the time taken for rescue operations. Once rescue operations are complete, clean-up procedures will commence.

Emergency procedures will be prescribed in an emergency response plan developed by the Proponent during the ERMP public review period, an outline of the plan is presented in Appendix H. This plan will be based on the Western Australian Hazardous Materials Emergency Management Scheme (WAHMEMS). The aim of this scheme is to detail Statewide arrangements to cope with hazardous material emergencies. The general procedures outlined will be adhered to wherever the accident may occur.

COMMITMENT 4

During the ERMP public review period, the Proponent will prepare an emergency response plan for the transport of the low level radioactive gangue residue, outlining the emergency and clean-up procedures in the event of an accident, for review by the DEP, DOME and the Radiological Council.

The objectives of WAHMEMS are to:

"(a) Prescribe the organisation, concepts, responsibilities and procedures for State Government departments and agencies in handling hazardous materials emergencies.

(b) Establish a basis for co-ordination between State Government departments and agencies with elements of the private sector involved in the manufacture, storage, use and/or transport of hazardous materials.

(c) Provide a basis for the provision and co-ordination of resources to cope with hazardous materials emergencies.

(d) Expedite the recovery of the community from the effects of such emergencies.

(e) Provide the basis for planning for hazardous materials emergencies at regional and local level."

(WAHMEMS, 1993)

The scheme divides emergency management into four elements:

- Prevention;
- Preparedness;
- Response; and
- Recovery.

Prevention

Prevention encompasses those measures designed to prevent or reduce the likelihood of accidents and lessen the effects emanating from the unplanned release of hazardous materials. The approach to addressing this element is legislation such as Codes of Practice and Regulations.

The relevant legislation for the prevention of accidents and the transport of hazardous materials is listed in Section 1.9. This legislation covers items such as:

- licensing of vehicles and drivers transporting hazardous materials;
- requirements for packaging and disposal;
- labelling, marking and placarding of packages and vehicles;
- requirements for emergency plans to be developed;
- training of users and transporters; and
- designation of transport rules.

Preparedness

Activities in this element are those concerned with preparing the community to respond to emergencies. These include:

- planning - preparation of emergency management plans;
- training - education and training of relevant personnel in the functioning of an integrated response;
- public information and education; and
- monitoring, testing, exercising and review of the scheme.

The organisations for dealing with hazardous materials emergencies comprise the following:

- The Control Authority, most likely to be the Senior Police Officer designated as the On-site Controller, will be responsible for control of all hazardous materials emergencies.

- The State Hazardous Materials Emergency Management Team will be responsible for providing advice and resource support. The team will comprise selected personnel from the Police Department, Western Australian Fire Brigade, Health Department and DOME. Representatives from the DEP, Water Authority of Western Australia and the company may also form part of the team. Roles and responsibilities of the authorities are detailed in WAHMEMS, 1993.

- Field Response Teams which would physically deal with the emergency itself. The Response Team is organised by the On-site controller and comprises trained members of the required agencies.

Response

Response element activities are those emergency response actions following the occurrence of an emergency. These include the following:

- Notification - all emergencies should be reported promptly, in particular to the Police Department where duty staff should fill in an Emergency Notification Form to assist in relaying relevant information to the Response Team.

- Identification - the marking and labelling of packages, containers and vehicles in accordance with the Codes will facilitate the identification of materials.

- First Strike Action - the immediate response action directions can be obtained from:

    - Emergency Procedure Guide (EPG) - transport cards;
    - Emergency Information Panels prescribed in the Code for the Transport of Dangerous Goods by Road and Rail (Federal Office of Road Safety, 1992a) and required to be affixed to vehicles;
    - Specialist Advisers provided by the Proponent or from Government organisations; and
    - HAZCHEM Code, or the Emergency Action Code, which is a coding system used to direct the correct first strike action in a hazardous materials emergency.

- Clean-up - initial clean-up incorporates those actions taken as part of the response activities in an emergency to contain, repackage and dispose of the hazardous material. The Police Department will be responsible for co-ordinating the clean-up in consultation with the Emergency Response Team. The Health Department, DEP, Water Authority of Western Australia and DOME have legislative powers to ensure the initial clean-up is performed in a timely manner and in accordance with all legislation.

- Stand Down, Debriefing and Reporting - the Police Department will co-ordinate the stand down and debriefing of response team members when it is considered that all response activities have been completed and the emergency site has been rendered safe. Each participating organisation shall, on request, provide a written report to the Control Authority.

Recovery

Those activities intended to return the community to normal as soon as possible following an emergency are within the recovery element of emergency management. These include counselling of affected people, provision of long term temporary accommodation, community redesign and rebuilding. Due to the nature of the materials to be transported it is unlikely that the long term activities involved in this element will be required.

Specific Clean-up Procedures

The Proponent's role in procedures for a clean-up in the event of a spill are likely to be:

- provision of equipment and containers for recovery of spilt material;
- provision of specialist advice;
- provision of adequately trained personnel to assist in site clean-up; and
- validation of site clean-up.

The assembly and tasks of the Response Team comes under the control of the WAHMEMS as described above.

To minimise response time to an emergency, the following measures will be taken:

- all trucks will be fitted with a Global Positioning System (GPS), so the plant base and Response Teams will know the location of trucks during its entire journey;
- all truck cabs will be fitted with a two way radio to enable drivers to call for assistance; and
- vehicles will be clearly marked with Dangerous Goods class labels required by the Code for Transport (Commonwealth of Australia, 1990), emergency information panels identifying the goods being transported and emergency contact numbers.

The Emergency Management Team, comprising personnel from selected authorities as described previously, and Field Response Teams comprising trained members of the required agencies will undertake training in emergency and clean-up procedures to ensure a safe and rapid response. Training courses will include specific training on emergency procedures for the clean-up of radioactive waste and be conducted by a suitably qualified member of a radiation authority. Response Teams will be sourced and trained from several locations along the proposed transport route. All training will be funded and co-ordinated by the Proponent.

Drivers will also be trained in emergency procedures, as part of the driver training courses described in the previous section.

The first reaction to an alarm triggered from the GPS tracking system will be for the base operators to contact the driver by radio-telephone to establish the reason for the stop. If the driver cannot be contacted or the driver confirms that an accident has occurred, then the relevant Senior Police Officer, as On-site Controller of an emergency response under WAHMEMS, will be notified and he would determine the status of the vehicle. The appropriate emergency response would then be implemented.

These procedures would be included in the Emergency Response Plan and the relevant response personnel would be trained in such procedures.

COMMITMENT 5

Emergency Management Teams and Field Response Teams will be trained in emergency response and clean-up procedures, prior to the transportation of waste and with refresher courses conducted yearly. Training will be funded and co-ordinated by the Proponent.

'Worst Case' Scenario

The worst case scenario for the purpose of this discussion, follows the occurrence of these unlikely sequence of events:

1. an accident occurs;
2. the container opens spilling out bulka bags;
3. bulks bags are then split exposing the waste; and
4. the entire contents of the bags are dispersed into the environment, possibly into a water resource area.

The perceived worst case could be considered to occur in the middle of a town along the Great Eastern Highway within the Mundaring catchment area.

If a spill of the gangue residue occurred in the land environment, it is in a form that could be readily retrieved and placed into suitable containers for transport and disposal.

The potential for the material to disperse into the environment by dusting or mobilisation due to runoff was also assessed. The gangue residue will be a clayey material with 40% moisture, as described previously, therefore, it would take a significant length of time for the material to dry.

In order to simulate the unlikely event of the waste being exposed for sufficient time, following an accidental spill, to allow it to dry completely (therefore represent a potential dust source) samples of similar material were either air or oven-dried. In these circumstances the waste behaved as a typical clay and negative pore pressures generated by the drying process bind the material into a hard solid which does not dust unless mechanical effort is applied.

The low level radioactivity of the waste would be of assistance in ensuring its complete retrieval following a spill as radiation detection equipment, such as a gamma counter, would readily identify the waste and any contaminated soil which would be collected and transported to the IWDF. The radioactive component of the material is dense and insoluble, therefore, in the event that heavy rain mobilises some of the spill it is unlikely that it would travel any distance. There will be minimal hazard to the clean-up team or general public by exposure to this material for the time taken for clean-up procedures.

Another scenario to be addressed is the unlikely event of a bulka bag of waste spilling into a flowing stream or river. The gangue residue has extremely low solubility, such that laboratory test work on samples of the material indicates that the total immersion of a bag of waste in fresh water would not result in an exceedance of the permissible levels of thorium contained in wastes discharged to the environment (Radiation Safety (General) Regulations, 1983). Solubility tests were conducted at the Proponent's La Rochelle Plant, using 100g of similar gangue material mixed with 1 litre of demineralised water for 16 hours. Three samples were analysed and the results are shown in Table 6.2.

TABLE 6.2

RESULTS OF SOLUBILITY TESTS

Component	Sample*			Guidelines for Quality of Drinking Water**
	1	2	3	
Ra-228 (Bq/l)	0.3	0.3	0.5	0.5
Ra-226 (Bq/l)	<0.2	<0.2	<0.2	0.5
U (mg/l)	0.08	0.04	0.03	0.25
Th (mg/l)	<0.5	<0.5	<0.5	0.1***
Pb (mg/l)	0.025	<0.1	<0.1	0.1
SO_4 (mg/l)	230	135	100	500

Sources: * Rhône-Poulenc.
** NHMRC/ARMCANZ, 1994.
*** DOME, 1995 pers. comm.

The results in Table 6.2 indicated that a solution of <0.5mg/L of thorium was generated, corresponding to 1.9Bq/L which can be compared to a regulatory level of 7.4×10^3 Bq/L as indicated in the Radiation Safety (General) Regulations (1983) (Schedule VIII Table 2 Column 2 natural thorium). These values can also be compared with the guidelines for drinking water (NHMRC/ARMCANZ, 1994) as shown in Table 6.2.

All the above components, with the exclusion of thorium, are equivalent to or are below the guidelines for drinking water quality. However, it is extremely unlikely that a sufficient quantity of material would be spilt into a drinking water source to reach the concentrations given in Table 6.2. In addition, in the unlikely event of waste being spilt into a flowing stream or drinking water source, the constituents would be immediately diluted to background level concentrations within a few metres from the spill. Tests will be undertaken to determine the physical dispersion characteristics of the gangue residue in water and the results will assist in preparing clean-up procedures.

There are four main issues associated with reducing the likelihood of the worst case scenario.

- The transport route will be approved by DOME, Main Roads and the DEP and will be on good quality safe roads.
- Codes of Practice for transport will be followed, thereby minimising the risk of a spill even in the unlikely event of an accident.
- Emergency response teams will be located at various towns along the transport route.
- The probability of a spill occurring anywhere along the route is low and the real risk of an accident actually occurring at one of the stream/river crossings resulting in a spill of waste material into streams or rivers is even lower.

Waste Documentation and Acceptance at the IWDF

Prior to leaving the Pinjarra plant site the waste will be analysed to ensure that it conforms to waste specifications as defined in the Code for Disposal (NHMRC, 1992) (Appendix E).

Each truck load of gangue residue delivered to the IWDF site will be accompanied by a shipment manifest, including a certification by the Proponent that the waste is within the specifications.

A document numbering system will be used to ensure that the manifests, certificates, test results, containers and trucks are readily identifiable. Each bulka bag, within each shipment, will be labelled so that it can be readily identified with the particular container and truck load.

The shipment manifest will contain the following information:

- Waste Identification:
  - the words "RADIOACTIVE MATERIALS, LOW SPECIFIC ACTIVITY, LSA-I"'
  - United Nations Class Number 7;
  - the United Nations number, "2912";
  - address and telephone number of Rhône-Poulenc's plant site; and
  - Rhône-Poulenc's batch number.

- Transport Identification:
  - name, address and telephone number of transport company;
  - registration and Dangerous Goods permit numbers for the truck;
  - time and date of delivery; and
  - the words "EXCLUSIVE USE SHIPMENT".

- Waste Description:
  - the words, "SPECIAL FORM RADIOACTIVE MATERIAL";
  - maximum activity of the radioactive contents during transport expressed in units of becquerels (Bq);
  - the category of the package "II-YELLOW";
  - the transport index;
  - total mass of waste; and
  - number and size of bulka bags.

- Approval Certification:
  - the approval certificate issued by the relevant authority applicable to the assignment.

- Rhône-Poulenc's Declaration:
  - a declaration to the full and accurate description of the waste and its classification, packaging and labelling.

COMMITMENT 6

A shipment manifest will be prepared prior to disposal operations in accordance with Code for Transport (Commonwealth, 1990) by the Proponent detailing the following information:

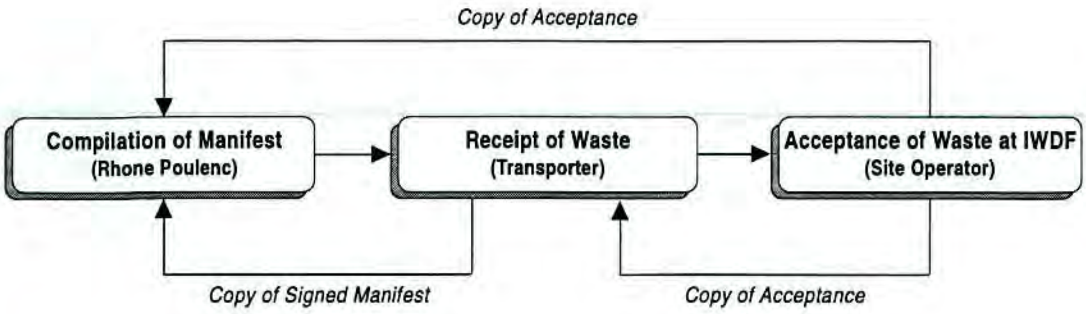
- *waste identification;*
- *transport identification;*
- *waste description;*
- *approval certification; and*
- *declaration.*

The manifest will accompany each truck load of gangue residue.

This "Chain-of-Custody" process will ensure complete tracking of the waste with the Proponent, the transporter and the operator of the IWDF each having a copy of the full documentation. The manifest documentation trail, as it appears to the road transport options, is illustrated by the flow chart on Figure 6.2. If any of the rail or road-rail options are chosen then the manifest will be signed and a copy retained at each point of transfer.

The operator of the IWDF will forward a copy of each manifest to the appropriate authority.

If the waste is found, on delivery to the IWDF site, not to meet the required specifications it will be returned to the plant for reprocessing. If this occurs, as part of the quality assurance programme, a "non-compliance" investigation would be undertaken to identify the causes of the non-compliance, and to modify procedures to minimise the risk of repetition of such non-compliance.



Rare Earth Plant - ERMP

Figure 6.2
WASTE SHIPMENT MANIFEST
"Chain-of-Custody" Document Trail

COMMITMENT 7

If the waste delivered to the IWDF is found to not meet the required specifications it will be returned to the plant for reprocessing. The Proponent will investigate and identify the reason for non-compliance and modify procedures to minimise the risk of repeating such non-compliance, to the satisfaction of the Minister for the Environment.

If on delivery to the IWDF a manifest is found to be incomplete, lost or damaged then the load will not be accepted by the operator of the IWDF site until such irregularities are clarified in writing by the Proponent and the transport company. In these circumstances, the load will be parked in a designated area and not unloaded until the operator of the IWDF is satisfied that the correct manifest information is received at the site.

6.3 WASTE DISPOSAL

6.3.1 General

Process wastes and the proposed disposal methods are described in Section 3.4 and Table 3.5. In summary, the significant wastes generated by the process will be:

- slurry effluent, comprised principally of tricalcium phosphate, which will be directed to the evaporation ponds for temporary storage prior to transporting to selected fertiliser companies;
- non-radioactive liquid process wastes to be disposed of in the on-site evaporation ponds; and
- low level radioactive gangue residue; containing thorium, uranium and their radioactive decay products; to be disposed of at the IWDF.

Waste management practices for non-process wastes such as putrescible wastes and other general solid office wastes such as waste paper and office waste will be similar to the acceptable practices that were in place for the operations of the Gallium Plant.

COMMITMENT 8

The Proponent will dispose of all process and non-process wastes in an environmentally acceptable manner, and in accordance with licensing and other requirements from the DEP, DOME, Water Authority and the Radiological Council throughout the life of the project.

6.3.2 Disposal into Evaporation Ponds

6.3.2.1 Issues

Stormwater runoff from the plant site will be collected and directed to the stormwater ponds (Figure 3.5) from where it will be discharged to the evaporation ponds or into surface drainage.

The effluent disposed of in the evaporation ponds will comprise non-radioactive liquid process wastes containing sodium salts, water from plant washdown areas and, if necessary, water from the stormwater pond. Rare Earth Plant process wastewaters will be neutralised by Gallium Plant effluent and will be non-toxic and pose little potential impact to the environment even in the unlikely event of a seepage.

Tricalcium phosphate ($Ca_3\ [PO_4]_2$), an insoluble by-product from the process, will be stored temporarily in the evaporation ponds (Section 3.4.1) from where it will be recovered for sale to the fertiliser industry, hence, not requiring permanent storage.

6.3.2.2 Management

The operation and monitoring of the evaporation pond system for Gallium Plant operations was regulated by a licence previously issued to the Proponent in 1988 under the provisions of the Environmental Protection Act 1986. A series of conditions are attached to this licence specifying in detail a range of management and monitoring requirements which must be implemented to the satisfaction of the EPA and the Water Authority of Western Australia. A new licence will be obtained for the operation and monitoring of the evaporation ponds for the Gallium and Rare Earths Plants.

Water in the stormwater ponds will be analysed to ensure the quality complies with licence requirements set by the DEP prior to discharging in a controlled manner into an existing surface drainage on the Proponent's property. Water that does not comply with licence requirements will be directed to the evaporation pond system.

The design features of the evaporation ponds will ensure that, in addition to the substantial clay liner which minimises leachate from the ponds, any material seeping through the clay liner will be intercepted by the underdrainage system and returned to storage.

COMMITMENT 9

Any additional ponds required for the project will be constructed by the Proponent according to the design standard approved by the DEP and Water Authority.

In order to minimise the potential for seepage, the ponds will be managed so as to minimise the amount of free water in the ponds whilst maintaining a continuously wet condition so that dusting does not occur.

Management of potential leachates will be facilitated by the groundwater monitoring system that is already in place at the plant site. This system allows abstraction from the bores as well as groundwater level and quality determination and will thus indicate any development of leachate plumes in the subsurface and allow for plume recovery.

6.3.2.3 Monitoring

In order to ensure that the pond system operates as designed, the Proponent has installed a comprehensive groundwater monitoring bore system comprising 33 monitoring bores (S-shallow, I-intermediate and D-deep) at 11 locations around the pond site. Initial groundwater level and hydrochemical data were collected in 1987 prior to commissioning of the Gallium Plant. During the operation of the Gallium Plant and whilst the plant has been on care and maintenance, monthly groundwater level measurements and quarterly groundwater sampling and analyses have been undertaken in all monitoring bores. Monitoring results are summarised in Appendix I.

The monitoring data (1987 to 1995) for groundwater monitoring bore sites (Figure 6.3) have been reviewed to determine if any major changes in the groundwater regime have occurred. These results are outlined below.

Groundwater Levels

Groundwater levels in all monitoring bores have displayed seasonal fluctuations of between 2 and 6m with the largest fluctuations generally east of monitoring bore site 3 (Figure 6.3). There has been no discernible change in the range of groundwater level fluctuations since 1987. A general downward trend in the annual summer groundwater levels in the monitoring bores has been observed, most likely due to climatic factors and/or groundwater abstraction in the general region.

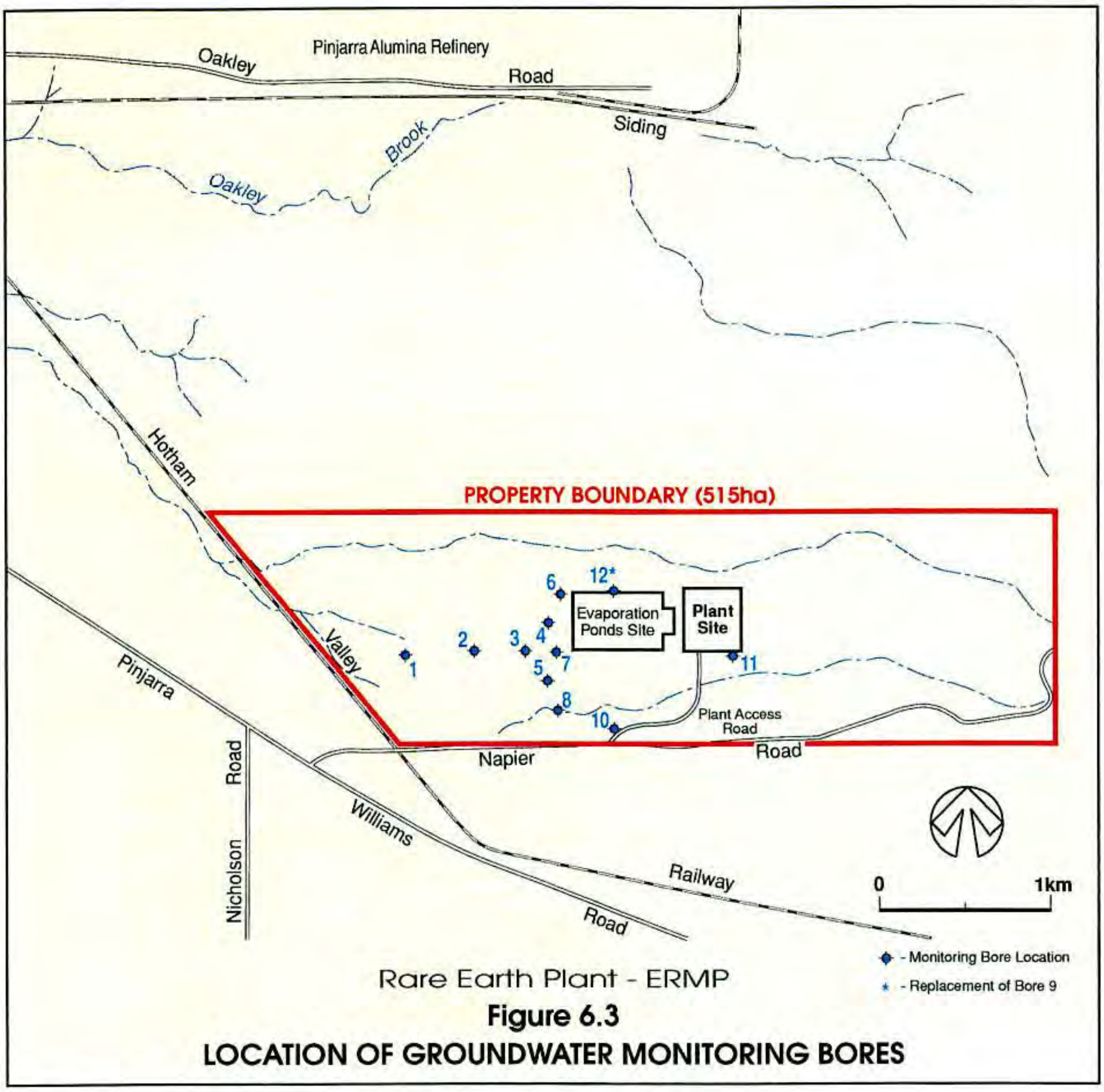
Groundwater Chemistry

The pH of the groundwater has remained in the range 3.8 to 7.5 and where fluctuations in this range are observed, all of the monitoring bores indicate a similar trend. Downslope and west of the evaporation ponds, naturally acidic groundwater conditions exist in a swampy area.

Groundwater salinity is generally less than 2,000mg/L total dissolved solids (TDS) and has generally remained constant or decreased. At sites 10S, 10I, 10D, 3I and 5I the groundwater salinity is between 3,000 and 5,000mg/L, however this is unrelated to the operation of the ponds.

The initial sulphate concentration in groundwater was generally less than 150mg/L and has not fluctuated, except for monitoring bores 10S, 5I and 8I where occasional higher concentrations have been measured. These slightly elevated sulphate concentrations are probably related to the historical application of sulphate-rich fertilisers to the pasture in the area, rather than the operation of the ponds.

Groundwater nitrate concentrations have remained less than 10mg/L, except for monitoring bores 4S, 6S, 11S and 12S which occasionally have slightly higher, unexplained values. Phosphorus concentrations have remained below 5mg/L. The sodium and magnesium concentrations in the groundwater have not fluctuated significantly since monitoring commenced.



Rare Earth Plant - ERMP

Figure 6.3

LOCATION OF GROUNDWATER MONITORING BORES

The aluminium concentrations in the groundwater have been generally less than 0.25mg/L for most of the monitoring period, with the exception of monitoring bores 12S, in which abnormally high aluminium concentrations (up to 25mg/L) have occasionally been measured. The high values are generally coincident with the seasonal rise in groundwater levels but are probably unrelated to the groundwater chemical regime and may be due to the presence of cement grout in the slotted interval of the monitoring bore.

There have been no significant changes in the chemistry of the groundwater under the site identified due to the presence or operation of the evaporation ponds.

The monitoring bores will continue to be monitored on a regular basis. The monitoring programme will be extended upon commissioning of the Rare Earth Plant and will include the following:

- groundwater levels - monthly in all monitoring bores;
- groundwater sampling and analyses - quarter yearly from all monitoring bores in accordance with acceptable methods and standards. The complete suite of analytes has not been determined but should include pH, total dissolved solids, nitrate and phosphate;
- evaporation ponds - monthly water levels and quarter yearly water sampling, weekly discharged effluent volumes; and
- sumps - monthly water levels and quarter yearly water sampling.

COMMITMENT 10

The existing evaporation pond and groundwater monitoring systems have been approved by the DEP and Water Authority. The monitoring bores have been and will continue to be monitored by the Proponent for both groundwater level and groundwater quality on a routine basis. The evaporation ponds and underdrainage sumps will also be monitored for level and quality. The results of the monitoring will be made available to the DEP at a frequency to be determined. If results indicate that leakage from the ponds is entering the groundwater under the site the DEP will be notified immediately.

6.3.2.4 Contingency Planning

While the Proponent is confident that these management measures will ensure that the environmental impacts of the operation of the evaporation ponds on surface and groundwater resources will be environmentally acceptable, contingency planning has resulted in the definition of the following additional management options:

- a series of collection sumps associated with the underdrain system will allow any leachate to be returned to secure storage;
- the network of 33 monitoring bores has been constructed so as to allow the installation of pumps and direct recovery of leachate; and
- monitoring of the nature and dispersion of any contaminant plume leaking from the pond, utilising the monitoring bores that have already been constructed at the plant site.

Public concerns raised during community consultation related to the security of the ponds for waste disposal resulted in the Proponent addressing other contingencies. These are detailed in Appendix J and relate to:

- flooding (overtopping);
- flooding (erosion);
- seismic risk;
- breach of pond wall; and
- bushfire.

In addition to these factors there was also some public concern of a phosphate source remaining in the Peel-Harvey system upon decommissioning. The tricalcium phosphate will be recovered from the ponds and sold to the fertiliser industry. However, in the unlikely event that the by-product remains in the ponds the "worst case" scenario were considered. These scenarios are detailed in Appendix J and related to mobilisation by infiltrating rainfall or by rising water table.

The results of the investigations of potential impacts related to phosphorous movement from the ponds indicate that, even in the unlikely event of the "worst-case" scenarios, the environmental impacts associated with such events would be manageable. This finding was supported by the Environmental Protection Authority (EPA, 1988a).

COMMITMENT 11

The Proponent will implement contingency plans should there be any leakage from the ponds, throughout the life of the project and remediation procedures will be undertaken to the satisfaction of the Minister for the Environment.

6.3.3 Disposal at the IWDF

6.3.3.1 Background

In the assessment of the Proponent's previous Rare Earth Treatment Plant the EPA considered the disposal of the low level radioactive waste to be manageable (EPA, 1988a). Disposal of low level radioactive waste at the IWDF, resulting from mineral processing such as monazite, was previously proposed by the Health Department of Western Australia (Maunsell, 1988) and was subsequently given conditional approval by the Western Australian Minister for the Environment (Appendix B).

One of the approval conditions is that the operator of the IWDF shall prepare an Environmental Management Programme (EMP) to the satisfaction of the EPA and that it shall be made available to the public.

Subsequent to the Ministerial approval in 1988, an EMP was prepared by the Health Department (Health Department of Western Australia, 1989) for the disposal of radioactive waste at the IWDF. This programme specifically addressed, amongst other things, the disposal of thorium hydroxide waste from the proposed Rhône-Poulenc Rare Earth facility by burial in trenches. However, due to Rhône-Poulenc withdrawing its proposal, the component of the EMP relating to the disposal of rare earth wastes was not assessed. The current operator of the IWDF, the Waste Management Division of the Department of Environmental Protection, is preparing an EMP for the disposal of the low level radioactive waste from the Rare Earth project at the IWDF. The EMP will be available for public comment during the ERMP public review period.

The Government operator of the IWDF will take responsibility for the waste at the IWDF site with the Proponent funding through its contract with the State Government, the following aspects of waste disposal:

- planning of site operations with respect to Rhône-Poulenc's waste (such as exploratory drilling, surveying, drawings etc.);
- disposal costs, including those relating to excavation of the trench and burial of the waste;
- backfilling and rehabilitation of the trench area;
- monitoring of the disposal operations for Rhône-Poulenc waste;
- a contribution to long-term monitoring of the site;
- a contribution, together with other users of the road such as mining companies, to the maintenance of the IWDF access road;
- a provision for maintenance and any costs of remedial work necessary in the first five years after a disposal operation; and
- the proportion of salaries and overheads for agreed Government management staff and site management contractors in relation to disposal of Rhône-Poulenc's gangue residue, including a proportion of out-of-pocket expenses related to the involvement of Government staff on the technical committee.

The composition and role of the technical committee are described in the EMP.

COMMITMENT 12

The Proponent will fund, through its contract with the State Government, the following aspects of waste disposal operations:

- *planning of site operations with respect to Rhône-Poulenc's waste;*
- *disposal costs;*
- *backfilling and rehabilitation of the trench area*
- *monitoring of the disposal operations for Rhône-Poulenc's waste;*
- *contribute to long term monitoring of the IWDF site;*
- *contribute, together with other users of the road, to the maintenance of the IWDF access road;*
- *a provision for maintenance and any costs of remedial work necessary in the first five years after a disposal operation; and*
- *the proportion of salaries and overheads for agreed Government management staff and site management contractors in relation to disposal of Rhône-Poulenc's gangue residue, including a proportion of out-of-pocket expenses related to the involvement of Government staff on the technical committee.*

6.3.3.2 Issues

As discussed in Section 3.4.2, the gangue residue is a low level radioactive waste. If not disposed of correctly, it may present a small health risk to humans or represent a long term detrimental impact on other biota and the environment. Such risks can only occur as a result of human intrusion after closure of the facility, and/or following failure of the disposal structure due to natural processes such as erosion. However, the site has been selected at a remote location and the disposal methods will minimise erosion.

The total area of the IWDF site is approximately 2,500ha. An area of 6ha (0.25% of the total site area) will be required for 20 years disposal of waste from the Rare Earth Plant.

6.3.3.3 Management

Disposal operations and management of such operations will be in accordance with the following requirements:

- existing Ministerial conditions for operation of the IWDF site;
- applicable legislation (Section 1.9);
- the National Health and Medical Research Council Code for Near-Surface Disposal of Radioactive Waste (NHMRC, 1992) referred to as the Code for Disposal;
- the EMP for the operation; and
- the IWDF site Radiation Management Plan (RMP).

The existing Ministerial conditions issued for the IWDF and the Code for Disposal (NHMRC, 1992) both require an EMP be prepared for the disposal of radioactive waste by the operator of the IWDF.

6.3.3.4 Technical Auditing

Waste disposal operations including transport will be subject to an annual technical audit to assess if the operations comply with the relevant regulations and environmental approvals given for the project. The appointment of the independent technical auditor and his role are defined in the Code for Disposal (NHMRC, 1992) and described in the EMP.

The technical auditor's principal roles for the disposal operations will be to review:

- the records maintained for the generation, transport and disposal of the gangue residue;
- that waste specifications have conformed with those in the Code for Transport (Commonwealth of Australia, 1990) and the Code for Disposal (NHMRC, 1992);
- the effectiveness of the management of the operations and the IWDF;
- the use of quality control and quality assurance procedures specified for the operations;
- the health and environmental radiation monitoring programmes as specified in the EMP and the RMP; and
- the operations in relation to the procedures specified in the EMP.

The technical auditor will provide an annual written report to the appropriate authority. This report will be available for public information and will identify, as appropriate, non-compliance issues and present recommendations on improvement of such issues. The proposed composition and duties and responsibilities of the appropriate authority are presented in the EMP.

COMMITMENT 13

Rhône-Poulenc's delivery of waste to the IWDF will be subject to technical auditing as part of the annual technical audit of the IWDF as specified in the Code of Practice for the Near-Surface Disposal of Radioactive Waste (NHMRC, 1992).

6.4 RADIOLOGICAL ISSUES

6.4.1 Background Information

Man has always been exposed to radiation from a number of sources namely; cosmic radiation and radiation from naturally occurring radionuclides in the earth, atmosphere and the human body. In addition, man's activities can also result in radiation exposure such as the use of particular building materials for houses, cooking with gas, open coal fires, home insulation, air travel and medical X-rays. Details of these sources are documented and summarised in a United Nations publication "Radiation, Doses, Effects Risks" (United Nations Environment Programme, 1985).

Natural background radiation varies from place to place on the earth, but generally results in individuals receiving about 2 milli Sievert (mSv) per year on average, although there are some places where the terrestrial levels are much higher than elsewhere. This general level of exposure to radiation is such that it is not possible to ascribe any ill-effects in man specifically to natural background radiation. On the other hand, radiation induced effects have been observed in man when individuals have been exposed to very large radiation doses and it is from such occurrences that our knowledge of biological effects from radiation exposure is derived (NHMRC, 1989).

Issues relating to radiation and radioactivity are complex and terms relating to such can be confusing. The following is a simple definition of some of the terms used.

Some atomic structures (or nuclides) are unstable and transform themselves shedding particles until they finally end up as stable nuclides. There may be many sequences of transformation and this is referred to as "decay" and the nuclides produced during the transformation are termed the "decay series".

As each transformation takes place, energy is released and is transmitted as radiation. This whole transformation process is called radioactivity and the unstable nuclides termed "radionuclides".

The period it takes half of any amount of an element to decay is known as its "half-life". The half-life varies considerably between nuclides, some decay in a fraction of a second and others take billions of years.

The number of transformation that takes place each second in an amount of radioactive material is called its "activity". The activity is measured in units called becquerels (Bq), each becquerel equals one transformation per second.

The different forms of radiation (alpha, beta and gamma) are emitted with different energies and penetrating power. Alpha radiation (containing neutron and protons) can be halted by a sheet of paper and cannot penetrate the dead outer layers of the skin. Beta radiation can go through one or two centimetres of living tissue. Gamma radiation can be extremely penetrating and, depending on the energy, can only be stopped by thick layers of dense material such as lead or concrete.

It is the energy of radiation which does the damage and the amount of energy absorbed in living tissue is called the "dose". The amount of radiation energy that is absorbed per kilogram of tissue is called the absorbed dose and is measured in units called Grays. However, the dose needs to be weighted for its damage potential. This weighted dose is known as the "dose equivalent" and it is measured in units called Sieverts (Sv).

Another factor which must be considered in assessing "doses" is that some parts of the body are more vulnerable than others, therefore different parts of the body are given weightings. For example reproductive organs are given a higher weighting than the thyroid gland due to the possibility of genetic effects. Once the dose equivalent has been weighted appropriately, this is termed the "effective dose" also expressed in Sieverts.

6.4.2 Issues

The principal issues relating to the radiological components of the project are:

- radiation from the plant;
- transport of the monazite and gangue residue; and
- disposal at the IWDF site.

The impact of man-made sources of radiation on the environment must be assessed in relation to background radiation levels and radiation protection standards.

6.4.3 Radiation Exposure

Due to the potential health effects of radiation exposure it is important to consider radiation protection procedures to ensure that workers and the general public do not receive unacceptable levels of exposure. This has been successfully achieved at similar plants elsewhere, some of which have been operated by Rhône-Poulenc. The mineral sands industries in Western Australia have been handling similar types of radioactive materials for approximately 30 years with adequate management procedures.

The main stages of the process during which radiation exposure to the workforce could occur are as follows:

- transport of monazite feedstock to the Pinjarra plant;
- transfer of monazite to the mill;
- grinding of monazite;

- removal of phosphate from the monazite matrix by dissolution with sodium hydroxide to produce a filter cake of rare earth hydroxide;
- dissolution of the rare earths from the rare earth hydroxide with nitric acid;
- precipitating of radium with barium sulphate; and
- packaging, transport and disposal of gangue residue containing the radioactive components of the monazite.

6.4.4 Radiation Protection and Management

6.4.4.1 Legislation and Protection Criteria

Radiation protection standards in Western Australia are covered by the following legislation and Codes of Practice:

- Radiation Safety Act (1975);
- Radiation Safety (General) Regulations (1983);
- Mines Regulation Act Regulations (1976);
- Radiation Safety (Transport of Radioactive Substances) Regulations 1991;
- Commonwealth of Australia's Code of Practice for the Safe Transport of Radioactive Substances (1990);
- Commonwealth of Australia's Code of Practice on Radiation Protection in the Mining and Milling of Radioactive Ores (1987);
- National Health and Medical Research Council's Australian Radiation Protection Standards (1991);
- Western Australian Explosives and Dangerous Goods Act (1961-1979) and the Dangerous Goods Regulations (1992);
- National Health and Medical Research Council's Code of Practice for the Near-surface Disposal of Radioactive Waste in Australia (1992);
- National Health and Medical Research Council. Recommendations for Limiting Exposure to Ionising Radiation (1995); and
- National Occupational Health and Safety Commission. National Standard for Limiting Occupational Exposure to Ionising Radiation (1995).

The regulations under the Mines Regulation Act are currently being reviewed and will, when completed, replace the requirements of the Mining and Milling Code (Commonwealth of Australia, 1987), by more modern regulations.

The Rare Earth Plant will be classified as a mine under the provisions of the Mines Regulation Act (1974) and therefore will be regulated by the DOME.

Radiation standards for radiation workers and the public are listed in Table 6.3. These limits follow those set by the International Commission on Radiological Protection (ICRP). Australia was one of the first countries to adopt the current international recommendations on occupational health limits.

TABLE 6.3

DOSE LIMITS FOR IONISING RADIATION

Application	**Dose Limit**[1]		
	Radiation Workers	**Transport Workers**	**Public**
Effective Dose	20mSv/yr averaged over a period of 5 consecutive calendar years[2, 3]	5mSv/yr	1mSv/yr[4]
Annual equivalent dose in:			
the lens of the eye	150mSv/yr		15mSv/yr
the skin[5]	500mSv/yr		50mSv/yr
the hands and feet	500mSv/yr		-

Notes:

1 The limits shall apply to the sum of the relevant doses from external exposure in the specified period and the 50-year committed dose (to age 70 years for children) from intakes in the same period.

2 With the further provision that the effective dose shall not exceed 50mSv in any single year. In addition, when a pregnancy is declared by a female employee, the embryo or foetus should be afforded the same level of protection as required for a member of the public.

3 When, in exceptional circumstances, a temporary change in the dose limitation requirements is approved by the appropriate authority, one only of the following conditions shall apply: (a) the effective dose limit shall not exceed 50mSv per year for the period, which shall not exceed 5 years, for which the temporary change is approved, or (b) the period for which the 20mSv per year average applies shall not exceed 10 consecutive years and the effective dose shall not exceed 50mSv in any single year.

4 In special circumstances, a higher value of effective dose could be allowed in a single year, provided that the average over 5 years does not exceed 1mSv per year.

5 The equivalent dose limit for the skin applies to the dose average over any $1cm^2$ area of skin, regardless of the total area exposed.

Sources: NHMRC, 1995.
NOHSC, 1995.

Radiation exposure as the result of radioactive materials handling operations can be considered as comprising the following three components:

- the external radiation exposure (D_e);
- the internal component from long lived radionuclides contained in dust (D_i); and
- the component due to exposure to the short half-life descendants of Radon and Thoron (D_d).

Total radiation exposure is the sum of these three components and it is this sum which must meet the regulatory requirements, i.e.:

$$D_e + D_i + D_d < D_l$$

where D_l is the applicable dose limit either for the general public or the workers as provided in Table 6.3.

COMMITMENT 14

The Proponent will comply with the requirements of the applicable legislation and codes of practice relating to radiation protection.

6.4.4.2 Sources of Radiation

Potential sources of radiation due to the project, the level of exposure and the proposed management strategies are listed in Table 6.4.

TABLE 6.4

POTENTIAL SOURCES OF RADIATION FROM THE PROJECT

Potential Source	Potential Exposure and Management Strategy
PLANT OPERATIONS	Exposure well below limits. The Proponent is committed to the ALARA principle that radiation dose be kept as low as reasonably achievable, economic and social factors being taken into account. The time a worker spends in the designated areas will be minimised to ensure that radiation doses are kept to a minimum.
TRANSPORT OF MONAZITE	
Internal exposure	Effectively zero as monazite transportation and associated handling will be designed to prevent significant transfer of monazite particles to the atmosphere.
External exposure	Gamma flux from monazite transport will comply with Radiation Safety Regulations 1991 and the Commonwealth Code of Practice for the Safe Transport of Radioactive Substances (1990).
MONAZITE MILL	
Internal exposure	Negligible within the plant, as the mill will be sealed to prevent release of thorium and uranium particulate matter. Levels of thoron and radon daughters within plant will be controlled by ventilation.
External exposure	Radiation doses will be reduced to acceptable levels by the layout of vessels and by siting the mill in the controlled area of the Plant.
MONAZITE REACTOR VESSEL	
Internal exposure	Negligible, as monazite transfer system and vessel will be sealed from the atmosphere.
External exposure	Radiation doses will be reduced to acceptable levels by the layout of vessels in the controlled area of the Plant.
GANGUE RESIDUE FILTRATION UNITS	
Internal exposure	Negligible within the plant as material will be moist.
External exposure	Radiation doses will be reduced to acceptable levels by layout of vessels and by siting the units in the controlled area of the Plant.
PACKAGING OF GANGUE RESIDUE	
Internal exposure	Negligible as material will be packed in bulka bags in moist form.
External exposure	Exposure of workers will be minimised according to the as low as reasonably achievable (ALARA) principle and will meet design objectives given in the ERMP.
TRANSPORTATION OF GANGUE RESIDUE	
Internal exposure	Negligible as bag seals will prevent escape of particulate matter and waste will remain moist.
External exposure	Gamma flux from transport vehicles will conform with the Commonwealth Code of Practice for the Safe Transport of Radioactive Substances (1990) and Radiation Safety Regulations, 1991.
DISPOSAL OF GANGUE RESIDUE	
Internal exposure	Negligible as waste will be disposed of in moist form in bulka bags.
External exposure	Gamma radiation levels will be controlled to meet the requirements of regulations by applying best practicable technology in handling.

6.4.4.3 Monazite Transport

Monazite is a low level radioactive material therefore careful management is required for its handling and transport. The loading and transport of the monazite will be the responsibility of the monazite suppliers. The Code governing transport of radioactive substances is the "Code of Practice for the Safe Transport of Radioactive Substances, 1990" (Code for Transport) (Commonwealth of Australia, 1990). In addition, the monazite is classified a Dangerous Good and therefore the handling and transport procedures must conform to the codes and regulations pertaining to Dangerous Goods (Federal Office of Road Safety, 1992a & b; and Dangerous Goods Regulations, 1992).

As the monazite and gangue residue both have the same classification (Commonwealth of Australia, 1990), the regulations and codes governing the handling and transport of the waste also apply for the monazite. Details of these regulations and codes are presented in Section 6.4.4.8.

Occupational Exposure

Data from the mineral sands industry on health monitoring of drivers of trucks transporting monazite have indicated that no significant radiation exposures have been experienced. Monitoring will be conducted by the Titanium Mineral Producers supplying monazite to ensure that dose levels received by the drivers are within acceptable limits. The dose limit for truck drivers defined in the Code for Transport is 5mSv/year (Commonwealth of Australia, 1990).

6.4.4.4 Plant Site

Protection Measures

Plants which process monazite have been in operation in other parts of the world for a number of years, some of which have been or are currently operated by the Proponent. A confidential report prepared by the Department of Mines in 1988 on the design and operation of Rare Earth Plants indicated that radiation exposures can be kept within the regulatory dose limits by the use of normal radiation protection measures in the design and operation of such plants.

Protection measures which will be considered in the design and implemented in the operation of the Rare Earth Plant are listed in Table 6.5. The Rare Earth Plant layout has been specifically designed to minimise radiation exposure to workers by separating the parts of the plant where radioactive materials are handled from the rest of the process units (Figure 1.3). This layout will result in well defined restricted areas and therefore allow better control of access by personnel. Details on final plant design will be made available to DOME on completion. These plans will detail engineering requirements related to radiation and occupational exposure, including shielding; aspects of plant to reduce contamination and build up of radioactivity; ventilation and dust controls.

TABLE 6.5

RADIATION DOSE PROTECTION MEASURES

Plant Section/Process	Strategies for Dose Reduction
1. All Controlled Areas	• Access should be via a change room with designated dirty and clean areas.
	• Restricted access-use of physical barriers (chains, gates, etc.).
	• Shielding and isolation of high gamma exposure sources should be used to the maximum extent practical.
	• Building design should allow wash down of floors and walls.
	• Surfaces should be non-absorbent and easy to clean.
	• Number of exposed horizontal internal surfaces (support structures, etc.) will be minimised.
	• All process sections should have good general room ventilation to prevent accumulation of radon/thoron daughters.
	• Regular housekeeping campaigns should be undertaken.
	• Remote metering/monitoring of process should be utilised as much as practicable.
	• Suitable administrative controls - education, training, supervision, etc.
	• Provision of air-conditioned control rooms.
2. Monazite Transfer/Debagging	• Shielding of monazite storage hopper/bin.
	• Ventilation of hopper/bin.
	• Automation of monazite transfer.
	• Monazite store should be in close proximity to debagging facility.
	• Normal movement of workers should be separated from monazite storage/transfer operations.
	• Multi-skilling of workers.
3. Monazite Grinding	• Isolate mill in a shielded room.
	• Grinding mill should be totally sealed and well ventilated.
4. Ore Attack	• Reaction vessels should be enclosed and ventilated.
5. Acid Attack/Filtration	• Procedures should be implemented to restrict spread or radioactive contamination - e.g. regular washing, monitoring/alarm equipment.
	• Isolation and shielding of gangue residue filter press.
	• Extraction ventilation around filter presses containing significant quantities of radioactive materials.
	• Introduction of remote metering of process conditions.
	• Tanks to be in suitably bunded areas.
	• Physical layout of plant and equipment to minimise gamma exposures.

Source: Confidential Department of Mines Report.

COMMITMENT 15

Details on final plant design will be made available to DOME on completion of the design by the Proponent.

Both caustic and nitric attack units will be located in the same concrete building, adjacent to the monazite and gangue residue storage area (Figure 1.3). By locating these areas adjacent to each other, the distance required for the transfer of both the monazite from the storage area to the caustic attack units and the residue from the nitric attack unit to the storage area will be minimised.

The building housing the attack units will be constructed in concrete and designed to ensure that:

- shielding effects are maximised;
- there is ease in venting and collection of dust; and
- areas are easily washable with minimised structural steelwork and good washdown collections.

Process area washdowns will either be recycled or filtered to separate the solids from the water and then directed to the evaporation pond system (Section 3.4.1). There will be no radioactive material in the wastewater as the radioactive components of this stage of the process will be insoluble and would have been filtered out with the solids to be recycled in the process.

Specific Design Objectives for Workers

Radiation objectives for design and management of the plant will be such that the limits on exposure will not be exceeded. To ensure this, the plant will be designed to achieve the objectives listed in Table 6.6.

TABLE 6.6

RADIATION OBJECTIVES FOR DESIGN AND MANAGEMENT OF THE PLANT

Category of Worker	Radiation Source			
	External Gamma	Thorium Dust	Thoron Daughters	Radon Daughters
Designated Worker	5mSv/yr	5mSv/yr	1mSv/yr	1mSv/yr
Non-designated Workers	2mSv/yr	2mSv/yr	0.5mSv/yr	0.5mSv/yr

During the operation of the plant a principal objective will be to minimise doses to workers and the general population. This principle will ensure that, with occupancy factors and other administrative precautions, the doses will be as low as reasonably achievable (ALARA) in accordance with DOME and Radiological Council regulations.

COMMITMENT 16

The Proponent is committed to the ALARA principle (that radiation dose be kept as low as reasonably achievable, economic and social factors being taken into account) in accordance with DOME and Radiological Council regulations.

Exposure to gamma radiation can be controlled by adhesion to the principles of radiation protection, namely: time, distance and shielding. In order to minimise radiation exposure, controlled areas will be designated in which administrative controls over access and working times will be exercised. Workers will need to remain in the controlled areas of the plant for only a short time as the use of automation and modern process control can reduce the time required for manual tasks. Areas occupied by the workers will be located as far as practicable from the controlled areas and appropriate shielding will be provided to reduce general gamma radiation levels.

Control of airborne activity will be achieved through containment of the activity and by wet processing to reduce dust production. Any airborne activity in vented vessels will be filtered to remove particulates, and gaseous radon and thoron will be vented outside the plant building to ensure suitable dilution is achieved. Details of radon and thoron emission are discussed in the following section relating to public exposure.

Special maintenance tasks may require extra levels of protection from either airborne dust or radon and its daughters. When such identifiable tasks are undertaken masks will be worn which filter the radioactivity and reduce exposures. All such tasks will be monitored as required by DOME for exposure of the workers to radiation.

Public Exposure

The operation of the Rare Earth Plant will have no significant impact on the radiation exposure of the general public. However, descriptions of four potential sources of exposure are given below.

Gamma Radiation

Gamma radiation levels resulting from the presence of monazite and radioactive waste on the site are difficult to estimate. The monazite and the waste will be stored in shielded areas and process vessels will also be shielded. The dose rate at the boundary will depend upon the configuration of unshielded radioactive material on site. If absorption in air is ignored the gamma dose rate at the boundary 500 metres from a container of waste has been estimated to be 0.00028μSv/hr. This would give a total dose of 2.5μSv in a year if a person was at the boundary for 24 hours a day, 365 days per year. Doses of this magnitude are considered to be negligible. The above calculation is based on a dose rate of 8μSv/hr at 3 metres from a container of waste material. Natural radiation levels on the site are between 0.08μSv/hr and 0.28μSv/hr (Section 5.5), therefore, dose rates at the boundary of the site from unshielded containers of waste are negligible in relation to the natural levels. The calculation is conservative as it does not take into account the significant shielding from 500 metres of air which is equivalent in shielding to about 5cm of lead.

Radon and Thoron Emission

Monazite ore will be treated at a rate of 2 tonne/hr. Assuming that all of the radon and thoron present in the monazite is released to the air during the treatment approximately 12×10^4Bq/sec of thoron and 1.8×10^4Bq/sec of radon would be emitted, although this estimate does not consider thoron's half life of less than 1 minute. The emissions of thoron and radon would be collected and discharged through a single stack which extends 4m above a 16m high building (20m total height). The DEP's worst case prediction model, known as MAXMOD, was used to predict the maximum ground level concentrations of radon and thoron at the closest plant boundary based on the following characteristics:

Stack height:	20m
Stack diameter:	1m
Emission rate:	
- Thoron:	12 x 10^4Bq/s
- Radon:	1.8 x 10^4Bq/s
Emission volume:	$20m^3$/hr @ 90°C ($0.056m^3$/s)
Building dimensions:	
- Height:	16m
- Cross wind width:	40m
Distance to closest boundary:	500m

The maximum predicted ground level concentrations, as a function of stability class, are presented in Table 6.7.

TABLE 6.7

PREDICTED MAXIMUM 3-MINUTE AVERAGE GROUND LEVEL CONCENTRATIONS OF THORON AND RADON DOWNWIND DISTANCE OF 500m

Stability	Predicted Maximum Concentrations (Bq/m³)		Critical Wind Speed (m/s)
	Thoron*	Radon	
A	6	1	0.5
B	4	1	1.5
C	9	1	1.5
D	17	3	1.5
E	26	4	1.5
F	126	19	0.5

Note: * Thoron levels do not take into account its 56 second half life. Therefore, in the time taken for the plume to reach the boundary, most of the thoron would have decayed.

In air dispersion modelling, stability class is used to categorise the rate at which a plume will disperse. In the Pasquil-Gifford stability class classification scheme (as used in this exercise) there are six stability classes, A through to F. Class A relates to unstable conditions which often occur on a sunny day with light winds, resulting in a rapid spread of plumes. Class F relates to stable conditions which normally occur at night or early mornings when the sky is clear, the winds are light and an inversion is present resulting in a slow rate of plume spreading. The classes B, C, D and E relate to intermediate dispersion conditions, with class D representing neutral conditions.

Due to the nature of the emissions (low volume, building influences) the maximum concentrations are predicted to occur under the lightest wind conditions considered for each stability class with the highest concentrations predicted to occur under very stable night-time conditions when the plume is poorly dispersed (Class F). The worst case concentrations modelled result in a level of $126Bq/m^3$ of thoron, however, due to the short half life of thoron the time the plume reaches the boundary the thoron would have decayed. A worst case prediction of $19Bq/m^3$ for radon can be compared to the average radon concentrations in houses in Australia of $11Bq/m^3$. There are no suitable measured thoron concentrations with which to compare.

The radon emanation rate can be compared with the possible natural radon emanation rate for the Proponent's property of 167 x 10^3Bq/s as calculated in Section 5.5. The radon emanation rate resulting from the process is therefore likely to be at least 9 times less than the natural rate of radon emanation from soils in the areas over the Proponent's property. Thus the natural levels of radon exposure will not be significantly increased by the presence of the Rare Earth Plant. Estimates of thoron emanation from soil at the Pinjarra site are not currently available. However, due to the small quantity of thoron likely to be emitted and the short half life of these isotopes, it is unlikely that natural background levels will be significantly increased by the project.

Release of Radioactive Dust

There will be little or no generation of radioactive dust at the plant. Workers' clothes will be laundered on site so there is no potential risk of dust contaminated work clothes being taken off-site.

Release into Water

No liquid process waste containing radionuclides will be released into the environment. Therefore there will be no impact on the public in terms of risk of water contamination.

6.4.4.5 Management

A comprehensive Radiation Management Plan (RMP) for the Rare Earth Plant and its environment will be prepared by a qualified and experienced person, approved by DOME, for the Proponent. The RMP will be subject to assessment by DOME and the Radiological Council prior to commencement of operations. The RMP will be implemented to ensure that the safety and health of the Proponent's employees and the general public will not be impaired. The contents of the RMP will be based on those elements detailed by the Titanium Minerals Committee of the Chamber of Mines which are as follows:

"• *Sources/pathways of exposure:*
  - *internal*
  - *external*

• *Equipment and facilities for controlling sources:*
  - *ventilation and other engineering controls*
  - *source or metallurgical control*
  - *dust suppression*
  - *plant design*
  - *housekeeping and spillage control*
  - *access control and shielding (physical barriers)*

• *Institutional controls and education:*
  - *induction programme*
  - *re-instruction and frequency*
  - *supervisor/management training*
  - *details/location of signs and notices*
  - *classification of controlled and supervised areas*
  - *controlled area work rules*
  - *inspection/auditing programmes*
  - *radiation safety organisation (personnel)*
  - *health surveillance*

- *Radiation monitoring programmes:*
  - *parameters to be determined*
  - *frequency of measurement*
  - *sites/personnel monitored*
  - *measurement/analysis protocols*
  - *dose estimates: employees/members of the public*
  - *number of designated/non-designated employees*
  - *domestic procedures*

- *Details of records:*
  - *parameters reported (format)*
  - *parameters recorded and method of record keeping (e.g. forms)*

- *Investigation/management action levels for radiation parameters:*
  - *selection rationale*
  - *remedial action*

- *Protective equipment:*
  - *tasks/locations likely to require protective equipment.*

- *Waste management strategies:*
  - *solid, liquid, gaseous effluents*
  - *stockpiled material (containment)*
  - *notifiable products*
  - *rehabilitation of sites"*

(Chamber of Mines and Energy, 1995)

COMMITMENT 17

A comprehensive Radiation Management Plan will be prepared by the Proponent for the Rare Earth Plant and its environment, and submitted for approval from DOME and the Radiological Council prior to commencement of operations.

The management programme will be based on the following commitments.

COMMITMENT 18

The Proponent will implement the following strategies for the radiation protection of plant personnel:

- *Controlled areas will be established to include the monazite handling and storage facilities, filtering stages, purification area and residue handling/transport/disposal facilities and areas.*
- *Handling of potential dust generators (monazite and residue) will be minimised to reduce air contamination; in particular, wet milling of monazite and disposal of residue in wet or moist forms will be undertaken.*
- *Adequate ventilation will ensure that radon and thoron daughter levels are maintained within acceptable levels.*
- *Supervised areas and appropriate procedures will be established to limit access by members of the public to the plant site.*
- *Where necessary, equipment containing bulk quantities of radioactive material will be shielded to reduce exposure rates.*

COMMITMENT 18 (cont'd)

- *Equipment in controlled areas will be selected and designed for reliable operation and ease of maintenance.*
- *Floor surfaces in controlled areas will be non-absorbent and designed for reliable operation and ease of maintenance.*
- *Facilities will be provided for easy washing of floors and equipment. All washings will be returned to the process via floor sumps or the purpose designed waste water treatment plant.*
- *Designated staff will be trained in radiation protection practices.*
- *Protective equipment and clothing will be issued to workers where required. Such workers will be fully trained in the use of this equipment.*
- *Special clothing worn by plant operators will be laundered on-site with changerooms specially designed to allow work clothing to remain on-site.*

6.4.4.6 Monitoring at the Plant Site

A comprehensive radiation monitoring programme will be established for all operations of the plant. The monitoring programme will aim at detecting and determining any releases of radioactive materials and will also estimate radiation doses to workers and to the general public. The monitoring programme will cover the following three stages:

- pre-operational monitoring;
- operational monitoring; and
- post operational monitoring (Section 7.5).

In addition, occupational health monitoring will be undertaken for plant site workers.

Pre-operational Monitoring

The pre-operational monitoring programme for the Pinjarra site is a requirement under DOME regulations and must be approved by them. Monitoring of some environmental parameters such as radon levels and airborne dust will be conducted for twelve months prior to commissioning of the plant. Pre-operational monitoring is aimed at providing a baseline of environmental radiation data which will be used to determine whether there have been significant changes attributable to the operation of the plant. The data will also provide a reference level for rehabilitation of the site upon decommissioning.

A preliminary survey of the natural radiation background of the site was conducted in 1988 and a summary of this data is presented in Section 5.5. The previous survey indicated that there are areas of the site where both natural radiation levels and levels of radioactivity in soils may be higher than world averages.

Pre-operational monitoring includes a number of components which will be detailed in a Radiation Management Plan (RMP) prepared by the Proponent and issued to DOME for approval once final plant design is known. The components include:

- Gamma radiation monitoring;
- Radon flux;
- Radionuclides in soil or sediment;
- Radionuclides in air;

- Radon, thoron and descendants; and
- Radionuclides in water.

Gamma Radiation Monitoring

A radiation survey of the plant site on a twenty metre by forty metre grid will be conducted. This survey will cover the plant site and its immediate surrounds with an additional survey undertaken at a radius of 100 metres from the plant location. The area covered by the evaporation ponds will be surveyed on an appropriate grid. The site boundary will be surveyed at 200 metre spacing. A single survey for the above monitoring will be undertaken prior to construction.

Off-site locations and background control sites will be identified and monitored prior to plant operations.

Measurement technique will be by portable gamma monitor of sufficient precision to measure normal background radiation or by integrating devices with similar sensitivity.

Radon Flux

Measurements of the natural radon flux in a number of locations on and off-site will be taken. The location of these measurements will be similar to those proposed for gamma monitoring with the exception of the site boundary.

Radon flux measurements will be recorded twice prior to operation of the plant, once during summer and once during winter.

The technique of measurement will be by absorption onto activated charcoal of radon emanating from the soil, followed by counting in sensitive gamma counting equipment or by other techniques approved by DOME.

Radionuclides in Soil or Sediment

Soil from the Pinjarra site will be sampled and analysed for the principal natural radionuclides (uranium, thorium, Radium-226 and Radium-228) and their descendants. Soil samples will be taken at similar locations as those proposed for the gamma radiation survey. Samples of soil or sediment from drainage systems on the Proponent's property will also be taken.

A single soil sampling programme will be undertaken prior to plant construction or commissioning, as appropriate. Soils will be analysed by gamma counters or other techniques approved by DOME.

Radionuclides in Air

Dust samples will be taken on the four boundaries of the plant site at quarter year intervals prior to plant operations. Sampling sites will be located at those areas where the highest dust concentrations are predicted based on wind speed and direction. Samples will be twice taken at nearby residences and the off-site locations, identified for the gamma survey, prior to plant operations.

All samples will be analysed for gross alpha activity with selected samples having a more comprehensive analysis (uranium, thorium, Radium-226 and Radium-228).

Radon, Thoron and their Descendants

A survey for radon, thoron and their descendants will be conducted to determine the background levels of these radioactive isotopes. Site boundaries will be surveyed at the four locations as for the measurements of radionuclides in air. A 24-hour survey for radon daughter concentration will be conducted and a three month average integrating measurement will be taken at each location.

Similar measurements will be recorded at nearby residences and at the control sites identified for the gamma survey.

Methods of measurements for these parameters will be determined and approved by DOME.

Radionuclides in Water

Water samples will be taken from the existing monitoring bores located on the property (Figure 6.3) and from others located in the area. Four samples will be taken in the 12 months prior to commissioning.

Surface water will be sampled and analysed, when available, from the two creeks on the property which flow after periods of rain.

Analyses will be for gross alpha and beta activity with selected samples being analysed for Radium-226 and Radium-228. Analytic methods will follow Australian Standard AS 3550.5-1990.

COMMITMENT 19

Prior to commissioning of the plant, a comprehensive survey of the existing radiation environment at the Pinjarra site will be conducted by the Proponent as required by DOME and the Radiological Council.

Operational Monitoring

The operational monitoring programme will be devised following consideration of the results of the pre-operational monitoring programme with the aim of identifying any changes to the baseline levels measured in the pre-operational programme. Therefore, the operational monitoring will contain the same components as the pre-operational programme and will use similar methods of analysis. The location of the monitoring sites will, as far as possible, be the same as for the pre-operational monitoring and the intensity of the monitoring will be no less than that of the pre-operational programme.

The operational monitoring programme will be included in a RMP for the site which will be developed by the Proponent and approved by DOME prior to operations at the site.

6.4.4.7 Occupational Monitoring at the Plant Site

Occupational monitoring of workers at the plant site will be detailed in the RMP for the plant. The aim of the monitoring is to detect any increases in radiation levels in the plant and at fixed locations (environmental monitoring) and to measure the actual exposure of workers (personnel monitoring).

Environmental monitoring will consist of measurements of gamma radiation, radon and thoron concentrations, potential alpha energy from their descendants and dust concentrations. All of these measurements will be taken at fixed locations inside the plant and its immediate surrounds. These environmental measurements will be used to identify any changes in the general levels of radioactivity.

Personnel monitoring will assess individual doses to which persons working on the plant site are exposed. Monitoring includes the following:

- Gamma Radiation
  Assessment of gamma radiation exposure by Thermo-Luminescent Dosimeter (TLD) badges supplied by the Australian Radiation Laboratory. The use of TLDs, is approved by the Radiological Council and the Titanium Mineral Producers currently use the TLD system for measuring gamma doses. Badges will be worn for a period approved by DOME, most likely in the order of two or three months per badge. For special tasks, where radiation levels may be high due to concentrations of radium, integrating electronic dosimeters will be worn to give immediate determination of doses to which the workers have been exposed.

- Radioactive Dust
  Exposure to airborne radioactive dust will be measured by the workers wearing standard approved air sampling pumps followed by assessment of their exposure by determination of the radioactivity on the sample and the application of standard assessment methods approved by DOME (DOME; 1988, 1991, 1995).

- Radon, Thoron and their Descendants
  Assessment of exposure to radon and thoron daughters will be difficult due to the low concentrations expected and the variation in natural background levels at the site. Assessment will be made by determining environmental levels in the plant and calculating times of exposure for workers who may have been exposed. Instrumentation is available to measure potential alpha energy in air semi-continuously and such instrumentation will be used if approved by DOME. Alternatively, grab samples will be taken and assessed by the standard methods for descendants of thoron and radon.

The results of the three monitoring programmes will be combined to estimate the total dose to workers. A design dose constraint for plant personnel of 10mSv/year will be established by the Proponent, in agreement with DOME and the Radiological Council. If any worker appears to exceed this level or does exceed the pro-rata dose in any monitoring period, the Proponent will investigate the circumstances of the exposure and implement measures to ensure that the worker or any other worker will not receive exposure in similar circumstances. The Proponent will thus use the concept of dose constraints to assist in minimising the exposure of workers and to keep doses as low as reasonably achievable (ALARA principle).

Monitoring of special maintenance tasks will also be necessary. For example, if it is necessary for any workers to enter semi-closed vessels which have held radioactive materials the workers will be monitored for radon and thoron activity and worker doses assessed. Special monitoring will also be required for any tasks which may generate radionuclide dust. Details on the monitoring required for these tasks will be included in the RMP for the plant.

COMMITMENT 20

The Proponent will implement a comprehensive monitoring and health surveillance programme for Rare Earth Plant personnel according to the requirements of DOME and the Radiological Council.

COMMITMENT 21

The Proponent will establish an operational dose constraint for plant personnel of 10mSv/yr to be agreed upon with DOME and the Radiological Council. Should any worker exceed this dose constraint on a pro rata basis, the circumstances relating to that exposure will be investigated and measures taken to ensure that the dose to an individual of 10mSv in any one year will not be exceeded.

COMMITMENT 22

Monitoring of radiation levels by the Proponent will continue over the life of the project. Reporting of radiation monitoring data and record keeping will be undertaken by the Proponent in accordance with the applicable legislation of DOME and the Radiological Council.

COMMITMENT 23

Radiation protection assessments given in the ERMP will be verified by the Proponent during plant commissioning, to the satisfaction of the DEP and DOME.

6.4.4.8 Transport of Gangue Residue

Regulations and Codes

The Code for Transport (Commonwealth of Australia, 1990) governing transport of the gangue residue is an Australian adaptation of the International Atomic Energy Agency's Regulations for the Safe Transport of Radioactive Substances, published by the Australian Government Publishing Office. The Code has been adopted by the Radiation Safety Act and all transport of radioactive substances must comply with it.

Classification of Gangue Residue

Under the Code for Transport, the gangue residue is classified as a Low-specific Activity Material (LSA) and more precisely as LSA-I material defined as "Ores containing naturally occurring radionuclides (e.g. uranium, thorium) and uranium or thorium concentrates of such ores" (Commonwealth of Australia, 1990). It is expected that the external radiation dose from a single bag of residue will be in the order of 200µSv/hr at zero distance. This level will be verified during operations.

Packaging

Gangue residue, as LSA-I material, must be packaged in Industrial Packages Type 1 (IP1). For these packages, the Code for Transport requires them to be able to contain the radioactive material and to be provided with lifting attachments adequate to lift the mass of the package and contents.

The gangue residue will be packaged in bulka bags, of similar type to those currently used for monazite, and placed into steel ISO containers or into dedicated trucks for transport to the IWDF. The bags will be fitted with lifting loops which will facilitate lifting of the bags. The bulk bags may be transported and handled on individual pallets to assist in handling operations at the IWDF site. The packaging will satisfy the requirements of the Code for Transport and the ADG Code, including the supplement titled Specifications for Intermediate Bulk Containers for the Transport of Dangerous Goods (Federal Office of Road Safety, 1992a & 1992b).

Labelling

Individual packages of gangue residue will be labelled with Type II Yellow transport labels (Figure 6.4).

(a) Category II - YELLOW label **(b) Category III - YELLOW label**

The background colour of the upper half of the label shall be yellow and of the lower half white, the colour of the trefoil and the printing shall be black, and the colour of the category bars shall be red.

Rare Earth Plant - ERMP

Figure 6.4
CATEGORY II AND CATEGORY III - YELOW LABELS

SOURCE: Code of Practice for the Safe Transport of Radioactive Substances, 1990.

Containers will be labelled with Type III-Yellow transport labels (Figure 6.4). Transport vehicles will be labelled according to paragraph 467 of the Code for Transport, which requires a road vehicle labelled with signs conforming with the Code on both sides and the rear of the vehicle and on the two sides for a rail vehicle.

Transport

Transport will be by exclusive use which is defined in the Code for Transport as the sole use by a single consignor of a large freight container with a minimum length of 6m, in respect of which all initial, intermediate and final loading and unloading is carried out in accordance with the directions of the consignor. The provisions of the Code for such cases apply such that "the maximum radiation level of any point on any external surface of a package under exclusive use shall not exceed 10mSv/hr". (Commonwealth of Australia, 1990). The activity of the gangue residue is such that radiation levels of this magnitude cannot occur.

The Code for Transport is designed to ensure that doses to the public during transport of radioactive substances are very small. Compliance with this Code and the nature of the material will ensure that public exposure during transport is negligible.

Radiation Dose Assessments

Public Exposure

Measurements of radiation levels from trucks transporting monazite have been made. The waste is expected to be approximately twice as concentrated in radionuclide as monazite, therefore, the radiation levels are expected to be about double those from monazite. Based on the measured levels from bags and containers of monazite the following doses from the waste are estimated as shown in Table 6.8 and Figure 6.5 (a & b).

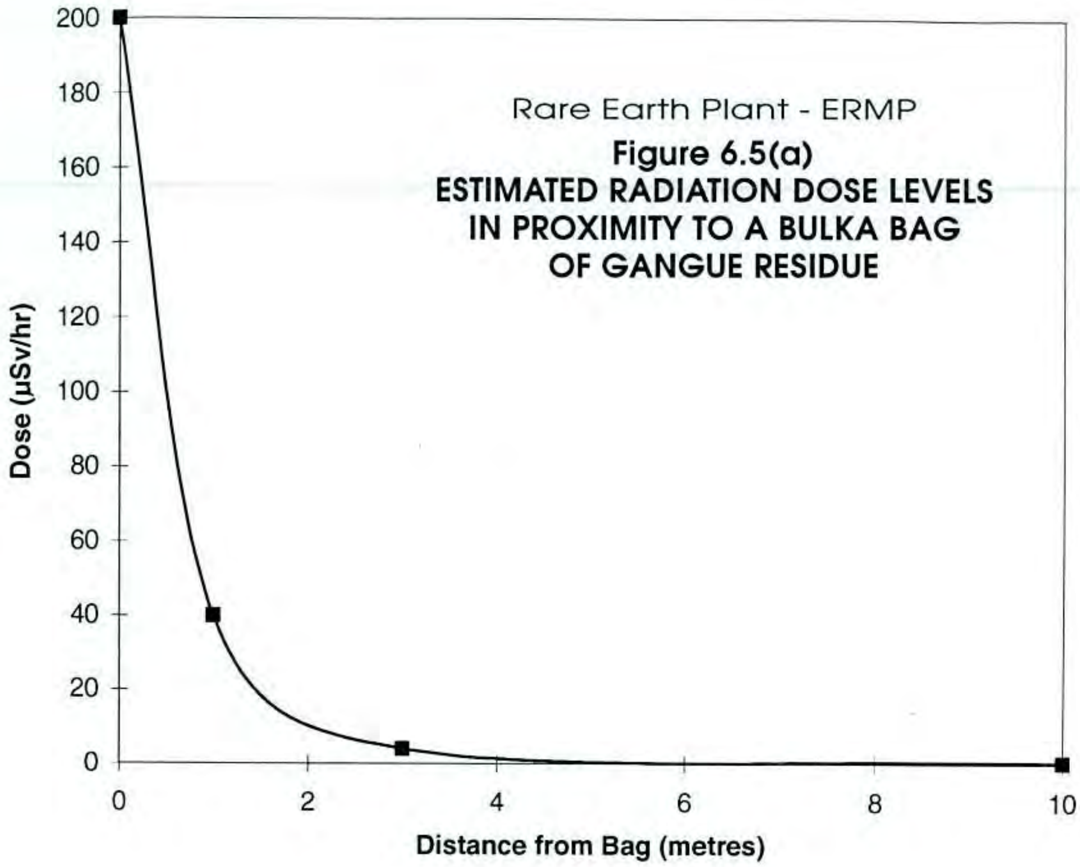
TABLE 6.8

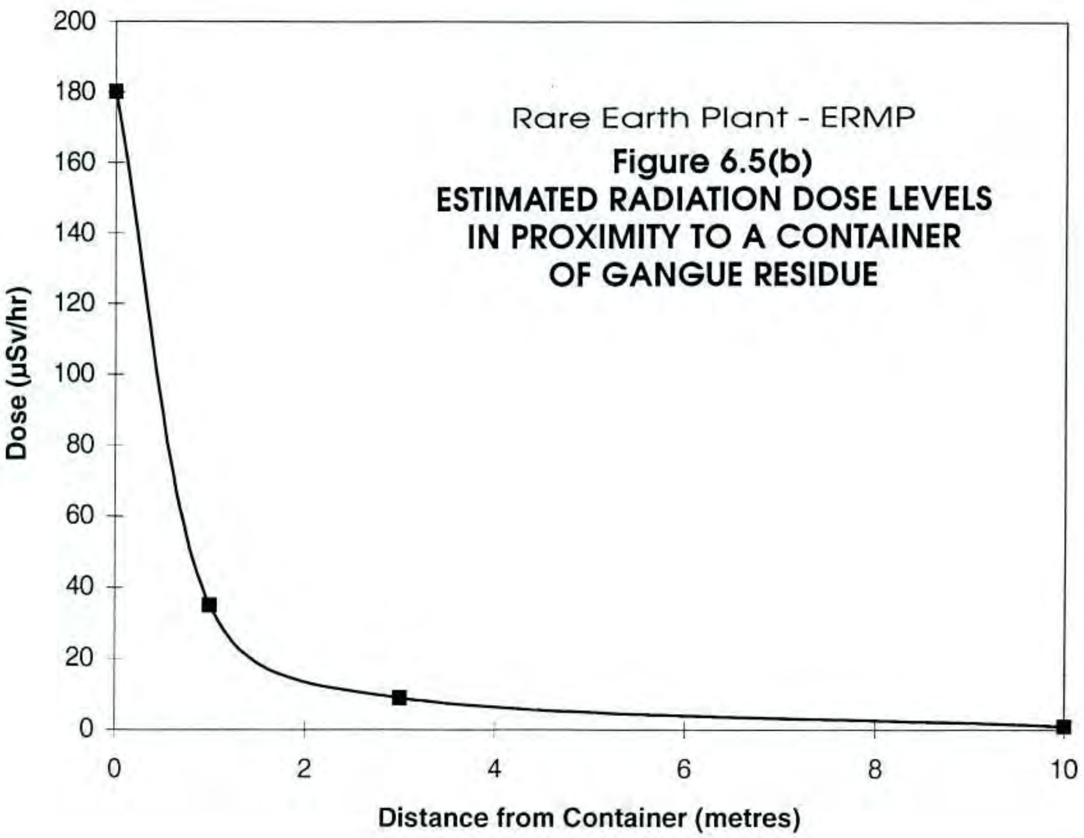
ESTIMATED DOSE RATES FROM A BULKA BAG AND CONTAINER OF GANGUE RESIDUE

Dose Rates in μSv/hr	In Contact	1 Metre	3 Metres	10 Metres	Driver
Single Bulka Bag	200	40	4	0.4	
Transporting Container (20 tonne of waste)	180	20-50	8-10	0.8-1.0	5

Source: Based on measurements of radioactivity of monazite (DOME pers. comm.).

The radiation dose rate relative to distance from the waste follows the inverse square law that by doubling the distance the dose factor is reduced by four. For comparison purposes the dose level of about 4-5 metres from a container of the waste will be approximately 5μSv/hr which is comparable to the level of natural radiation passengers experience in air travel at a normal cruising altitude of 10,000 metres (United Nations Environment Programme, 1985).


Rare Earth Plant - ERMP
Figure 6.5(a)
ESTIMATED RADIATION DOSE LEVELS
IN PROXIMITY TO A BULKA BAG
OF GANGUE RESIDUE
Dose (µSv/hr)
200
180
160
140
120
100
80
60
40
20
0
0
2
4
6
8
10
Distance from Bag (metres)


Rare Earth Plant - ERMP
Figure 6.5(b)
ESTIMATED RADIATION DOSE LEVELS
IN PROXIMITY TO A CONTAINER
OF GANGUE RESIDUE
Dose (µSv/hr)
200
180
160
140
120
100
80
60
40
20
0
0
2
4
6
8
10
Distance from Container (metres)

Based on the anticipated dose rates (Table 6.8) for a single bulka bag of waste it would take up to five hours for a person to be in contact with the bag to reach the public dose limit for exposure or about 2500 hours at a distance of ten metres. For a container transporting 20 tonne of waste a person would be in contact with the container for 5.5 hours to reach the public dose limit or 1000 hours at a distance of 10 metres. It is unlikely that members of the public would remain close to the waste for such periods even in emergency situations. Members of the emergency teams would be able to complete clean-up operations in a period of time so as not to exceed public dose limits.

Occupational Exposure

Exposure of workers handling the bags will be controlled by limiting the time which workers may be exposed and applying distance and shielding to reduce radiation dose rates. The design of operations will aim at limiting radiation exposure from gamma radiation to less than 5mSv/yr. Estimates of exposure will be made available to the DEP, DOME and the Radiological Council when details of final plant design are available.

The limit for exposure of truck drivers is 5mSv/yr (Commonwealth of Australia, 1990). The dose rate in the cab of the vehicle is expected to be 5μSv/hr, therefore (based on levels monitored for monazite transport operations) theoretically allowing 1000 hours of driving per year to reach the exposure limit. The driver will return from the IWDF to the Pinjarra site with an empty truck and as the normal working year is 2000 hours a maximum limit of radiation exposure to the truck drivers would be 5mSv/year. The Proponent will aim to keep driver dose levels below 2mSv/yr. The total time for transport of waste to the IWDF site is around 1,200 hours, therefore, at least two truck drivers each driving 600 hours, will be required. The dose rate in the cab of the vehicle, hence the driver total dose, will depend on the configuration of the trucks used for transport and the distance and shielding between the driver and the container of the waste.

The Proponent plans to include a suitable shield, most likely containing water, between the container and the driver to reduce radiation levels. It is estimated that a shield of about 350mm of sand or water would reduce radiation levels by at least a factor of four and the construction and carriage of such a shield is considered feasible. It will therefore be possible to limit driver doses to levels well below the regulatory limits of 5mSv/yr. The Proponent will establish an operational dose constraint to reduce driver dose limits to 2mSv/yr. Should a driver exceed the 2mSv dose constraint on a pro rata basis, the circumstances relating to that exposure will be investigated and measures taken to ensure that the dose to an individual driver of 2mSv in any one year will not be exceeded.

COMMITMENT 24

An operational dose constraint of 2mSv/yr will be established by the Proponent, in agreement with the Radiological Council, for drivers transporting the gangue residue. Should a driver exceed this dose constraint on a pro rata basis, the circumstances relating to that exposure will be investigated and measures taken to ensure that the dose to an individual driver of 2mSv in any one year will not be exceeded.

Emergency Procedures

As the waste material is radioactive, it is classified as a Dangerous Good and emergency procedures must be in place in the event of an accident. However, the material is not such that persons are likely to be injured by the waste in the short time that would be needed to mobilise an emergency team even at a distant location. Emergency response and clean-up procedures during transport are described in Section 6.2.2.3 and Appendix H.

Public concerns have raised the issue of the potential for the waste to dry and dust and disperse into the surrounding environment and increase the risk of inhalation to the general public and emergency crews. It is unlikely that the waste material will dry and dust after a spill since the material, if allowed to dry, forms a solid and not a powder and will not become airborne unless it is mechanically disturbed. However, should it do so, the hazard due to inhalation will be small. Experience in the mineral sands industry indicates that persons would need to be subjected to relatively long exposures (in the order of many hours) to obtain doses in excess of the acceptable limits. In the open environment it is not feasible that sufficient dust levels could occur which pose a hazard unless the material has been mechanically disturbed. This could only occur during the actual clean-up of a spill during which the emergency response team may be required to wear approved dust masks.

6.4.4.9 Disposal at the IWDF Site

Issue

Radiological issues relevant to the IWDF site will be:

- minimising the health risk to humans from radiation exposure; and
- protecting the environment in both the short and long term from radiation exposure.

Management

The site has been approved for the disposal of low level radioactive waste such as the gangue residue, as long as it conforms with the appropriate codes and regulations. Operations and management relating to the disposal will be detailed in an EMP prepared by the operator of the IWDF. Specifications for the waste and its disposal are presented in Appendix E.

Radiation exposure will be managed in the short term through the development and use of the EMP and RMP prepared by the operator of the IWDF.

Preparation and correct use of the EMP for the disposal operation will maximise protection of the environment. The EMP will stipulate procedures for:

- waste handling and placement;
- surface water collection and disposal;
- contingency;
- emergency and response;
- monitoring; and
- quality assurance.

These procedures will ensure that the environment surrounding the disposal structure will not be contaminated by the waste. In the long term, the environment will be protected by the integrity of the disposal structure.

The RMP will include procedures for:

- personnel training;
- personnel monitoring;
- record maintenance;
- monitoring within the operational area;
- designation of areas of potential radiation exposure;
- emergency preparedness;
- contamination control; and
- protective clothing and apparatus.

6.5 PIPELINE FROM ALCOA'S REFINERY

Caustic soda will be delivered from the nearby Alcoa Pinjarra Refinery via the existing pipeline constructed for the Gallium Plant.

The pipeline is a carbon steel construction. Monitoring will be conducted at each end of the pipeline to measure flow rate, pressure and temperature. An inbuilt alarm system is incorporated in the design to warn the operators if any factors deviate beyond the set parameters. Pipelines will be inspected daily.

Pumps are centrifugal so excessive pressure cannot occur. In the unlikely event of a pipeline rupture the Programmable Logic Controller monitoring will allow the pipeline to be shutdown immediately thereby minimising the loss of caustic soda to the environment.

The alumina industry in Western Australia has been handling caustic soda solutions via pipelines for over 30 years in significantly larger volumes than required for the project without major incident. Experience with the pipeline for the Gallium Plant has indicated no problems with sourcing the caustic via the pipelines.

6.6 STORAGE AND HANDLING OF PROCESS CHEMICALS

Process chemicals will be stored in a dedicated liquid storage area at the plant (Section 3.3,2 and Figure 3.3) in a manner suitable for each chemical.

In the case of accidental spillage, such as from a damaged valve or line on a liquid storage tank, it would be contained within the separate concrete bunded area. After repairs, the liquid chemical would be recovered by a portable or fixed pump and returned to the storage tank.

Process areas will be edged with kerbing so any leakages or losses could be collected into sumps, filtered and returned to the process. Any leakage from pipes into the process areas will be drained into the evaporation pond system. There will be no loss or leakage of process chemicals into the environment.

COMMITMENT 25

Plant and employee safety will be maximised by the Proponent ensuring that storage and handling of hazardous materials such as process chemicals is in accordance with the relevant statutory standards and codes.

6.7 PLANT MAINTENANCE, INSPECTION AND CONTINGENCY PLANNING

6.7.1 General

To achieve high standards of safety and reliability for the plant a comprehensive preventative maintenance and equipment inspection programme will be established. Annual shutdowns will be planned to enable inspection, cleaning and repair of equipment.

In addition, due to the high level of instrumentation at the plant that is connected to a process computer system, valuable data on the performance and conditions of equipment will provide early indication of any deterioration.

6.7.2 Radioactive Scaling of Equipment and Pipes

High pressure water rotative cleaning heads will be installed to clean both the caustic attack reactors and nitric attack/precipitation reactors. There is a potential for scale to build up in the nitric attack/precipitation reactors, so these reactors will be contained in a dedicated room surrounded by 200mm thick concrete wall to ensure adequate protection to workers in the building in between the cleaning operations. Piping in the area will be designed to ensure minimum scaling by appropriate fluid velocities and ease of access for cleaning.

6.7.3 Contingency Planning

In order to ensure safe and reliable plant operations the Proponent has incorporated the following contingency plans:

- Prior to commissioning, all equipment will be test run and, where appropriate, leak tested with circulating water. Construction defects will be detected and corrected.
- Operators will undertake a comprehensive training scheme. Experienced personnel from one of the Proponent's other Rare Earth Plants will assist with and supervise commissioning of the plant.
- Appropriate safety equipment will be positioned so as to reduce the incidence of accidents.
- Equipment design will incorporate safety features so that in the case of an emergency situation the impacts will be minimised or avoided, wet processing areas will be bunded to contain spillages and safety showers will be located in corrosive chemical areas.
- Process instrumentation will be designed for "fail safe" in cases where process conditions deviate from objectives or a malfunction of the instruments occur.
- A Hazop safety review will be undertaken and the findings implemented for design, construction and operating phases.

- Operations in those areas where radioactive materials are handled and hot caustic soda and nitric acid are utilised will be designed to minimise operator time in those areas.

- None of the chemicals to be stored at the Rare Earth Plant are combustible. The only potential fire hazard may be due to materials of construction such as electrical installation, conveyor belts etc. Fire hoses, extinguishers and other fire fighting equipment will be readily available on-site. This equipment together with operator training will be sufficient to cater for these types of fires.

- The existing infrastructure includes a fire water storage tank dual fire water pumps (one of which is diesel driven) and an extensive fire water ring main.

- Most of the process vessels do not operate under pressure, therefore any loss of contents due to a spill will be localised and contained within bunded areas.

- Plant emergency response plans will be prepared and all plant personnel will be trained to combat any type of emergency situation.

- A rigorous work permit system will be implemented for maintenance and non-routine plant operations. The permits will be authorised by a responsible supervisor and will provide contractors and maintenance personnel with specific safety constraints and procedures to follow.

6.8 VEGETATION AND FLORA

It is unlikely that any of the native mammal or other native vertebrate and invertebrate animals living in the project area are rare, restricted or endangered. No vegetation will need to be cleared for the Rare Earth Plant as the proposed site (1ha) is within the existing site boundary of the Gallium Plant. There is virtually no remnant vegetation on the proposed site of the additional evaporation pond. Therefore, impacts on native vegetation surrounding the plant site will be minimal.

6.9 FAUNA

It is possible that the evaporation ponds and storm lakes may attract water-fowl and wading birds. However, the evaporation ponds have been established since 1989 and no significant incidents are known to have occurred. Even if the birds do land on the ponds, the effluent is neutralised and not toxic and will therefore pose no threat to them.

6.10 RESERVES

As the nearest reserves and State Forest blocks are more than one kilometre from the plant site, there will be no impact from the project on reserves.

6.11 NOISE

6.11.1 Construction

Issue

The construction phase of the project will result in impacts similar to, but generally less than those evident during construction of the Gallium Plant. No difficulties with construction noise were noted during construction of the Gallium Plant. Noise from construction activities will occur during daylight hours and be relatively shortlived. The nearest residence in the vicinity is 800m from the plant site (Figure 5.4), therefore noise from construction should not exceed acceptable levels.

Management

COMMITMENT 26

Construction activities at the plant site will be undertaken in accordance with the statutory requirements and appropriate management techniques will be implemented to ensure that noise levels are within acceptable limits.

6.11.2 Operation

Issue

Experience with other processing plants operated by the Proponent indicates that plant operations will be relatively quiet. One nearby resident complained of intermittent noise intrusion during the operation of the Gallium Plant, however, the noise source relating to this complaint was not established and could have been attributed to the nearby refinery. The main noise source from the plants will be from electrical motors, however, these motors are relatively small and most will be enclosed within buildings.

The combined noise levels from both the Gallium and Rare Earth Plants operating simultaneously will be required to meet the requirements of the Draft Environmental Protection (Noise) Regulations 1995 of 35dB(A) at the closest residence between 2200hrs and 0700hrs. Due to the large buffer area surrounding the plant (Figure 5.4), it is unlikely there will be any noise impact from the plant.

Where possible truck movements will be restricted to business hours and noise levels from operations traffic will conform to the same regulations as those for plant operations.

Monitoring

Prior to the commencement of construction, the Proponent will undertake a noise monitoring programme in the vicinity of the site. The programme will commence during the ERMP public review period and will be designed to monitor the existing background noise levels at the site boundary and nearby residences over a period of several weeks.

Following the commencement of operations further monitoring programmes will be undertaken periodically to record the noise levels experienced at the site boundary and the nearby residences.

Management

If recorded noise levels, due to the operation of the plant, indicate that noise may be impacting on nearby residences or in the event that substantiated noise complaints relating to the operation of the Proponent's plant are received, then the Proponent will instigate a specific monitoring programme to:

- monitor the noise levels at the location at which the impact was observed; and
- identify the source of the complaint and take remedial action to reduce the level of impact if the noise source is due to the Proponent's operations.

The Proponent believes that the monitoring programme will provide an effective mechanism to identify and rectify any noise issues related to its operations.

COMMITMENT 27

A noise monitoring survey will be conducted by the Proponent prior to and during plant operations. Appropriate actions will be taken by the Proponent to rectify any noise problems should levels exceed those in the noise regulations and to reduce noise levels to meet those specified in the DEP regulations.

6.12 BUFFER AREA

The plant site incorporates a substantial buffer area with the total development of both the Gallium and Rare Earth Plants including evaporation ponds impinging on less than 25ha within a total landholding of 515ha. Approximately 170ha of the buffer area is subject to a Hardwood Growing Agreement with the Department of Conservation and Land Management with a further 20ha of screening vegetation bordering the site (Figure 5.4).

The proposed Rare Earth Plant location is approximately 500m from the closest boundary and a further 300m from the boundary to the nearest residence. This buffer distance should be adequate for noise attenuation and to reduce potential air emissions from the plant to negligible levels at the boundary.

6.13 VISUAL

Issue

The Rare Earth Plant buildings have the potential to impact on visual amenity. However, due to the relatively small-scale of the plant, it will be no more obtrusive on the landscape than the Gallium Plant or other nearby industrial facilities.

Management

The plant will be screened from occupied residences by existing trees, although the higher structures may be visible from some locations. The hardwood plantation and screening vegetation existing on the Proponent's property will both assist in reducing the visual impact of the plant.

6.14 ECONOMIC

The Rare Earth project is expected to have some regional benefits on the social environment by providing employment opportunities and the economic advantages of a new industry.

The project will provide up to 150 jobs in the 12 month construction phase and it is expected that these will largely be filled by residents of local communities. There is a high percentage of unemployment in the area compared with the state average, (Section 5.4.3) mainly attributable to high levels in Mandurah.

There is not expected to be a high demand for short term housing, hence there will be little impact on temporary and rental accommodation.

The operations phase will directly provide in the order of 50 permanent jobs, not including those contractors associated with the waste disposal operations. Some professional and technology skills may be provided by non-local people with local communities providing the majority of the other manpower requirements. The Proponent's preference is to employ local people wherever possible.

Existing community infrastructure in terms of health, education and retail facilities have adequate capacity to cope with any immigrants and their families resulting from the project. Therefore, there are not expected to be any adverse impacts on community infrastructure due to the construction or operation of the Plant.

6.15 HISTORICAL, ETHNOGRAPHICAL AND ARCHAEOLOGICAL SITES

No sites in or near the process plant site are listed on the National Estate, and the project will have no impact on historical sites.

There is one Aboriginal site located on the Proponent's property which was identified as a recent and relatively short term camping site located in an area in which no further development is planned (Dames & Moore, 1988a). As no site disturbance is likely to take place there will be no impact.

No archaeological sites have been recorded either previously or as a result of the archaeological survey of the plant site commissioned by the Proponent in 1987 (Dames & Moore, 1988a). Consequently, there will be no archaeological impacts resulting from the development.

6.16 GENERAL MANAGEMENT

In accordance with the Proponent's overall commitment to the development of an environmentally sound project, the following general commitments are made. A complete list of the Proponent's commitments is included in Section 9.0.

Rhône-Poulenc is committed to achieving certification for ISO 9002 for both the Rare Earth and Gallium Plants. The Proponent's Rare Earth Plants at La Rochelle France and chemical plants in Australia are already certified at ISO 9001 or ISO 9002.

COMMITMENT 28

The Proponent is committed to achieve certification for ISO 9002 for both the Rare Earth and Gallium Plants and will operate a quality assured system.

COMMITMENT 29

The Proponent endorses the concept of a Community Liaison Committee which will encourage the active involvement of local residents and Shire of Murray officials in the monitoring process at the Pinjarra plant site.

COMMITMENT 30

The Proponent will liaise with the Mt Walton Community Liaison Committee, local Shires and interest groups on the transport, disposal, safety and environmental issues relating to the low level radioactive gangue residue.

COMMITMENT 31

The Proponent will ensure that the best practicable technology is applied throughout the life of the project where best practicable technology is defined in Clause 1(3) of the Radioactive Waste Management (Mining and Milling) Code (1982) as:

> *"that technology, from time to time relevant to a specific project, which enables radioactive wastes to be managed so as to minimise radiological risks and detriment to people and the environment, having regard to:*
>
> *(a)* *the achievable levels of effluent control and the extent to which pollution and degradation of the environment is minimised or prevented in comparable mining and milling operations elsewhere;*
>
> *(b)* *the cost of the application or adoption of that technology relative to the degree of radiological and environmental protection expected to be achieved by its application or adoption;*
>
> *(c)* *evidence of detriment or lack of detriment to the environment after the commencement of mining or milling operations;*
>
> *(d)* *the location of the mine or mill;*
>
> *(e)* *the age of the equipment and facilities in use for mining and milling purposes and their relative effectiveness in achieving radiological and environmental protection; and*
>
> *(f)* *the potential hazards from the wastes over the long term".*

COMMITMENT 32

In addition to complying with the requirements of the Radiation Protection (Mining and Milling) Code (1987), the Radioactive Waste Management (Mining and Milling) Code (1982) and the Code for Disposal (NHMRC, 1992) the Proponent will meet any future changes in these (and other relevant) standards throughout the life of the project.

Specific initiatives will include:

- the maintenance of a manifest of all chemicals stored on-site;
- the location of all tanks containing hazardous materials in side-bunded areas that will retain the contents of the largest vessel in the area;
- technical data on all chemicals to be used in the process will be obtained before chemicals are brought onto the site, these data will be summarised in hazardous materials data sheets, which will be distributed throughout the plant;
- all employees will be informed of the properties of all chemicals handled in the plant, using data sheets as reference material;
- handling procedures will comply with the recommendations of the manufacturers, and recognised safe handling practices for the chemicals involved;
- employees will be trained in these specific procedures for handling chemicals;
- the plant will be designed to enclose reagents and to minimise personal handling of chemicals;
- operating manuals will be prepared, which will provide written details of the procedures for operating the plant and handling all chemicals;
- protective equipment will be made available and supplied as necessary to supplement the protective measures described above; and
- handling and operating procedures will be subject to regular audit by professionally trained safety and occupational health personnel.

COMMITMENT 33

The Proponent will prepare reports for the DEP on the environmental management of the project at a frequency to be determined by the DEP.

7.0 DECOMMISSIONING AND REHABILITATION

7.1 OBJECTIVES

A decommissioning and rehabilitation programme will be undertaken for the Pinjarra site at the end of the plant's life. The objectives of the programme will be to:

- eliminate unacceptable health hazards;
- restore the site to a condition such that it may be returned to its former land use or such other use as may be appropriate at the time of decommissioning; and
- ensure that the State does not incur any ongoing liability with regard to the plant.

7.2 STRATEGY FOR DECOMMISSIONING

The strategy for decommissioning will include:

- **Site Clean-up**
  The site will be cleaned up to improve its visual appearance by removing any debris, machinery and structures. Depending upon the nature and contamination potential of these materials, they may be deposited in the local Shire rubbish tip, buried on site or if necessary transported to the IWDF.

- **Decommissioning of Machinery and Building**
  Where possible, process and other machinery will be recycled or dismantled and sold as scrap. Where equipment from controlled areas cannot be economically decontaminated, it may be disposed of at the IWDF subject to Government approval. The total quantity of such wastes is estimated to be much less than 1,000 tonnes. The end use of buildings, hard standings, etc., will be determined at the time of decommissioning.

- **Decommissioning of the Evaporation Pond System**
  Decommissioning is a necessary precursor to rehabilitation, and decommissioning activities are likely to include:

  - removal of excess water from the ponds by evaporation;
  - solar drying of the wastes in the ponds to the maximum degree possible; and
  - the construction of a low permeability earth cover structure over the contained salts.

When addressing this issue in detail, the Proponent will be guided by the appropriate statutory requirements in force at the time of decommissioning.

7.3 STRATEGY FOR REHABILITATION

The strategy for rehabilitation will necessarily include considerations of:

- geomorphology and long term potential failure mechanisms;
- the use of best practicable technology;
- a design life of at least 200 years for rehabilitated structures;
- a structural life of at least 1000 years;
- hydrological design criteria;
- engineering principles for shaping and grading of rehabilitated structures; and
- revegetation.

The Proponent will rehabilitate with the intention that future land uses at the plant site will only be constrained by the need to avoid deep excavation of the rehabilitated evaporation pond system.

At this stage, it is considered likely that the rehabilitated site, including the evaporation pond system, will be revegetated and returned to pasture.

COMMITMENT 34

Decommissioning by the Proponent will be undertaken in accordance with statutory requirements in force at the time and in a manner acceptable to the Minister for the Environment.

7.4 EVAPORATION PONDS

The predominant residual wastes remaining in the ponds will be sodium salts, since the phosphate solids will have been recovered and sold to the fertiliser industry.

It is anticipated that the underdrainage system to the ponds will become inoperative after the Rare Earth Plant ceases operation therefore, other means of long term management of the wastes contained in the ponds must be considered.

The operational concept to be applied to the pond system is to minimise the amount of free water in the ponds whilst at the same time ensuring that waste remains sufficiently wet to ensure that dusting does not become a problem. This objective will be achieved by depositing fine-grained (and hence low permeability) materials into the ponds towards the end of the project in order to reduce the amount of free water. This procedure will also reduce the potential for leakage from the ponds as well as assist in the management of the closure and rehabilitation of the ponds.

The evaporation ponds will need to be covered with low permeability material to minimise infiltration of rainwater to ensure that the solids remain in an unsaturated state and to reduce the leaching potential of the solid wastes contained within the ponds. The cover material will also be required to enable the ponds to be rehabilitated and returned to a condition capable of sustaining an appropriate land use (such as pasture).

A combination of cover materials usually provides a better protection than one material alone, and a number of zones and layers of natural soils will be used to form a complete impoundment cover. It is likely that the zones of the cover structure will consist of layers of clays, topsoil and vegetation.

Management of the closure and rehabilitation of the evaporation ponds will require that the remaining free water be evaporated and cover materials placed over the ponds and contoured to promote runoff. The nature, thickness and configuration of the cover will necessarily depend upon matters such as the stability of the materials in the pond at the time of closure. It would, therefore, be necessary to undertake an investigation of the pond at that time in order to develop an adequate design for the cover.

COMMITMENT 35

Upon decommissioning, the Proponent will ensure all free water is evaporated from the ponds prior to placing materials over the ponds. The ponds will be developed and designed to the satisfaction of the Minister for the Environment.

7.5 POST-OPERATIONAL MONITORING AT THE PLANT SITE

Post-operational monitoring will be designed to identify if radioactive materials have accumulated in any areas within the plant and to ensure that all radioactive materials associated with the plant's operations are removed from the site.

The post-operational monitoring will comprise a plant site survey as well as environmental surveys. The extent of the post-operational monitoring will be designed during decommissioning procedures for the plant and to comply with the environmental requirements in force at the time. Post-operational monitoring will be part of the required decommissioning plan which must be developed as part of the Radiation Management Plan for the plant, these will be reviewed regularly to ensure that they meet the existing requirements of DOME and/or the regulatory authority at the time.

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8.0 CONCLUSION AND LIST OF COMMITMENTS

The Rare Earth Plant proposed to be constructed at a site alongside the Proponent's Gallium Plant near Pinjarra represents a world-scale development in the processing of monazite. This material is currently a by-product of the Western Australian mineral sands industry and, as such, has no commercial value and currently incurs a cost for its disposal. The processing of monazite to produce rare earth nitrate will result in benefits to both the State of Western Australia and to the nation as a whole.

The previous proposal for the Proponent's Rare Earth Plant was assessed by the Western Australian EPA in 1988. The EPA concluded that Stage I of the proposal (to produce rare earth hydroxide product) was environmentally acceptable. However, the EPA concluded that Stage II of the proposal (to separate the rare earths from the rare earth nitrate) was environmentally unacceptable due to the long term disposal of ammonium nitrate.

Rhône-Poulenc has altered the scope of the project and introduced some technological innovations to eliminate ammonium nitrate from the waste stream and to now include the radium stream with the solid waste for disposal at the IWDF.

The major potential environmental impacts associated with the project relate to the generation of waste products, in particular the low level radioactive waste stream referred to as gangue residue. It is pertinent to note that there is no additional generation of radioactive material as the waste contains only the original radioactive component of the monazite.

The gangue residue will be transported from the Pinjarra site to the IWDF by B-double trucks at a rate of approximately three per week. The route will follow the major highways and roads recommended by DOME and Main Roads for the transport of Dangerous Goods. The gangue residue is of relatively low hazard in comparison with other Dangerous Goods such as petrol and LPG. The potential risk of exceeding radiation exposure limits from the waste can only occur if a member of the public is in contact with the waste for an extended period of time which will not be in the case in either normal circumstances or emergency situations. In the unlikely event of an accidental spill, the material is in a moist form and is immobile and insoluble so it can be easily retrieved and repackaged. Emergency Response Plans will be established for emergency and clean-up procedures.

The low level radioactive waste will be disposed of at the IWDF in accordance with the appropriate codes and regulations for disposal of radioactive waste. This facility has been located, designed and approved by the EPA for the disposal of such wastes (EPA, 1988b, 1991a). The disposal of low level radioactive waste by burial at the IWDF has been previously found to be environmentally acceptable by the EPA (EPA, 1988a, 1988b) and granted Ministerial approval subject to the preparation of an EMP approved by the EPA. Disposal methods will be governed by those presented in the EMP prepared by the operator of the IWDF.

Tricalcium phosphate, produced as a by-product, will be sold to the fertiliser industry as feedstock. It will therefore not require permanent disposal in the on-site evaporation ponds.

The liquid process wastes generated by the Rare Earth Plant will be disposed of into the evaporation pond system located adjacent to the Gallium Plant on the Proponent's Pinjarra property. The satisfactory operation of similar ponds at the nearby Pinjarra alumina refinery for a period of more than 20 years attests to the general suitability of the area for this method of disposal. The evaporation ponds constructed for the Gallium Plant have been constantly monitored using an extensive network of permanent groundwater monitoring bores (33 in all), both during the active life of the plant and since the care and maintenance programme commenced. Monitoring has shown no adverse impacts from the ponds on the environment.

The Proponent has proposed the following management commitments to ensure the development of an environmentally sound project. These are:

1. During all phases of the project, the Proponent will comply with all applicable standards and regulations pertaining to and appropriate for a chemical and mineral processing plant and for waste disposal.

2. The Proponent will transport the low level radioactive gangue residue in compliance with the Code of Practice for the Safe Transport of Radioactive Substances (1990) and will develop an Emergency Response Plan to deal with an accident.

3. The Proponent will ensure that drivers attend approved Driver Training Courses including specific training for the transport of radioactive materials prior to any transport of waste materials. Refresher courses will be conducted at least yearly. This will be a condition of contract with the transport operators. The companies transporting radioactive material shall, under the Radiation Safety Act, hold an appropriate licence.

4. During the ERMP public review period, the Proponent will prepare an emergency response plan for the transport of the low level radioactive gangue residue, outlining the emergency and clean-up procedures in the event of an accident, for review by the DEP, DOME and the Radiological Council.

5. Emergency Management Teams and Field Response Teams will be trained in emergency response and clean-up procedures, prior to the transportation of waste and with refresher courses conducted yearly. Training will be funded and co-ordinated by the Proponent.

6. A shipment manifest will be prepared prior to disposal operations in accordance with Code for Transport (Commonwealth, 1990) by the Proponent detailing the following information:

   - waste specification;
   - transport identification;
   - waste description;
   - approval certificate; and
   - declaration.

   The manifest will accompany each truck load of gangue residue.

7. If the waste delivered to the IWDF is found to not meet the required specifications it will be returned to the plant for reprocessing. The Proponent will investigate and identify the reason for non-compliance and modify procedures to minimise the risk of repeating such non-compliance to the satisfaction of the Minister for the Environment.

8. The Proponent will dispose of all process and non-process wastes in an environmentally acceptable manner and in accordance with licensing and other requirements from the DEP, DOME, Water Authority and the Radiological Council throughout the life of the project.

9. Any additional ponds required for the project will be constructed by the Proponent according to the design standard approved by the DEP and Water Authority.

10. The existing evaporation pond and groundwater monitoring systems have been approved by the DEP and Water Authority. The monitoring bores have been and will continue to be monitored by the Proponent for both groundwater level and groundwater quality on a routine basis. The evaporation ponds and underdrainage sumps will also be monitored for level and quality. The results of the monitoring will be made available to the DEP at a frequency to be determined. If results indicate that leakage from the ponds is entering the groundwater under the site the DEP will be notified immediately.

11. The Proponent will implement contingency plans should there be any leakage from the ponds throughout the life of the project and remediation procedures will be undertaken to the satisfaction of the Minister for the Environment.

12. The Proponent will fund, in agreement with the State Government, the following aspects of waste disposal operations:

    - disposal costs;
    - backfilling and rehabilitation of the trench area;
    - monitoring of the disposal operations of Rhône-Poulenc's waste;
    - contribute to long term monitoring at the IWDF site;
    - contribute, together with other users of the road, to the maintenance of the IWDF access road;
    - a provision for maintenance and any costs of remedial work necessary in the first five years after a disposal operation.

13. Waste disposal operations including transport will be subject to an annual audit in accordance with the Code of Practice for the Near-Surface Disposal of Radioactive Waste (NHMRC, 1992). The auditor will be selected by the Government to the satisfaction of the Radiological Council.

14. The Proponent will comply with the requirements of the applicable legislation and codes of practice relating to radiation protection.

15. Details on final plant design will be made available to DOME on completion of design.

16. The Proponent is committed to the ALARA principle (that radiation dose be kept as low as reasonably achievable, economic and social factors being taken into account) in accordance with DOME and the Radiological Council regulations.

17. A comprehensive Radiation Management Plan (RMP) will be prepared by the Proponent for the Rare Earth Plant and its environment and submitted for approval from DOME and the Radiological Council prior to commencement of operations.

18. The Proponent will implement the following strategies for the radiation protection of plant personnel:

    - Controlled areas will be established to include the monazite handling and storage facilities, filtering stages, purification area and residue handling/transport/disposal facilities and areas.
    - Handling of potential dust generators (monazite and residue) will be minimised to reduce air contamination; in particular, wet milling of monazite and disposal of residue in moist form will be undertaken.
    - Adequate ventilation will ensure that radon and thoron daughter levels are maintained within acceptable levels.
    - Supervised areas and appropriate procedures will be established to limit access by members of the public to the plant site.
    - Where necessary, equipment containing bulk quantities of radioactive material will be shielded to reduce exposure rates.
    - Equipment in controlled areas will be selected and designed for reliable operation and ease of maintenance.
    - Floor surfaces in controlled areas will be non-absorbent and designed for reliable operation and ease of maintenance.
    - Facilities will be provided for easy washing of floors and equipment. All washings will be returned to the process via floor sumps or the purpose designed wastewater treatment plant.
    - Designated staff will be trained in radiation protection practices.
    - Protective equipment and clothing will be issued to workers, where required. Such workers will be fully trained in the use of this equipment.
    - Special clothing worn by plant operators will be laundered on-site with changerooms specially designed to allow work clothing to remain on-site.

19. Prior to commissioning of the plant, a comprehensive survey of the existing radiation environment at the Pinjarra site will be conducted by the Proponent as required by DOME and the Radiological Council.

20. The Proponent will implement a comprehensive monitoring and health surveillance programme for Rare Earth Plant personnel according to the requirements of DOME and the Radiological Council.

21. The Proponent will establish an operational dose constraint for plant personnel of 10mSv/yr to be agreed upon with DOME and the Radiological Council. Should any other worker exceed this dose constraint, on a pro rata basis, the circumstances relating to that exposure will be investigated and measures taken to ensure that the dose to an individual of 10mSv in any one year will not be exceeded.

22. Monitoring of radiation levels by the Proponent will continue over the life of the project. Reporting of radiation monitoring data and record keeping will be undertaken by the Proponent in accordance with the applicable legislation of DOME and the Radiological Council.

23. Radiation protection assessments given in the ERMP will be verified by the Proponent during plant commissioning, to the satisfaction of the DEP and DOME.

24. An operational dose constraint of 2mSv/yr will be established by the Proponent, in agreement with the Radiological Council for drivers transporting the gangue residue. Should a driver exceed this dose constraint on a pro rata basis, the circumstances relating to that exposure will be investigated and measures taken to ensure that the dose to an individual driver of 2mSv in any one year will not be exceeded.

25. Plant and employee safety will be maximised by the Proponent ensuring that the storage and handling of hazardous materials such as process chemicals is in accordance with the relevant statutory standards and codes.

26. Construction activities at the plant site will be undertaken in accordance with the statutory requirements and appropriate management techniques will be implemented to ensure that noise levels are within acceptable limits.

27. A noise monitoring survey will be conducted by the Proponent prior to and during plant operations. Appropriate actions will be taken by the Proponent to rectify any noise problems should levels exceed those in noise regulations and to reduce noise levels to meet those specified in the DEP regulations.

28. The Proponent is committed to achieving certification of ISO 9002 for both the Rare Earth and Gallium Plants and will operate a quality assured system.

29. The Proponent endorses the concept of a Community Liaison Committee which will encourage the active involvement of local residents and Shire of Murray officials in the monitoring process at the Pinjarra plant site.

30. The Proponent will liaise with the Mt Walton Community Liaison Committee, local Shires and interest groups on the transport, disposal, safety and environmental issues relating to the low level radioactive gangue residue.

31. The Proponent will ensure that the best practicable technology is applied throughout the life of the project where best practicable technology is defined in Clause 1(3) of the Radioactive Waste Management (Mining and Milling) Code (1982) as:

> *"that technology, from time to time relevant to a specific project, which enables radioactive wastes to be managed so as to minimise radiological risks and detriment to people and the environment, having regard to:*
>
> *(a) the achievable levels of effluent control and the extent to which pollution and degradation of the environment is minimised or prevented in comparable mining and milling operations elsewhere;*
> *(b) the cost of the application or adoption of that technology relative to the degree of radiological and environmental protection expected to be achieved by its application or adoption;*
> *(c) evidence of detriment or lack of detriment to the environment after the commencement of mining or milling operations;*
> *(d) the location of the mine or mill;*

(e) *the age of the equipment and facilities in use for mining and milling purposes and their relative effectiveness in achieving radiological and environmental protection; and*

(f) *the potential hazards from the wastes over the long term".*

32. In addition to complying with the requirements of the Radiation Protection (Mining and Milling) Code (1987), the Radioactive Waste Management (Mining and Milling) Code (1982) and the Code for Disposal (NHMRC, 1992) the Proponent will meet any future changes in these (and other relevant) standards throughout the life of the project.

33. The Proponent will prepare reports for the DEP on the environmental management of the project at a frequency to be determined by the DEP.

34. Decommissioning by the Proponent will be undertaken in accordance with statutory requirements in force at the time and in a manner acceptable to the Minister for the Environment.

35. Upon decommissioning, the Proponent will ensure all free water is evaporated from the ponds prior to placing materials over the ponds. The cover material will be developed and designed to the satisfaction of the Minister for the Environment.

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10.0 STUDY TEAM

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Max Webb	Operations Manager
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11.0 AUTHORITIES CONSULTED

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Australian Geological Survey Organisation
Bureau of Meteorology
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Department of Conservation and Land Management
Department of Environmental Protection
Department of Employment, Education and Training
Department of Environment, Sport and Territories (Commonwealth)
Department of Minerals and Energy
Department of Resources Development
Environment Protection Agency (Commonwealth)
Environmental Protection Authority
Health Department of Western Australia
Heritage Council of Western Australia
Main Roads Western Australia
Ministry of Planning
Radiological Council
Shire of Coolgardie
Shire of Murray
Shire of Yilgarn
Water Authority of Western Australia
Westrail
Waterways Commission

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ABBREVIATIONS

ABS	Australian Bureau of Statistics
ALARA	The ALARA principle is that radiation doses be, social and economic factors being taken into account, as low as reasonably achievable
AHD	Australian Height Datum
ARI	average recurrence interval
Bq	becquerel
CEPA	Commonwealth Environment Protection Agency
DASETT	Commonwealth Department of the Arts, Sport, The Environment, Tourism and Territories
DCE	Department of Conservation and Environment (now DEP)
DEP	Department of Environmental Protection
DRD	Department of Resources Development
EMP	Environmental Management Programme
EPA	Environmental Protection Authority (now DEP)
ERMP	Environmental Review and Management Programme
ERMP/EIS	Environmental Review and Management Programme/Environmental Impact Statement
g	gram
Gy	Gray
ha	hectare
HLV	half value layer
HNO_3	Nitric Acid
H_2O	water
ISO	International Standards Organisation
IWDF	Integrated/Intractable Waste Disposal Facility
hr	hour
kg	kilogram

km	kilometre
kPa	kilopascal
kV	kilovolt
L	litre
m	metre
MJ	megajoule
mm	millimetre
mg	milligram
mGy	milligray
mSv	millisievert
m^3	cubic metres
N	nitrogen
Na_3PO_4	trisodium phosphate
NOI	Notice of Intent
PER	Public Environmental Report
PMP	probable maximum precipitation
ppm	part per million
Ra	radium
RE	rare earths
RES	rare earth salts
$RE(NO_3)_3$	rare earth nitrate
$REOH/RE(OH)_3$	rare earth hydroxide
RMP	Radiation Management Plan
RPCA	Rhône-Poulenc Chimie Australia
s	second
Sv	sievert

Th	thorium
$Th(OH)_4$	thorium hydroxide
tpa	tonnes per annum
U	uranium
µg	microgram
µGy	microgray
µSv	microsievert
°C	degree Celsius

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GLOSSARY

Activity	The number of disintegrations per unit time taking place in a radioactive material.
Alpha-emitter	A radioisotope which emits an alpha particle when it decays.
Alpha particle	A positively charged particle containing two protons and two neutrons which is emitted by certain radioactive material. It is identical with the nucleus of a helium atom and the least penetrating of the three forms of radiation (alpha, beta and gamma) in that it may be stopped by a sheet of paper.
Aquifer	A permeable rock formation which stores and transmits sufficient groundwater to yield quantities to wells, bores or springs.
Archaean	Referring to rocks older than 2,600 million years.
Bayer liquor	Effluent resulting from the Bayer process for refining alumina. Contains a high proportion of caustic soda with other dissolved compounds. It is a primary input to the Gallium plant.
B-double	A prime mover pulling two trailers.
Becquerel (Bq)	The unit of measurement of radioactive decay defined as one radioactive disintegration per second. The disintegration may occur as a result of emission of an alpha particle or beta particle.
Beta-emitter	A radioisotope which emits a beta particle when it decays.
Beta particle	An elementary particle emitted from a nucleus during radioactive decay. It may carry a negative or a positive charge, but in common usage, it is a negatively charged particle identical to an eletron. Beta particles may be easily stopped by a thin sheet of metal.
Colluvium	Weathered materials transported by gravity.
Controlled areas	An area to which access is subject to control in order to limit the radiation exposure of employees.
Daughter products	Radionuclides which are formed as a result of radioactive decay of a specified radionuclide.
Decay product	The product of the spontaneous radioactive decay of a nuclide. A substance such ^{238}U decays through a sequence of steps and has associated with it many successive decay products in a decay series.

Designated worker	An employee who works under conditions such that his annual employee dose equivalent might exceed 5mSv. Other employees are non-designated employees.
Dose	The radiation energy absorbed in a unit mass of material. The general term used to describe exposure to radiation.
Dose-equivalent	The mathematical product of the absorbed dose, the quality factor, and any other specified modified factors. The quality factor accounts for the effectiveness of energy transfer of the ionising radiation in producing in biological detriment. Modifying factors are those which may act to modify the effect of the energy imparted the matter.
Effluent	Liquid industrial waste.
Ethnography	Scientific description of the races of man.
Evaporation	Transfer of water from liquid to vapour from soil, vegetation and waterbodies.
Fault	A fracture in rock along which there has been an observable amount of movement.
Feedstock	Basic process raw material.
Gamma radiation	A form of electromagnetic radiation similar to light or X-rays, distinguished by its emission from the nucleus of an atom.
Gangue	The part of the ore that is not the objective in working the ore deposit.
Gray	The special name for the unit of absorbed dose. It is the quantity of energy imported by ionising radiation to a unit mass of matter such as tissue. One gray corresponds to one joule per kilogram.
Groundwater	Underground water contained within a saturated zone or rock (aquifer).
Half-life	The period it takes half of any amount of an element to decay. Half-lives vary between nuclides, some decay in a fraction of a second and others take billions of years.
Hydrogeology	The science dealing with groundwater and its relationship with geology.
Ionising radiation	Radiation which interacts with matter to remove electrons from (i.e. to ionise) the atoms of the material absorbing it, producing electrically charged atoms called ions.
Isotope	One of two or more forms of an atomic element having the same number of protons but a different number of neutrons. All isotopes of the same element have the same chemical properties, and therefore cannot be separated by chemical means.

Laterite	Iron-rich material which hardens on exposure to the atmosphere and is associated with deeply weathered profiles.
Mischmetal	A natural mixture of the rare earth metals cerium, lanthanum, neodymium and praseodymium.
Monazite	A mineral containing phosphate of rare earth metals. Chief source of rare earth elements.
Phanerozoic	The period of time from the beginning of the Cambrian period to the present day.
Piezometer	A small diameter cased bore used for groundwater level measurements and groundwater sampling.
Quaternary	Refers sampling to geological time since the end of the Pliocene i.e. to Pleistocene and Holocene time.
Radiation	Energy flux associated with electromagnetic (X-rays, Gamma rays) or particle (alpha, beta and neutron) emissions.
Radioactive	Spontaneously emitting radiation by nuclear transformation.
Radionuclide	A nuclide of an atom that is radioactive.
Radon	The radioactive decay product of radium. It occurs as an inert gas. The predominant isotope, ^{222}Rn, has a half-life of 3.8 days.
Radon daughters	A term applied to the four short-lived decay products of radon gas: ^{218}Po, ^{214}Pb, ^{214}Bi and ^{214}Po.
Rare earth elements	A group of metals with atomic numbers from lanthanum (atomic number 57) to lutetium (71). Yttrium (39), and scandium (219),), while not strictly rare earths, are generally grouped with them. Rare earth elements are not especially uncommon. They have very similar chemical and physical properties making separation of individual elements difficult.
Secular equilibrium	A condition which occurs when the activity of the decay products is equal to that of the parent in a material. It may arise when a radioactive parent is long-lived compared with its decay products and none of the decay products are removed from the material.
Sievert (Sv)	The unit of measurement of radiation dose-equivalent. One sievert is equal to the product of the absorbed dose by the quality factor and any modifying factor(s). It allows a comparison of the relatively greater biological damage caused by some particles such as alpha particles and fast neutrons. For most beta and gamma radiation, one sievert is equal to an absorbed dose of one joule per kilogram.
Slurry	A mixture composed of a solid phase within a liquid phase.

Supervised area	An area to which access is controlled in order to limit the radiation exposure to members of the public.
Thorium (decay) series	A series of radionuclides produced in the decay of radioactive thorium to stable lead.
Uranium (decay) series	A series of radionuclides produced in the decay of radioactive uranium to stable lead.

Appendix A

APPENDIX A

DEPARTMENT OF ENVIRONMENTAL PROTECTION GUIDELINES

RHONE-POULENC
RARE EARTH PROJECT, 4 KM SOUTH OF ALCOA ALUMINA REFINERY AND NEXT TO GALLIUM PLANT, PINJARRA, WESTERN AUSTRALIA
(ASSESSMENT No 954)

GUIDELINES FOR ENVIRONMENTAL REVIEW AND MANAGEMENT PROGRAMME

Overview

All environmental reviews have the objective of protecting the environment, and environmental impact assessment is specifically a public process in order to obtain broad ranging advice. The review requires the proponent to describe the proposal, receiving environment, potential environmental impacts and the management of the issues arising from the environmental impacts, so that the environment is protected to an acceptable level.

Throughout the assessment process it is the objective of the Department of Environmental Protection (DEP) to assist the proponent to improve the proposal such that the environment is protected in the best manner possible. The DEP would co-ordinate relevant government agencies and the public in providing advice about environmental matters during the assessment of the Environmental Review and Management Programme (ERMP) for this proposal.

These guidelines are issued to assist in identifying matters that should be addressed within the ERMP. They are not exhaustive and other relevant issues that may arise during the preparation of the document should also be included in the ERMP.

Contents of the ERMP

The Authority understands that this proposal is a modified version of a proposal assessed by the Authority in 1988 (EPA Bulletin 352). As parts of the previous proposal were found to be environmentally acceptable, appendices can be used to describe those parts, accompanied by brief reference in the text.

The Authority also understands that, unlike the previous proposal, this proposal does not generate ammonium nitrate waste. Accordingly, the issues of disposal of radium contaminated ammonium nitrate to evaporation ponds in the Peel Harvey catchment or by deep well injection are not issues that need addressing.

The emphasis of the environmental review should be to describe that part of the proposal which differs from that previously assessed, and explain why the modified version is now considered environmentally acceptable.

The ERMP should focus on risk minimisation of radiation exposure, particularly as perceived by the community, during transportation of monazite feedstock and radioactive wastes, and the management of radioactive wastes at the disposal site. As well, contingency plans for dealing with accidental spillage should be addressed.
The ERMP should facilitate review of the key environmental issues (both biophysical and social surroundings). The contents should reflect the purpose of the ERMP, which is to:

- communicate clearly with the public (including government agencies), so that the

Environmental Protection Authority can obtain informed public comment to assist in providing advice to government;

- describe the proposal adequately, so that the Minister for the Environment can consider approval of a well-defined project; and
- provide the basis of the proponent's environmental management programme, which shows that the environmental issues resulting from the proposal can be acceptably managed.

The language used in the body of the ERMP should be kept simple and concise, considering the audience includes non-technical people, and any extensive, technical detail should either be referenced or appended to the ERMP. Remember that the ERMP would form the legal basis of the Minister for the Environment's approval of the proposal and, hence, should include a description of all the main and ancillary components of the proposal, including options if necessary.

The contents of the ERMP should include:

- a summary of the ERMP(*including a brief description of the proposal*);
- introduction of the proponent, the project and location;
- the legal framework, decision making authorities and involved agencies;
- description of the components of the proposal, particularly the difference between this project and the previous project assessed by the Authority in 1988 *(A table should be presented which summarizes a mass balance of raw materials (inputs) and products and wastes(outputs) for the processing plant);*
- identification of the potential impacts;
- description of the receiving environment which may be impacted by this project only;
- discussion of the key issues, including an assessment of the significance as related to objectives or standards which may apply;
- discussion of the management of the issues, including commitments to appropriate action; and
- a summary of the environmental management programme, including the key commitments, monitoring work, strategies employed to rectify unacceptable environmental impacts and the auditing of the programme.

Key environmental topics

The key topics can be determined from the potential impacts from the various components of the proposal on a receiving environment, including social surroundings. The ERMP should focus on the key issues for the proposal, and it is recommended that these be agreed in consultation with the DEP and relevant public and government agencies. A description of the project component and the receiving environment should be directly included with, or referenced to, the discussion of the issue. The technical basis for measuring the impact and any objectives or standards for assessing and managing the issue should be provided.

Key environmental topics include the following:

- radiological impacts from:
  - transportation of monazite feedstock;
  - processing plant operation;
  - on-site handling and storage of radioactive wastes;
  - transportation of radioactive wastes from the plant site to the disposal site, including:
    - detailed description of the physical, chemical and radioactive

    - characteristics of the wastes, particularly the stability and mobility of the wastes in the environment in the event of a spill into water in the form of swampy ground or running streams;
    - evaluation of feasible transport options (including rail, road and a combination of rail/road) with respect to potential impacts on public health and biophysical environment;
    - qualitative risk assessment of the consequences of a spill along the proposed transport route(s), in terms of impacts on public health and the environment (ecological impacts);
    - packaging of the wastes and transport management procedures to minimise occurrence of spillage resulting from an accident/incident; and
    - emergency response management to minimise public health and environmental impacts in the event of a spill;
  - handling and storage of radioactive wastes at the disposal site;

- long term management of the radioactive wastes at the disposal site including liability;

- requirements for and provision of buffer zones around the project site based on predicted impacts which cross the property boundary (including noise, dust, air quality, radiation);

- management of surface and groundwater contamination at the plant site;

- noise and air quality impacts:
  - during construction phase, including construction traffic;
  - during operation phase;
  - potential cumulative noise and air quality impacts from the operation of the project and the Gallium plant on the nearest neighbours;

- impacts from transport of other raw materials and products, particularly hazardous chemicals such as nitric acid;

- any other impacts which might be apparent to the proponent;

- contingency plans for the processing plant:
  - during the commissioning stage and
  - during an emergency situation due to fire, breakdown or malfunctioning of critical equipment or other unplanned situations; and

- decommissioning of plant and infrastructure and the rehabilitation of contaminated areas.

Further key topics/issues may be raised during the preparation of the ERMP, and on-going consultation with the DEP and relevant agencies is recommended. Minor issues which can be readily managed as part of normal operations for similar projects may be briefly described. Information used to reach conclusions should be properly referenced, including personal communications. Assessments of the significance of an impact should be soundly based rather than unsubstantiated opinions, and the assessment should lead to a discussion of the management of the issue.

Predicted environmental impacts and proposed measures to overcome or minimise these problems should be discussed in sufficient detail so as to allow an adequate assessment to be made.

(The EPA would not normally require proponents to address occupational health and safety matters in environmental review documents, nor does the EPA advise government on such matters. However, given that there is a high level of public interest in occupational health and safety matters associated with radiation levels during processing and in the gangue residue, the proponent may wish to give details of proposed management of these matters in the ERMP in the public interest.)

Environmental management

The EPA considers that the proponent should approach environmental management in terms of best practise. Best practice environmental management includes:

- development of an environmental policy;
- agreed environmental objectives;
- management of the environmental objectives;
- involve the public as appropriate;
- audit environmental performance against agreed indicators;
- regular reporting to the EPA (or nominated agency);
- commitment to a quality assured management system and continuous improvement;
- periodic (for example 5 yearly) review in conjunction with EPA (or nominated agency).

The proponent should provide a table which describes the following:

(a) the present state of the environment;
(b) potential impacts of the proposal on the environment
(c) nominate environmental management objective(s) for those aspects which require management;
(d) environmental management response to manage impacts to meet the above objective(s); and
(e) envisaged resultant state of the environment

under 3 major headings:

- biophysical environment
- pollution potential
- social surroundings.

The environmental management programme for the proposal should be developed in conjunction with the engineering and economic programmes of the proposal. Hence, the ERMP should be designed to be immediately useful at the start of the proposal, and the DEP recommends that the basis of an environmental management and audit programme be developed as a concluding part of the ERMP. For this proposal, the environmental management plans for the transport and disposal of the gangue residue should be addressed in as much detail as possible in the ERMP.

Public consultation

A description should be provided of public consultation activities undertaken by the proponent in preparing the ERMP. This should outline the activities, the groups or individuals involved and the objectives of the activities. A summary of concerns raised should be documented along with how each of these concerns has been addressed.

Cross reference should be made with the description of environmental management of the issues which should clearly indicate how community concerns have been addressed. Those concerns which are dealt with outside the EPA process can be noted and referenced.

Proponent's commitments to environmental management

Where an environmental impact has been predicted, and an appropriate management response identified, the proponent should commit to it.. The commitments should include:

(a) who is responsible for the commitment and who will do the work;
(b) what is the nature of the work ;
(c) when and where the work will be carried out; and
(d) to whose satisfaction will the work be carried out.

The method of implementation of the proposal and all commitments made by the proponent in the ERMP would become legally enforceable under the environmental conditions of the Minister for the Environment's approval. *A consolidated list of commitments in numbered form should be given.* These commitments show that the proponent is committed to actionable and auditable management of the environmental issues. A set of well written concise commitments covering the key issues of the proposal and its effects will help to expedite assessment of the proposal.

Additional information

Guidelines

A copy of these guidelines should be included in the document.

References

All references should be listed.

Appendices

Where detailed technical or supporting documentation is required, this should be placed in appendices.

Glossary

A glossary should be provided in which all technical terms, and unfamiliar abbreviations and units of measurement are explained in everyday language.

How to make a public submission

The ERMP should include advice to members of the public as to how they can make a submission to the Environmental Protection Authority and should enclose a copy of the free pamphlet "How to Make a Submission", available from the Department of Environmental Protection. This advice should be at the beginning of the document.

Note

1. *In order to expedite the assessment the proponent should discuss the format of each section of the ERMP with the assessment officer and present the officer with the document in electronic form.*

2. *Following preparation of the main ERMP document, the proponent is required to prepare a stand-alone summary document which must be provided free of charge during the review period to those most likely to by affected by, or have an interest in, the project.*

Appendix B

INTEGRATED WASTE DISPOSAL FACILITY

Report and Recommendations
of the
Environmental Protection Authority

Environmental Protection Authority
Perth, Western Australia

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APPENDIX B

EPA'S REPORT AND RECOMMENDATIONS FOR THE PROPOSED INTEGRATED WASTE DISPOSAL FACILITY IN THE EASTERN GOLDFIELDS WESTERN AUSTRALIA AND MINISTERIAL CONDITIONS SET FOR THE ABOVE FACILITY

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APPENDICIES

SUMMARY AND RECOMMENDATIONS

The Health Department of Western Australia proposes to establish an Integrated Waste Disposal Facility in the Eastern Goldfield Region. The facility would be owned and operated by the Health Department and only wastes generated in Western Australia would be accepted for disposal.

The proposal includes:

- a high temperature incinerator for the disposal of organochlorines, which at this stage include agricultural chemicals and polychlorinated biphenyls (PCB's); and
- an area for burial of intractable solid wastes which include low level radioactive wastes generated from the processing of phosphate rock and monazite.

The Health Department would own and operate the facility and would assume responsibility for collection of the waste from storage and transport to the waste disposal site. The actual transport of wastes would be managed by Westrail. The Health Department has proposed three areas in which to site the facility, two in the Shire of Coolgardie and one in the Shire of Yilgarn.

There is a need for an Integrated Waste Disposal Facility in Western Australia for a variety of reasons. Stockpiles of PCB's and other organochlorine chemicals pose a risk of environmental contamination. The mineral processing industry has the potential to produce low level radioactive waste which would require disposal in an environmentally acceptable manner. There is also a need to dispose of equipment which has become contaminated with radionuclides by the processing of phosphate rocks and mineral sands. These are currently being stockpiled.

The Environmental Protection Authority determined that a Public Environmental Report would be required to assess the proposal. The PER had a public review period of six weeks and then a second review period of three weeks closing 15 August 1988. The second review period accommodated a further alternative site for the proposal.

The major environmental issues associated with the proposal are the siting of the facility, the transport of the wastes to the facility, emissions from the incinerator, radiation levels, (both for workers and the environment), and the need for proper environmental management and monitoring.

All three sites satisfy the criteria for the disposal of low level radioactive waste. These criteria are more restrictive than the criteria for the incinerator. All three sites also have a sufficiently large buffer zone from human habitation and agricultural activities. Transport of the waste would comply with the appropriate regulations, but the proponent would be required to investigate, the transport of wastes, including emergency procedures and liaison with local communities. The emission from the incinerator would be monitored and are expected to be so low as to be insignificant. Radiation levels associated with the disposal of the low level radioactive waste are considered by the Authority to be manageable and the Health Department has made a commitment to comply with the ALARA principle, that is to keep radiation uses as low as reasonably achievable.

Accordingly, the Authority has concluded that the proposal is environmentally acceptable, and has made the following recommendations:

RECOMMENDATION 1

The Environmental Protection Authority concludes that the proposed Integrated Waste Disposal Facility is environmentally acceptable and recommends that it could proceed subject to the EPA's Recommendations in this report and the proponent abiding by the environmental commitments in the Public Environmental Report including (see Appendix A):

- **the operation will be controlled by the Health Department of Western Australia;**
- **the facility will be owned by the Health Department of Western Australia;**
- **wherever possible transport will be by rail;**
- **a monitoring programme will be implemented; and**
- **personnel will be trained in emergency response procedures.**

RECOMMENDATION 2

The Environmental Protection Authority recommends that the proponent drill the chosen site to confirm the absence of potable water and to confirm the depth of clay is in excess of 15 m and forward results to the EPA for review.

RECOMMENDATION 3

The Environmental Protection Authority recommends that prior to construction, the proponent undertaken biological surveys to indicate the impact of the facility on rare and endangered species to the satisfaction of the EPA.

RECOMMENDATION 4

The Environmental Protection Authority recommends that prior to construction, the proponent undertake a survey for Aboriginal sites to comply with the Aboriginal Heritage Act.

RECOMMENDATION 5

The Environmental Protection Authority recommends that prior to commissioning the proponent prepare an Environmental Management Programme to the satisfaction of the EPA, and that the EMP be available to members of the public. The EMP should address:

- **size of the incinerator;**
- **operational procedures;**
- **transportation of the wastes;**
- **emergency procedures;**

- radiation monitoring programme; and
- organochlorine monitoring programme.

RECOMMENDATION 6

The Environmental Protection Authority recommends that prior to commissioning the proponent undertakes the following for all stages of the transport operation to the satisfaction of the EPA and relevant Government agencies and that it be included in the Environmental Management Programme:

- establish detailed specifications for organochlorine loading, transfer and unloading areas;
- establish detailed specification for low level radioactive wastes loading transfer and unloading areas;
- outline specific safeguards for rail containers containing organochlorine and low level radioactive waste;
- detail plant site storage and handling requirements, including fire safety;
- identify responsibility for the various aspects of transport and transfer operations;
- prepare contingency plans for dealing with spillages should they occur; and
- liaise with the local communities over emergency procedures.

RECOMMENDATION 7

The Environmental Protection Authority recommends that the proponent should report the results of the monitoring programme to the EPA six monthly and that these results should be made available to the public.

RECOMMENDATION 8

The Environmental Protection Authority recommends prior to commissioning the proponent prepares a hazard and safety management strategy for the incinerator to the satisfaction of the EPA and relevant Government agencies.

RECOMMENDATION 9

The Environmental Protection Authority recommends that the disposal at the Integrated Waste Disposal Facility of any wastes other than those specified in the PER should be referred to the EPA for assessment.

1. INTRODUCTION

The Department of Health proposes to establish an Integrated Waste Disposal Facility in the Eastern Goldfield Region. The facility would be used to dispose of certain hazardous wastes generated in Western Australia.

The proposal includes:

. a high temperature incinerator for the disposal of organochlorine and other intractable wastes for which this is the optimum disposal method; and

. an area for burial of low level radioactive wastes arising from the processing of mineral sands and phosphate rock, and solid waste such as the transformers (after being cleaned of PCBs).

The Environmental Protection Authority discussed the proposal and decided that a Public Environmental Report should be prepared to allow public involvement in the assessment of the proposal. There were two public review period. The first six week review period was for the whole proposal. The second, three week review period finishing on August 1988, was to allow public comment on another alternative site for the facility.

The Environmental Protection Authority has determined that the proposal should be assessed in two parts:

. the disposal of liquid intractable wastes by incineration; and

. the disposal of solid intractable wastes by burial.

2. NEED FOR THE PROPOSAL

The proponent states in the PER that there is a requirement for the proposal for a number of reasons:

(1) Stockpiles of PCB's and other organochlorine chemicals which have been or are being withdrawn from industrial and agricultural use, require a long term environmentally acceptable management solution;

(2) ongoing production of intractable wastes require disposal by high temperature incineration; and

(3) the need to dispose of low-level radioactive wastes arising from the processing of mineral sands and phosphate rock.

Stockpiled organochlorines pose a risk of environmental contamination and occupational exposure. A low temperature storage fire could convert the organochlorines to dioxins which could be an exposure hazard for the community.

Ongoing production of intractable waste by industry would be stockpiled, and this pose a risk of environmental contamination unless disposal by high temperature incineration was available.

Low level radioactive wastes cannot be destroyed and require long term isolation and containment. Western Australia produces approximately 65% of the worlds monazite and so it seems probable that Western Australia will have downstream processing of monazite. Monazite is radioactive due to its uranium and thorium content and wastes from processing monazite would also be radioactive. The Environmental Protection Authority has already approved one proposal by Allied Eneabba to treat monazite. An environmentally secure disposal site for the waste will be needed should any such plants be established. As well, Western Australia processes phosphate rock to produce fertiliser. The phosphate rock contains small amounts of radium which is concentrated in the fertiliser works. The old tanks, pipes and filter etc. become contaminated through absorption of the radionuclides. At present this discarded equipment is stored in a variety of places. As it is certain that fertiliser used will continue and as such radioactive equipment will continue to be produced, then it is necessary to provide a secure disposal site for such material.

The establishment of an integrated facility obviously offers the potential for considerable cost savings in terms of construction and operation. An integrated facility would also avoid the need for duplicated infrastructure such as electricity, water, road and rail, and for duplicated operational expenses in terms of personnel and some monitoring requirement.

3. PUBLIC AND GOVERNMENT SUBMISSIONS

The PER was released for public comment for a six week period from 21 May 1988 until 4 July 1988. In July the Health Department requested that the Environmental Protection Authority consider a third site. The Authority determined that public review period of three weeks on the final site was required. This review period period closed on the 15 August 1988. The submissions received from members of the public were of four differing formats:

Standard Submissions - members of the public signed a standard letter opposing the siting of a hazardous waste disposal facility in the Goldfields:

Semi-Standard Submissions - the letter format consisted of various combinations of 8-10 paragraphs, selected from a total of 68 paragraphs. Each paragraph identified one issue. Members of the public signed one or more of the letters which opposed the proposal:

Individual Submissions - individual responses; and

Petition - a petition organised by the group, GASP (Goldfields Against Serious Pollution).

	TOTAL	FOR	AGAINST	INFORMATION
Standard	783	0	783	-
Semi-Standard	1618	0	1618	-
Individual	45	3	42	-
Government	18	-	0	18
Local Government	5	-	3	2
Others	8	-	-	8
	2477	3	2446	28
Petition (signatures)	6500	0	6500	

Opposition to the Proposal

The majority of submissions received were opposed to the proposal and more specifically the siting of the facility in the Goldfields region. The submissions identified a range of issues and concerns, some of which were of a non-environmental nature.

The majority of the submissions addressed the disposal of radioactive wastes component of the proposal. Issues raised included the radiation hazard posed by the transport of the waste to the facility, the lack of detailed contingency planning in the event of an accidental spillage; and concern with respect to the long term storage of radioactive waste in terms of stability, security and safety aspects. Many people viewed the disposal of Western Australia waste only as a precursor for the facility being developed to dispose of Australian and international waste. The Rhone-Poulenc Rare Earths processing plant proposal and the present proposal were seen as intimately connected.

A number of submissions expressed concern regarding the nature and level of emissions from the incinerator and the lack of detail about the design specifications of the incinerator.

The overall lack of detail in the PER was also identified as limiting the degree to which the proposal could be assessed.

Support for the Proposal

Only three (3) submissions received supported the proposal, in principle. All identified areas requiring further consideration by the proponent, and in particular the hazards associated with the disposal of radioactive waste.

Government Submissions

Eighteen submission were received from a number of Government departments. Overall these submissions provided information, acknowledged the need for such a facility and supported the concept of the proposal detailed in the PER.

A summary and review of the submissions is presented in Appendix B; and the proponent's responses to these issues are presented in Appendix C.

4. PROJECT DESCRIPTION OF THE LAND DISPOSAL OF SOLID INTRACTABLE WASTES

4.1 WASTES

4.1.1 RARE EARTH WASTES

Monazite occurs as a minor component of mineral sands which are mined in Western Australia. It consists of 60% rare earth oxides, 7% thorium, 0.2% uranium and 33% gangue, which includes phosphorus. Western Australia produces approximately 66% of the world's monazite. Monazite can be treated to produce rare earth salts and an insoluble thorium hydroxide waste is produced in the process. The thorium hydroxide wastes consist of 14% thorium, 40% water, some uranium and other impurities. Should all the Monazite currently produced in Western Australia be processed approximately 8000 tonnes per annum of thorium waste would be produced. This waste would require an environmentally secure disposal site.

4.1.2 OTHER LOW LEVEL RADIOACTIVE WASTES

During the processing of mineral sands and phosphate refining, the minerals are subject to various physical and chemical processes which separate the radioactive isotopes. Components of the processing plants such as, reaction vessel, linings, pipes and filter parts become contaminated with a surface deposit of radioactive substances. The main contaminant is radium. It is generally considered safer to discard these components after a reasonable service life than to expose workers to radiation risks to decontaminate them. Plant components of this nature have been held in storage for many years in Western Australia. They cannot be stored indefinitely on the sites of fertiliser works without posing a risk of contamination.

4.1.3 OTHER INTRACTABLE WASTES

The solid wastes from the incinerator, consisting of metal containers and the shells of capacitors would require disposal by burial. In the future, Western Australian industry, research and medicine will produce small amounts of solid intractable wastes such as spent catalysts. The Health Department may propose that such wastes should be disposed of at the Integrated Waste Disposal Facility. This will require separate assessment by the EPA.

4.2 SITE SELECTION

The Health Department has presented three areas for assessment. The site for the facility would be located inside one of the areas.

AREA 1	
Shire	Yilgarn
Land Use	Vacant Crown Land
Area	Approximately 150 km^2
Distance from Koolyanobbing	20-40 km NE
Distance from Southern Cross	70-90 km
Distance from railway	15 km
Elevation	460 m AHD
Gradient	Flat

AREA 2	
Shire	Coolgardie
Land Use	Vacant Crown Land
Area	30 km^2

AREA 2 (cont'd)	
Distance from Coolgardie	70 km
Distance from Bullabulling	45 km
Distance from Koolyanobbing	75 km
Distance from Walleroo Siding	16 km
Distance from Railway	5 km
Distance from Southern Cross	100 km
Elevation	456 m AHD
Gradient	Flat

AREA 3	
Shire	Coolgardie
Land Use	Vacant Crown Land
Area	50 km^2
Distance from Coolgardie	115 km
Distance from Koolyanobbing	80 km
Distance from Railway Line.	60 km
Elevation	450-500 m AHD
Gradient	Flat to gently undulating

4.2.1 GEOLOGY

The main criterion to be met for the disposal of low-level radioactive wastes is that the area is geologically stable. This criterion is paramount as the wastes will remain radioactive, albeit at a low level for an extremely long time. Such stability is afforded by the Yilgarn Block which covers much of the southern part of Western Australia. All three sites are located in the Yilgarn Block. This region comprises of a massive thickness of granite with generally low seismic activity.

4.2.2 TOPOGRAPHY

All three sites are located on plateaux between drainage systems.

4.2.3 HYDROGEOLOGY

The region is typically underlain in parts by hypersaline groundwater which is unlikely to be exploited for domestic or agricultural use. The only major use for the water in the goldfield region is for gold processing. The waste disposal sites are all relatively distant from local sites of potential gold mineralisation. Reconnaissance drilling in site 1 did not locate any significant occurrence of groundwater. Drilling at site 3 indicated that there was no retrievable water to a depth of 40 metres when granite bed rock was reached. Site 2 has yet to be drilled.

4.2.4 SOILS

The surface of the plateaux comprises a mixture of laterite and sandplain.

4.2.5 BIOLOGICAL ENVIRONMENT

The area required for the integrated waste disposal facility is small, approximately 5 km^2, relative to the total suitable area available as described in Section 4.2. It is unlikely that the facility would have a major impact on the flora and fauna.

4.2.6 LAND USE

Sites 1, 2, and 3 are all located on Vacant Crown Land, and so conflict with any current land use is not expected. None of the sites is known to have mineral or agricultural significance or potential. They are also not known to be important to aboriginal communities. Each site has an adequate buffer zone from agricultural and permanently inhabitated areas.

4.3 ASSESSMENT OF WASTE PROPOSED FOR BURIAL

Health Department Officers would consult with the waste producer and other Government Authorities and experts to produce specifications for the conditioning and packaging of wastes. The waste producer will then condition and package the wastes to appropriate standards.

4.4 TRANSPORT OF WASTE

After appropriate packaging the waste would be loaded into ISO - freight containers by means which would minimise operator radiation exposure. Filled transport containers can easily be transferred to road or rail vehicles by gantry crane or other mechanical means. Remote loading and unloading of containers from the vehicles would occur.

Consignment would be managed by Westrail.

Waste packaged in ISO -freight containers would be transported by rail to a dedicated siding at either Koolyanobbing or Jaurdi. The ISO - freight containers would then be transferred to road trucks for transport to the Integrated Waste Disposal Facility on a private road. Transfer from rail to road vehicle and from road vehicle to the ground at the Integrated Waste Disposal Facility would be by purpose built transfer crane, attached to the truck.

ISO - freight containers would be transported by rail from Pinjarra through Mundijong, Wellard, Kwinana, and Canning Vale to Kewdale. There it would be transferred onto the main East-West railway line to either Koolyanobbing or

Jaurdi Road transport would be used to transfer the ISO - freight container to the Facility.

4.5 WASTE DISPOSAL

Solid Intractable Waste would be disposed of by shallow burial beneath the ground surface in a series of trenches.

(1) Separate trenches would be used for different categories and types of solid waste.

(2) Trenches would be progressively back filled.

(3) Trench location would be surveyed, designated and marked on the ground and on the detailed site diagram.

(4) Earth moving equipment would dig the trench.

(5) Bottom of the trench would be compacted to the engineering design criterion.

(6) Wastes would be transferred from the ISO - freight container into the trench as solid packages using a boom crane or similar remote handling technique to ensure distance protection from radioactive wastes for operator radiation protection. Waste packages would be stacked in an orderly manner to provide minimum scope for future subsidence or movement.

(7) Records would be entered of the exact location of each package of waste in the trench.

(8) After wastes have been stacked to the appropriate height in the trench, they would be covered with excavated clay to the detailed engineering specification. This clay cover would be compacted and domed to divert any rain infiltration towards the sides.

(9) According to the detailed engineering design, a layer of rock may be placed upon the compacted clay cover to further reduce the likelihood of erosion.

(10) A further layer of clay would be compacted and domed over the rock layer if specified in the detailed engineering design.

(11) The excavated sand cover would be returned, shaped to aid drainage according to the detailed engineering design and be revegetated with native vegetation.

(12) Appropriate rock/cement markers would be erected to identify the filled trench.

5. **ENVIRONMENTAL MANAGEMENT AND MONITORING**

5.1 MANAGEMENT OF THE OPERATIONS

The Health Department would establish a Central Committee for the facility which would include local representatives. This Committee would oversee the project through the design, commissioning and operational phases and would issue a site operating licence.

9he Health Department would establish a separate Community Liaison Committee which would provide local residents with information on the operation of the facility. It is envisaged that the Committee will consist of, amongst others, representative of Shire Officers, elected Councillors, local residents and appropriate government officers.

A suitably qualified safety officer would be appointed to supervise operations at the disposal facility.

The development of the facility would be in accordance with the principle of minimising the impact on the natural environment. This would involve minimising clearing and revegetation of disturbed areas such as the filled burial trenches.

5.2 MONITORING

Baseline radiation monitoring would be conducted once a final site has been selected. The measurements would include:

- gamma radiation levels;
- airborne dust concentration;
- alpha/beta activities;
- groundwater concentration of thorium, uranium radium 226 and radium 228;
- radon, radon daughter, thorium, thorium daughter concentration in air; and
- radon and thorium emanation rates from the ground.

Gamma emissions from freight containers would be measured during the commissioning phase of any monazite processing plant and monitoring would continue for the duration of the project.

A radiation monitoring programme would be designed for the operational phase of the Integrated Waste Disposal Facility.

6. PROJECT DESCRIPTION FOR INCINERATION OF LIQUID INTRACTABLE WASTES

6.1 BACKGROUND

The Authority has previously assessed a proposal to construct a PCB incinerator, to be located near Koolyanobbing (EPA Bulletin 297, September 1987). That proposal consisted of a high temperature incinerator and associated infrastructure which was capable of incinerating all of Western Australia's PCB wastes (estimated at approximately 1000 tonnes) over a period of three to five years. The incinerator was to take only PCB wastes which were generated in Western Australia.

6.2 FURTHER DEVELOPMENTS

A number of developments have occurred recently to warrant the current proposal for an integrated waste facility. The liquid intractable waste stream has expanded from PCBs to include other organochlorine wastes. These include the agricultural pesticides which were recalled in a buy-back programme organised by the Department of Agriculture in 1987. The total quantity of DDT, dieldrin, aldrin, chlordane and heptachlor received amounted to approximately 180 tonnes. The Department of Agriculture currently has these materials stored in dedicated storage areas located at three agricultural research stations. These materials can also be safely destroyed by high-temperature incineration.

Proposed industrial development is also creating a need for on-going disposal of intractable wastes. The petrochemical plant proposed by Petrochemical Industries Company Limited (PICL) which was assessed by the Authority in April 1988 (EPA Bulletin 331) has the potential to generate significant quantities of chlorinated hydrocarbon wastes. The Authority noted that the plant had the potential to produce chlorinated aromatic wastes, which were likely to represent the most serious environmental contaminants in PICL's chlorinated hydrocarbon waste stream.

These chlorinated aromatics consist principally of monochlorobenzene, with the potential for other chlorinated benzenes up to hexachlorobenzene (HCB). The likelihood of PCBs being present in the waste stream is extremely low. Further information provided by PICL indicates that monochlorobenzene is the only chlorinated aromatic of any consequence in the waste stream (approximately 230 tonnes per annum). Should provision be made for incineration off-site of this waste stream, then expansion of the capacity of the incinerator would have to be allowed for. In addition, it is envisaged that small quantities of various tarry wastes from PICL would have to be destroyed in the incinerator. The Environmental Protection Authority has recommended that an Environmental Management Programme should be prepared for PICL wastes.

Moreover, there is the potential for other industrial projects which may be proposed in the future to generate intractable wastes requiring high temperature incineration.

Hence, there is a need for a facility which would destroy not only the PCBs in Western Australia, but service the on-going needs of the State. Consequently, although the initial capacity of the plant may be limited, it should have the capacity for expansion to an appropriate level in the future. All proposals for additional waste will be publicly assessed by the Authority.

6.3 THE PROPOSAL

A description of the proposed incinerator is provided in the PER. In summary, this consists of the following:

- an unloading area for the receival of wastes including facilities for the receival and unloading, and facilities for the preparation of organochlorines for transfer to the incinerator;
- storage tanks and drum storage area. An area for the storage of capacitors awaiting disposal would also be provided;
- high temperature incinerator system including feed system, primary and secondary combustion chambers with associated controls;
- air pollution control system - ie either a wet venturi scrubber system or a dry lime reactor for particulate removal and for gas scrubbing;
- evaporation ponds for the disposal of scrubber water;

- a residue treatment and disposal system;

- process control; and

- support services infrastructure, administration and amenity buildings.

The actual incinerator site would be approximately one hectare, surrounded by a separate security fence.

The initial capacity of the proposed incinerator would be 300 tonnes per year of liquid and solid wastes, with a proposed feed rate of 1-2 tonnes per day. The facility would not have a defined life span.

Other aspects of the proposal include:

- PCBs collected from different parts of the State would be transported by road to central interim storage facilities in Perth;

- the proponent would make use of the central collection and interim storage facilities in the metropolitan area with subsequent bulk conveyance of organochlorines to the disposal site so as to meet the long-term collection timetable and the need to avoid storage of wastes on-site at the disposal facility;

- organochlorines would be handled and transported in purpose-built steel containers which would be safely sealed; and

- there would be a single storage, handling and transport agency throughout the disposal operation.

Non-PCB organochlorine wastes would be transported from their source sites in purpose built containers.

Rail transport will be used wherever feasible.

7. ENVIRONMENTAL ASSESSMENT OF INTRACTABLE WASTES

The major environmental issues associated with the proposal are:

- the siting of the facility;

- actual disposal of the wastes, solid waste and organochlorines;

- transport of wastes to the facility; and

- radiation levels.

7.1 SITE SELECTION

The selection of a suitable site for the facility requires that the site fit the selection criteria for shallow ground disposal of low level radioactive waste. These selection criteria are more restrictive than those for an incinerator facility alone. Site selection criteria are detailed in the reports of the International Atomic Energy Agency (1976,1981,1987) and the Australian Atomic Energy Commission. The general criteria include:

- geological stability;

- uniformity of rock type;

. deep weathered profile;

. low rainfall ;

. high evaporation rate;

. absence of groundwater or groundwater generally unusable;

. minimum depth to any groundwater 10 m;

. appropriate site drainage;

. suitable soil type;

. adequate buffer zone from areas of human inhabitation and agricultural production;

. absence of mineralisation;

. absence of aboriginal sites or areas of environmental significance.

All three sites proposed by the Health Department could meet the above criteria. They are all in a geologically stable area on the Yilgarn Block. There is an adequate buffer zone to areas of human inhabitation and agricultural production. They are in a low rainfall high evaporation area. There is uniformity of rock type, deep weathered profile, suitable soil types and appropriate drainage. Sites 1 and 3 have been drilled and have a suitable depth of clay and the an absence of usable groundwater. The Health Department would be required before final approval to investigate the mineralisation of the selected site, conduct a survey for aboriginal sites and also undertake a biological survey to identify rare or endangered species. Should site 2 be chosen as the site for the facility then the Health Department would be required to drill to confirm the absence of usuable water and the depth of suitable soils before final approval of the site.

7.2 BURIAL OF THE WASTE

The essential criteria for safe disposal of intractable solids are that they need to be buried such that:

(a) they remain in a stable physical and chemical form;

(b) they do not interact or react with themselves or with adjacent wastes; and

(c) they remain isolated from the environment.

Immobilisation of intractable wastes and inhibition of their migratory path way is achieved by:

. conditioning wastes; and

. burying them in an appropriate sited and operated repository.

The Health Department proposal meets the essential criteria for safe disposal of solid wastes. The waste would remain in a stable physical and chemical form and they would not interact with themselves. Neither would they interact with adjacent wastes as separate trenches would be used for different types of waste. The Health Department has made a commitment to fill the trenches and design the trenches and covering to prevent erosion. This should allow the waste to remain isolated from the environment.

7.3 ALTERNATIVE DISPOSAL OPTIONS FOR THE HIGH TEMPERATURE INCINERATOR

There are approximately 1000 tonnes of PCB waste stored in Western Australia. Stored PCBs can be spilt and leakages can occur from containers. In addition low temperature fires can result in toxic products being formed. The Environmental Protection Authority considers that the consequences of indefinite storage of these wastes and other organochlorine wastes in the State is environmentally undesirable.

The Environmental Protection Authority had already assessed the various disposal options for PCBs (Bulletin 297) and came to the conclusion that high temperature incinerator is technically and environmentally the most acceptable method for disposing of Western Australian PCBs. A chemical process for the destruction of organochlorine compounds is currently being investigated at the University of Sydney. This is still at the early research stage and may not be applicable to all situations. Therefore, the EPA still considers high temperature incineration environmentally the most acceptable method for disposing of Western Australia organochlorines.

7.4 SAFETY ASPECTS OF HIGH TEMPERATURE INCINERATOR

As discussed earlier, the destruction of intractable organochlorine needs to be carried out in a manner so as to minimise the potential hazards and maximise the safety of the disposal facility. The major safety issue associated with the incinerator is the storage and destruction of organochlorines and the possibility of the loss of containment of organochlorines and associated compounds from the incineration facility.

The Authority notes that there are over 20 such high temperature incinerator facilities in at least eight countries (mostly in Europe) and that all of these facilities are significantly larger than the incinerator proposed for the Koolyanobbing area. Many of these overseas facilities are located in close proximity to residential areas (some within 500 metres), and have been operating for more than ten years.

All three sites proposed in the PER would have a minimum of 20 kilometres from the nearest permanent habitation.

However, the Authority does not consider that having an adequate buffer zone is sufficient. In its assessment, the Authority has examined in detail the proposed safeguards within the facility. In principle, the Authority considers that the safeguards for this incinerator should be appropriate and adequate to site such a facility within an industrial area in the metropolitan region.

In order to achieve this objective, the Health Department has provided the following safeguards to ensure that the highest standards of safety would be implemented at the proposed incineration facility including:

- storage, handling and transport of wastes would be carried out only by properly trained and fully qualified operators;
- waste unloading and preparation for incineration would be automated as far as economically possible to minimise chances of worker exposure;

- equipment would be provided in the incinerator unloading area to contain spills and to remove excessive levels of vapours from sealed containers.;

- liquids awaiting incineration would be stored in a liquids tank farm that will provide full fire control, spillage containment and vapour control for all waste liquids stored;

- containers such as capacitors would be drained and prepared for treatment in the incinerator using automatic equipment;

- waste feed to the incinerator would be achieved by positive displacement metered pumping through an atomising lance for liquids and by a ram feed into an air lock for solids;

- the primary and secondary combustion chambers would be operated at 15 mm negative pressure to control fugitive emissions with facility to vary solids retention times and to achieve specified minimum temperatures, gas retention times and excess oxygen content in the flue gas;

- an air pollution control system using either a wet or dry scrubber system would be installed to limit particulate and gaseous emissions to acceptable levels; and

- a combination of automatic and manual controls would be used to monitor and control the system.

The EPA is satisfied that the Health Department of Western Australia's commitments on the safety aspects demonstrate that a safe and viable incineration facility can be built and maintained.

For the previous assessment (Bulletin 297) the proponent provided a fault identification and management programme which outlines the contingency and prevention measures to manage possible faults or accidents which could occur. In addition the proponent has outlined a detailed set of commitments (see Appendix A) to manage the safety requirements for the incinerator.

The EPA also notes that the proponent, as part of a Safety Management Strategy, would be undertaking the following:

- a Hazard and Operability (HAZOP) study for the plant;

- a fire safety study for the site; and

- a study of emergency procedures before the commissioning of the plant.

The Authority considers that the above safety management strategy is appropriate. The details of this safety strategy would need to be approved by the EPA and relevant Government agencies.

The EPA considers that with the implementation of the proponent's proposed safeguards (as outlined in Appendix A) and with the plant being operated by the Health Department, the safety issues associated with the plant would be managed to the satisfaction of the Environmental Protection Authority. In addition, the EPA would be undertaking periodic auditing of the facility to ensure that safety requirements are maintained.

7.5 ENVIRONMENTAL IMPACTS DUE TO THE EMISSIONS OF WASTES

The PER identified a number of waste products being generated from the plant which would require treatment and/or disposal. These include:

- atmospheric emissions;
- liquid wastes; and
- solid wastes.

7.5.1 ATMOSPHERIC EMISSIONS

The PER states that the atmospheric emissions would be treated through an air pollution control device. The options proposed are:

- wet venturi scrubber; and
- dry lime reactor.

Implementation of the proposal would require a Works Approval for a construction under the Environmental Protection Act 1986. The EPA considers that the matter of the appropriate air pollution control technology and its efficiency should be resolved at the works approval stage.

7.5.2 LIQUID WASTES

Under the assumption that a wet venturi scrubber system would be employed (as it is in most other incinerators in Europe) the proponent states that liquid waste from the scrubbers would be stored in lined ponds. A subsequent commitment by the proponent entails the destruction of any wastewater contaminated with organochlorines, either from scrubber water, stormwater runoff or from in-plant spillages, through incineration within the facility. Other relevant commitments made by the proponent, are as below:

- aqueous residues would be contained and evaporated. Regular testing would be carried out; and
- on-site liquid wastes would be fully contained and generally disposed of by evaporation unless they result from spillage in which case they would be fed into the incinerator.

The Authority notes that no contaminated wastewater would be discharged off-site under any circumstances.

7.5.3 SOLID WASTES FROM THE INCINERATOR

Solid residues would consist of metal containers such as drums and the shells of capacitors after these have passed through the incinerator. They will be disposed of by landfill. This is addressed under solid intractable waste disposal (Section 4.1.3) of this report. The Health Department has made the following comments regarding the waste:

- solid residues including remnants of burnt waste containers and residue from evaporation ponds would be disposed of as landfill. Monitoring of leachates would be carried out to ensue no pollution occurs from this waste; and

- contamination by organochlorines in all solid waste from the incinerator would be less than 2 ppm, which is well below allowable levels in the United States of America.

7.6 TRANSPORT

7.6.1 SOLID INTRACTABLE WASTES

The proposed transport route for the low level radioactive waste passes through suburbs, country towns and agricultural areas, and is of concern to the local community.

There are two major concerns associated with the transport of radioactive waste are accidents and radiation levels.

The transport of radioactive wastes is covered by the requirements of the Radiation Safety (Transport of Radioactive Substances) regulations 1982 administered by the Radiological Council. These regulations incorporate the Code of Practice for the Safe Transport of Radioactive Substances 1982. This Code recognises that accidents will occur. Packaging and transport standards are specified to minimise any impact on personnel, the public and the environment when an accident occurs.

The Western Australian Road Transport Emergency Assistance Scheme (WATERS) is already in existence and has been extended to include rail transport. Contingency plans will be further extended to include emergency responses appropriate to all wastes consigned to the Integrated Waste Disposal Facility. The proponent has made a commitment to train emergency response personnel before consignment of the first freight containers of waste.

7.6.2 ORGANOCHLORINES

It is proposed to collect PCBs from different parts of the State and transport them to one or more central interim storage facilities in Perth. The PCBs and other organochlorines would then be transported by rail to Jaurdi or Koolyanobbing and then trucked to site.

The Health Department has made the following commitments with regard to ensuring a safe transport operation:

- storage, handling and transport of wastes would be carried out only by properly trained and fully qualified operators;

- wherever possible, transportation of waste would be by rail;

- organochlorine wastes would be tested before transport to the disposal facility to allow optimum incineration control for each type of waste;

- all wastes consigned for transport would be in double containment;

The Authority considers that the transport of organochlorines would be to be undertaken in a manner which minimises the likelihood of spillages. The proponent would need to prepare emergency plans for any contingencies.

7.7 RADIOLOGICAL ISSUES

The radiological issues occur at each stage of the operation.

7.7.1 TRANSPORT

As noted earlier the transport of radioactive waste is covered by the requirements of the Radiation Safety (Transport of Radioactive Substance) Regulation, 1982, administered by the Radiological Council.

Radiation doses to transport workers would be kept to a minimum by providing distance between them and the wastes. This distance would be achieved by using cranes and gantry cranes for loading and unloading the wastes and also providing remote locking and unlocking facilities.

7.7.2 DISPOSAL

The disposal method and sites meet the criteria for the isolating of the low level radioactive waste from the environment. After disposal the gamma flux from the waste at the ground surface would not be detectable above background. The Health Department has also made a commitment to keep workers radiation doses to less than 10 milli sieverts per annum and to conform to the ALARA principle of keeping radiation doses as low as reasonable achievable.

Protective clothing would be applied to the workers by the Health Department and laundered on site. Personal radiation monitoring would be carried out. A radiation safety officer would be appointed. Workers would be required to shower and change in the abultion facilities provided at the end of shift.

The combinations of these commitments would make the radiation aspects of the proposal manageable.

7.8 OCCUPATIONAL HEALTH ISSUES

The responsibility for reviewing occupational health issues within the plant rests with the Commission for Occupational Health Safety and Welfare. The Authority notes that the proponent has made a number of commitments regarding the occupational health matters. Accordingly, the Authority, considers that the proponent needs to liaise with the Commission on these issues.

8. CONCLUSION

The Environmental Protection Authority has concluded that the proposed Integrated Waste Disposal Facility would be environmentally acceptable, subject to the following recommendations:

RECOMMENDATION 1

The Environmental Protection Authority concludes that the proposed Integrated Waste Disposal Facility is environmentally acceptable and recommends that it could proceed subject to the EPA's Recommendations in this report and the proponent abiding by the environmental commitments in the Public Environmental Report including (see Appendix A):

- **the operation will be controlled by the Health Department of Western Australia;**

- **the facility will be owned by the Health Department of Western Australia;**

- **wherever possible transport will be by rail;**

. **a monitoring programme will be implemented; and**

. **personnel will be trained in emergency response procedures.**

The Authority assessed all three sites and concluded that all sites were in principle suitable for the disposal of solid intractable wastes and the siting of a high temperature incinerator. However, there would be a requirement for further investigation of the chosen site to confirm the depth of clay and the absence of potable groundwater.

RECOMMENDATION 2

The Environmental Protection Authority recommends that the proponent drill the chosen site to confirm the absence of potable water and to confirm the depth of clay is in excess of 15 m and forward results to the EPA for review.

The Health Department would also have to undertake a survey of the vegetation, flora and fauna, and Aboriginal sites at the chosen site.

RECOMMENDATION 3

The Environmental Protection Authority recommends that prior to construction, the proponent undertaken biological surveys to indicate the impact of the facility on rare and endangered species to the satisfaction of the EPA.

RECOMMENDATION 4

The Environmental Protection Authority recommends that prior to construction, the proponent undertake a survey for Aboriginal sites to comply with the Aboriginal Heritage Act.

RECOMMENDATION 5

The Environmental Protection Authority recommends that prior to commissioning the proponent prepare an Environmental Management Programme to the satisfaction of the EPA, and that the EMP be available to members of the public. The EMP should address:

. **size of the incinerator;**

. **operational procedures;**

. **transportation of the wastes;**

. **emergency procedures;**

. **radiation monitoring programme; and**

. **organochlorine monitoring programme.**

RECOMMENDATION 6

The Environmental Protection Authority recommends that prior to commissioning the proponent undertakes the following for all stages of the

transport operation to the satisfaction of the EPA and relevant Government agencies and that it be included in the Environmental Management Programme:

. establish detailed specifications for organochlorine loading, transfer and unloading areas;

. establish detailed specification for low level radioactive wastes loading transfer and unloading areas;

. outline specific safeguards for rail containers containing organochlorine and low level radioactive waste;

. detail plant site storage and handling requirements, including fire safety;

. identify responsibility for the various aspects of transport and transfer operations;

. prepare contingency plans for dealing with spillages should they occur; and

. liaise with the local communities over emergency procedures.

RECOMMENDATION 7

The Environmental Protection Authority recommends that the proponent should report the results of the monitoring programme to the EPA six monthly and that these results should be made available to the public.

RECOMMENDATION 8

The Environmental Protection Authority recommends prior to commissioning the proponent prepares a hazard and safety management strategy for the incinerator to the satisfaction of the EPA and relevant Government agencies.

RECOMMENDATION 9

The Environmental Protection Authority recommends that the disposal at the Integrated Waste Disposal Facility of any wastes other than those specified in the PER should be referred to the EPA for assessment.

9. REFERENCES

Environmental Protection Authority (1987), Western Australian PCB Incineration Facility near Koolyanobbing. Health Department of Western Australia. Report and Recommendations of the Environmental Protection Authority, Bulletin 297.

Environmental Protection Authority (1987), Proposed Integrated Petrochemical Complex at Kwinana. Petrochemical Industries Company Limited. Report and Recommendations by the Environmental Protection Authority, Bulletin 331.

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International Atomic Energy Agency (1982), Site Investigated for Repositories for Solid Radioactive Wastes in Shallow Ground. Technical Report Series No 216.

MINISTER FOR ENVIRONMENT

STATEMENT THAT A PROPOSAL MAY BE IMPLEMENTED (PURSUANT TO THE PROVISIONS OF THE ENVIRONMENTAL PROTECTION ACT 1986)

PROPOSED INTEGRATED WASTE DISPOSAL FACILITY
EASTERN GOLDFIELDS WESTERN AUSTRALIA

HEALTH DEPARTMENT OF WESTERN AUSTRALIA

This proposal may be implemented subject to the following conditions:

1. The proponent shall adhere to the proposal as assessed by the Environmental Protection Authority and shall fulfil the commitments made in the Public Environmental Report (copy of commitments attached).

2. Prior to construction of the proposal, the proponent shall undertake a drilling programme at the chosen site to confirm (or otherwise) the absence of potable water and to confirm (or otherwise) that the depth of clay is in excess of 15 metres, and forward results to the Environmental Protection Authority for assessment.

3. Prior to construction, the proponent shall undertake biological surveys to the satisfaction of the Environmental Protection Authority, to indicate the impact of the facility on any rare and/or endangered species.

4. Prior to construction, the proponent shall undertake a survey to the satisfaction of the Registrar of Aboriginal Sites, to determine if any Aboriginal sites exist on the project area.

Published On
26 OCT 1988

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5. Prior to commissioning, the proponent shall prepare an Environmental Management Programme (EMP) to the satisfaction of the Environmental Protection Authority. The EMP shall be made available to the public and shall include:

- size of the incinerator;
- operational procedures;
- transportation of the wastes;
- details of packaging of the wastes;
- emergency procedures;
- protection of any rare or endangered species found on or near the site;
- disposal of waste containers and other solid wastes from the facility;
- a monitoring programme.

6. Prior to commissioning, the proponent shall undertake, for all stages of the transport operation, the following:

- establish detailed specifications for waste loading, transfer and unloading areas;
- outline specific safeguards for rail containers and their contents;
- detail plant site storage and handling requirements, including fire safety;
- identify responsibility for the various aspects of transport and transfer operations;
- prepare contingency plans for dealing with spillages should they occur; and
- liaise with the local communities over emergency procedures.

The above matters shall be included in the Environmental Management Programme and shall be to the satisfaction of the Environmental Protection Authority and relevant Government agencies.

7. The proponent shall report the results of the monitoring programme to the Environmental Protection Authority at six monthly intervals. These results shall be made available to the public following their consideration by the Environmental Protection Authority.

8. Prior to commissioning, the proponent shall prepare a hazard and safety management strategy for the incinerator, to the satisfaction of the Environmental Protection Authority and relevant Government agencies.

9. Any proposal to dispose of wastes other than those specified in the Public Environmental Report at the Integrated Waste Disposal Facility, shall be referred by the proponent to the Environmental Protection Authority for assessment. No such wastes shall be disposed of at the facility unless it is found to be environmentally acceptable to do so following referral and assessment.

10. The proponent shall be responsible for decommissioning the facility and rehabilitating the site and its environs to the satisfaction of the Environmental Protection Authority.

11. The proponent shall, at least six months prior to decommissioning, prepare a decommissioning and rehabilitation plan to the satisfaction of the Environmental Protection Authority.

12. The proponent shall obtain a Works Approval (prior to construction) and a Licence (prior to commissioning) for the proposed facility under the provisions of Part V of the Environmental Protection Act 1986.

13. For any proposal to dispose of "other wastes" referred to the Environmental Protection Authority pursuant to Condition 9, and subsequently found to be acceptable, the proponent shall prepare (to the satisfaction of the Environmental Protection Authority) an Environmental Management Program, which shall include the issues listed in Conditions 5 and 6 for that proposal.

Barry Hodge, MLA
MINISTER FOR ENVIRONMENT

25 OCT 1988

Appendix C

APPENDIX C

SUMMARY AND RECOMMENDATIONS FROM THE EPA AND DASETT ASSESSMENT REPORTS

RARE EARTH TREATMENT PLANT
RHONE POULENC CHIMIE AUSTRALIA PTY LTD

Report and Recommendations
of the
Environmental Protection Authority

Environmental Protection Authority
Perth, Western Australia

Bulletin 352 September 1988

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i SUMMARY AND RECOMMENDATIONS

Rhone Poulenc Chimie Australia Pty Ltd, has submitted a proposal to establish a Rare Earth Treatment Plant at Pinjarra in Western Australia.

The proposal has two stages. The first stage would treat the monazite with caustic to produce a solid containing rare earth hydroxides and a calcium phosphate waste. The second stage would treat the solid containing the rare earth hydroxide to produce rare earth salts, thorium waste and the ammonium nitrate waste. Upon consideration of the proposal the Environmental Protection Authority has concluded that Stage One is environmentally acceptable and that Stage Two is not environmentally acceptable.

The project at full production would process 15,000 tonnes of monazite per annum to produce rare earth salts and a product containing rare earth hydroxide. The proponent would initially only produce the rare earth hydroxide product, and then at a later date half of that product would be treated at Pinjarra to produce rare earth salts.

Stage One of the process would produce calcium phosphate as a waste product which would be disposed of in evaporation ponds in Pinjarra. Stage Two would produce a low level radioactive thorium hydroxide waste, which would be disposed of off site, and liquid wastes containing ammonium nitrate and radium which would be disposed of in the evaporation ponds.

The project would have a construction workforce of approximately 200 people and a permanent workforce of 100 people.

The Environmental Protection Authority determined that an Environmental Review and Management Programme would be required to assess the proposal. The Commonwealth Department of the Arts, Sport, Environment Tourism and Territories also wished to assess the proposal, therefore the Environmental Review and Management Programme had to fulfill the requirement of a Draft Environmental Impact Statement. The ERMP had a public review period of ten weeks.

The Environmental Protection Authority has previously assessed a proposal by Allied Eneabba to establish a Rare Earth Treatment Plant and this was found to be environmentally acceptable. That proposal was located at a different site and was using a different process. That site does not have the same constraints as the Pinjarra Site inpart because the groundwater is not potable and the site is not in the catchment of an inlet system with nutrient enrichment problems.

The Environmental Protection Authority has reached conclusions on the two stages of the proposal separately, taking into account the public submissions received, and the proponents response there to.

The Authority has concluded that Stage One of the proposal which would produce the rare earth hydroxide product, is environmentally acceptable.

RECOMMENDATION 1

The Environmental Protection Authority concludes that Stage One of the proposal to produce rare earth hydroxide product is environmentally acceptable and recommends that it could proceed subject to the EPA's recommendations and the proponent abiding by the environmental commitment in the Environmental Review and Management Programme (Listed in Appendix A

A) including:

- management of principal sources of radiation exposure;
- commitment to the ALARA (as low as reasonably achievable), principle of minimizing radiation doses; and
- management of the closure and rehabilitation of Pinjarra evaporation ponds.

RECOMMENDATION 2

The Environmental Protection Authority recommends that before commissioning the plant the proponent prepare and implement a groundwater monitoring programme to the satisfaction of the EPA and the Water Authority of Western Australia.

RECOMMENDATION 3

The Environmental Protection Authority recommends that should the monitoring of the underdrains or groundwater identify seepage containing excess quantities of salts, then the problem should be rectified and the design of future evaporation ponds should be modified by the proponent to prevent seepage from the ponds.

RECOMMENDATION 4

The Environmental Protection Authority recommends that the transport of Rare Earth Hydroxide Product be restricted to carriage by road to Pinjarra and by rail from Pinjarra to Fremantle.

RECOMMENDATION 5

The Environmental Protection Authority recommends that prior to decommissioning a rehabilitation plan for the evaporation ponds be prepared and implemented by the proponent to the satisfaction of the EPA and Department of Mines.

The Authority has also reviewed the potential impacts of Stage Two of the proposal. For the proposal to be acceptable it must be demonstratably possible to manage the environmental impacts during the operational phase and the long term environmental impacts and occupational health issues must be acceptable. There must be a "walk away" solution such that the state does not incur future environmental problems after completion of the project. The major environmental issues associated with Stage Two of the proposal are:

- production, transport and disposal of the thorium hydroxide radioactive waste;
- radium disposal in the evaporation ponds; and
- ammonium nitrate disposal in the ponds.

1. Transport of Thorium Hydroxide Waste

The transport of the thorium hydroxide has been addressed in the Public Environmental Report on the Department of Health's Integrated Waste Disposal Facility. The proposal to transport the waste in iso-container by rail and road to the Integrated Waste Disposal Facility would meet the Commonwealth Code of Practice for the Safe Transport of Radioactive Substances. The Environmental Protection Authority considers that the transport of the waste may be manageable but requires further investigation and community involvement.

2. Disposal of the Thorium Waste

The Authority believes that disposal of the thorium waste could occur in an environmentally acceptable manner. This has been addressed in greater detail in the Environmental Protection Authority's Report and Recommendations on the Integrated Waste Disposal Facility, Bulletin No 353.

3. Radium Disposal in the Evaporation Ponds

The Authority has concluded that the disposal of small quantities of radium 226 and 228 in the evaporation ponds at Pinjarra does not represent an environmental (nor health) threat.

4. Ammonium Nitrate Disposal in the Evaporation Ponds

16,000 tonnes per annum of ammonium nitrate would be disposed of in the evaporation ponds. The Environmental Protection Authority believes that this should be environmentally manageable during the operational phase of the proposal. However, the Authority does not consider the storage of large quantities of ammonium nitrate, above potable groundwater and in the catchment of the Peel-Harvey Inlet, which has nutrient enrichment problems, to be environmentally acceptable in the long term.

The ammonium nitrate waste would consist of three streams:

- 10,000 tonnes per annum of clear ammonium nitrate;
- 2,000 tonnes per annum of ammonium nitrate contaminated with organic material; and
- 4,000 tonnes per annum of ammonium nitrate contaminated with 7 gram per annum radium.

It may be possible to sell as fertilizer and/or explosive, the clean ammonium nitrate and the organic contaminated ammonium nitrate. It would not be possible to sell the remaining radium contaminated ammonium nitrate.

There is no apparent environmentally acceptable method available for removal, transportation and disposal of the radium contaminated ammonium nitrate.

The option involving the removal of the radium from the ammonium nitrate by a radium removal circuit in the plant, hence allowing the ammonium nitrate to be sold and removed from the ponds is unacceptable from an occupational health aspect.

Given that many of the environmental issues raised by stage two have yet to be satisfactorily resolved the Environmental Protection Authority has concluded that Stage Two is environmentally unacceptable.

RECOMMENDATION 6

The Environmental Protection Authority concludes that Stage Two is environmentally unacceptable and recommends that it does not proceed for the following reasons:

a) The long term storage of large quantities of ammonium nitrate in the Peel-Harvey Catchment is unacceptable in the long term because of the potential to add significant quantities of nitrogen to the Peel Harvey Inlet an area already subject to nutrient enrichment problem;

b) The long term storage of large quantities of ammonium nitrate above potable and near potable ground water sources is unacceptable in the long term because of the potential to pollute those sources with nitrate, and

c) There is no apparent environmentally acceptable method for the removal, transportation and disposal of radium contaminated ammonium nitrate.

MINISTER FOR THE ARTS, SPORT, THE ENVIRONMENT, TOURISM AND TERRITORIES

17 OCT 1988

Mr Dominique Namer
General Manager
Rhone-Poulenc Chimie Australia Pty Ltd
P.O. Box 6310
Hay Street East
Perth WA 6000

Dear Mr Namer,

I am writing to you to advise you that my Department has completed its environmental examination of the environmental impact study (EIS) on the proposal by your company to construct and operate a rare earths processing plant at Pinjarra in Western Australia.

A copy of my Department's assessment report is enclosed.

On the basis of my Department's examination of the EIS and public comments made on it, I consider that the environmental aspects of the proposal have been fully examined and taken into account and therefore the object of the Environment Protection (Impact of Proposals) Act has been met.

However, I have recommended to the Treasurer, pursuant to paragraph 9.3.1 of the Administrative Procedures under the Act, that in any approval he might give under the Government's foreign investment policy he should take into account the recommendations set out in the attachment to this letter.

I have also advised the Western Australian Minister for the Environment, the Hon. Barry Hodge, of the result of this assessment.

Yours sincerely

Graham Richardson

GRAHAM RICHARDSON

PARLIAMENT HOUSE, CANBERRA, A.C.T. 2600

ADVICE AND RECOMMENDATIONS TO THE TREASURER ON THE RHONE-POULENC RARE EARTHS PLANT, PINJARRA, WESTERN AUSTRALIA.

The following advice and recommendations are made in accordance with paragraph 9.3.1 of the Administrative Procedures under the Environment Protection (Impact of Proposals) Act 1974.

An Environmental Impact Study (EIS) was prepared for and submitted by Rhone-Poulenc Chemie Australia Pty Ltd (the proponent). The EIS has complied with the requirements of the Administrative Procedures and, together with written comments received during the public review period of the EIS and the proponent's response in the final EIS, provides a sufficient basis for examination of the environmental effects of the proposal.

The assessment of the EIS, public comments, the proponent's response and additional background material provided by or on behalf of the proponent indicated that there is no overriding environmental reason for not granting foreign investment approval for the project provided that the following recommendations are taken into account to minimise the environmental impact of the proposal:

(i) that the proponent establish and operate the proposed rare earths plant in a manner consistent with the undertakings given in the EIS, and arrangements below. In particular, the proponent should commit the design and operation of the plant to the ALARA (as low as reasonably achievable) Principle as regards radiation protection; and

(ii) that satisfactory arrangements be made for the following:

- the proponent submit for approval of the Western Australian Environmental Protection Authority (WAEPA), prior to commencing Stage I of the proposal, a groundwater monitoring program for the evaporation ponds at Pinjarra;

- prior to development of Stage II of the proposal the proponent must obtain approval from WAEPA for a strategy for the management of nutrients generated by the proposal; and

- prior to decommissioning the rare earths plant a rehabilitation plan for the evaporation ponds, which meets with the approval of WAEPA, must be prepared.

SUMMARY AND RECOMMENDATIONS

A. SUMMARY

Rhone-Poulenc Chimie Australia Pty Ltd (Rhone-Poulenc) has prepared an environmental impact statement in accordance with the Administrative Procedures under the Commonwealth's Environment Protection (Impact of Proposals) Act. The proposal is to establish a rare earths treatment plant at Pinjarra in Western Australia. The plant is expected to be built in two stages with an ultimate capacity to process up to 15,000 tonnes of monazite per annum. The project would have a construction workforce of approximately 200 people and a permanent workforce of some 100 people when fully developed.

The proposal has two stages. The first stage involves the treatment of monazite with caustic to produce an intermediate product (rare earth hydroxide) and a calcium phosphate waste. Stage two involves the production of the intermediate product as well as further processing to produce rare earths. The calcium phosphate produced in Stage I will be disposed of in the evaporation ponds adjacent to the plant site at Pinjarra. The second stage produces thorium a low level radioactive waste which is to be disposed of off site in a proposed WA Government Integrated Waste Disposal Facility proposed for the eastern goldfields. Other wastes produced in Stage II are, ammonium nitrate and a radioactive stream (containing small amounts of radium) which would be disposed of in the evaporation ponds on site.

The environmental assessment of the proposal was undertaken in accordance with agreed arrangements between the Commonwealth and the WA Governments for the joint environmental assessment of projects. So that one document satisfied the requirements of both Governments an Environmental Impact Statement/Environmental Review and Management Programme was prepared; the document was released for public review for 10 weeks.

The WA Environmental Protection Authority concluded that Stage I of the proposal was environmentally acceptable. However Stage II was not acceptable having regard to the potential, in the long term, for nutrients to enter and adversely effect the Peel-Harvey Inlet system. This system is currently under environmental stress due to nutrients arising primarily from the use of fertiliser in the wheat belt which comes within the catchment of this system.

The key issues that have arisen during the assessment are:

The disposal of ammonium nitrate waste - This is to be stored in on site evaporation ponds when this waste is generated in Stage II. An assessment of the surrounding hydrology has led to the development of monitoring and underdrainage systems which should ensure potential pollution is controlled. In the long term no assurance can be given that nutrients from these ponds will not drastically effect the Murray River and the Peel-Harvey Inlet System. This system has recently had approved remedial measures to lower its nutrient load and involves floating so as to lower nutrient levels.

The disposal of low level radioactive waste - Two streams of low level radioactive waste will come from this plant during Stage II. One stream will be disposed of in evaporation ponds. Calculations undertaken have identified the necessary design parameters for the plants disposal ponds and the Department considers that the measures taken will be sufficient to minimise the movement of radionuclides from the ponds into the environment.

A second stream of waste, thorium hydroxide, is also involved in Stage II of the project. This waste is to be the responsibility of the WA Government at the plant gate and has been the subject of separate environmental assessment contained in a Public Environment Report prepared for the WA Government. This aspect of the proposal is not examined in detail in this assessment.

B. RECOMMENDATIONS

It is recommended that the Treasurer be advised, pursuant to paragraph 9.3.1 of the Administrative Procedures under the Environment Protection (Impact of Proposals) Act that the object of the Act has been achieved in relation to the proposal, but that any approval under the Commonwealth Government's foreign investment policy should be subject to:

i) Rhone-Poulenc establishing and operating the proposed rare earths plant in a manner consistent with the undertakings given in the environmental impact statement, and arrangements below, in particular, Rhone-Poulenc committing the design and operation of its plant to the ALARA (as low as reasonably achievable) principal as regards radiation protection; and

ii) satisfactory arrangements being made for the following:

- Rhone-Poulenc submit for approval of the WA Environmental Protection Authority, prior to commencing of Stage I of the proposal, a groundwater monitoring program for the evaporation ponds at Pinjarra;

- prior to development of Stage II of the proposal, Rhone-Poulenc has to obtain from the WAEPA an approved strategy for the management of nutrients generated by the proposal; and

- prior to decommissioning of the plant a rehabilitation plan for the evaporation ponds be prepared and approved by the WA Environmental Protection Authority.

Appendix D

APPENDIX D

COMPARISON OF RISKS AND HAZARDS FOR ROAD AND RAIL

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A component of the evaluation study is to compare the risks and hazards associated with road and rail transport of the low level radioactive residue with the aim of proposing a mode of transport which minimises potential human health and environmental impacts.

It is pertinent to note that the nature of the material is not as hazardous as other materials which are transported daily on metropolitan and country roads and that there will be only 3 truck movements per week.

The following discussion is based on studies conducted on far more hazardous and mobile materials such as sodium cyanide, chlorine, ammonia, LPG and motor spirit and hence can be conservatively applied to the transport of the low level radioactive residue.

In Western Australia, about 80 percent of the dangerous goods transported by road is motor spirit comprising about 7 million litres/day (O'Brien, 1994) or approximately 250 tankers/day, a risk readily accepted by the public.

A recent study conducted for Australian Gold Reagents on the Transport of Sodium Cyanide Solution from Kwinana (O'Brien, 1994), noted that the most recent and extensive data on relative risks of road versus rail transport demonstrate that generically the two modes of transport have comparable safety.

These findings were based on the following (O'Brien, 1994):

- the Dutch consultant, TNO (TNO, 1984) prepared a report in 1984 showing that rail and road had comparable safety (which superseded their previous 1982 report finding that rail was 5,000 times safer than road transport);

- a five year $2.5 million hazard analysis conducted by the Health and Safety Commission (HSC) of the United Kingdom documented in 1991 that one cannot say that road is generally safer than rail or vice versa; and
- a Working Party of the Western Australian Dangerous Goods Liaison Committee (1993) found that the United Kingdom HSC findings and other international findings could be applied to Western Australia and give conservative results.

The 1984 TNO study analysed the risks of fatalities for road transport versus rail transport of 100,000 tonnes of liquefied petroleum gas (LPG), for movements of 13.5 tonne by trucks and 23 tonne by rail in Wellington, New Zealand. The analyses indicate that, for this case, risk associated with rail and road movements are similar when account is taken of the higher capacity of the rail.

An extensive Quantified Risk Assessment (QRA) was conducted by the HSC of the United Kingdom (HSC, 1991). All relevant factors were considered in analyses of the transport of dangerous goods by road and rail throughout the United Kingdom. This study focussed on four chemicals:

- chlorine;
- ammonia;
- LPG; and
- motor spirit.

The general conclusions of the HSC analysis is:

> *"what is clear from our assessment is that one cannot justifiably say that road is generally safer than rail or vice versa. While comparison of any particular pair of routes might conceivably suggest a choice in that particular case, there seems to be no justification in conditions in Great Britain for legislation requiring a general transfer on safety grounds, even of long-haul traffic, from road to rail, or the reverse".*
>
> *(HSC, 1991)*

A Working Party for the Dangerous Goods Liaison Committee (DOME 1993) was established to:

- consider the public safety issues associated with the setting of routes for dangerous goods vehicles in Western Australia; and
- make recommendations to the Dangerous Goods Liaison Committee on the need, or otherwise, for more research in this area.

Numerous studies relating to those issues were considered and various indicators reviewed to determine the validity of applying conclusions from overseas studies to the transport of dangerous goods in Western Australia. The three major studies considered were:

- the United Kingdom HSC Report (HSC, 1991) mentioned above;
- a Canadian Report (Institute for Risk Research, 1988); and
- a Queensland Study (Queensland Transport, 1992).

After considering the various studies, assessing factors which indicate risk levels from the transport of Dangerous Goods and comparing those with Western Australia's condition, the Working Party concluded:

> *"1. Public safety issues associated with setting of routes for dangerous goods vehicles in Western Australia are not significantly different from the public safety issues identified elsewhere in Australia, UK, USA and Canada.*
>
> *2. The application of the transport of dangerous goods regulatory program to bulk vehicles in Western Australia is as good or better than similar programs in UK and North America.*
>
> *3. The applications in Western Australia of policies developed from risk analysis carried out in UK and North America using their local data, will result in relatively conservative policies for Western Australia. That is, policies which do not underestimate the level of risk."*
>
> *(DOME, 1993)*

These studies have shown that a general conclusion cannot be made as to rail being the safer mode of transport or vice versa, hence other factors must be considered when evaluating modes of transport in relation to minimising potential impacts for a particular operation.

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Appendix E

APPENDIX E

SPECIFICATION FOR WASTE GENERATED BY THE RHÔNE-POULENC RARE EARTH PLANT TO BE DISPOSED OF AT THE MT WALTON (EAST) INTRACTABLE WASTE DISPOSAL FACILITY SITE

Prepared by

Dr Bruce Hartley

Specification for Waste Generated From the Rhone-Poulenc Rare Earth Treatment Plant to Be Disposed of At the Intractable Waste Disposal Site At Mount Walton (East).

Regulations and Codes.

Two Codes of practice govern the specification for material to be disposed of at the Mount Walton (East) Integrated Waste Disposal Facility (IWDF). These codes relate to the transport of the material and the disposal and the disposal itself. In addition, regulation under the Radiation Safety Act 1975 determine limits on radiation exposure of workers and the public as a consequence of transport and disposal and determine limits on discharges and concentrations of radio-nuclides in air and water.

The code governing transport is an Australian adaptation of the International Atomic Energy Agency's Regulations for the Safe Transport of Radioactive Substances, published by the Australian Government Publishing Office and entitled "Code of Practice for the Safe Transport of Radioactive Substances 1990". This code has been adopted by regulations under the Radiation Safety Act and all transport of radioactive substances must comply with it.

The code which is applicable to disposal is the National Health and Medical Research Councils code on the disposal of radioactive Waste entitled " Code of Practice for the Near Surface Disposal of Radioactive Waste in Australia(1992)". This code has been adopted under the Radiation Safety Act and is applicable to the disposal of waste at remote arid sites such as that at Mount Walton (East).

Requirements of the Codes and Regulations

Transport

Classification of Waste

Paragraph 131 of the Transport Code defines **Low Specific Activity Material** (LSA)in three categories. The first of these applies to the waste to be produced from the Rhone-Poulenc monazite treatment plant.

LSA-1 material is defined as "Ores containing naturally occurring radionuclides(e.g. uranium, thorium), and uranium or thorium concentrates of such ores" or "Radioactive material, other than fissile material for which the A_2 value is unlimited". Both these definitions could apply to the waste from monazite treatment.

Packaging

LSA-1 material must be transported in accordance with paragraphs 422 to 427 of the Transport Code. This requires in Table V that packaging of LSA-1 material be done in IP-1 packages meaning Industrial Packages type 1.Packaging must also comply with the contamination limits specified in Paragraphs 422 to 427. The general requirements for IP-1 packages are set out in paragraphs 505 to 514 of the transport code. These paragraphs make no special requirements on the packages apart from their ability to contain the radioactive material and to be provided with lifting attachments adequate to lift the mass of the package and contents. If the waste is transported in bags these will be designed to meet the requirements of paragraphs 505 to 514.

Transport Index

The transport Index for the waste is calculated in the following manner as set out in paragraph 428 of the Transport Code. The external radiation dose rate will be measured in milli sievert per hour and multiplied by 100. It is expected that the external radiation dose from a single bag of waste will be about 0.3 milli sievert per hour. Multiplying by 100 gives a value of 30. As the material will be transported in containers with several bags per container the Multiplication Factors of Table VII must be used. If it is supposed that the size of the load is between 5 and 20 square metres the multiplication factor is 3; applied to the above number this results in a transport index of 90.

Transport

Transport will be by exclusive use and the provisions of paragraph 434 apply. "The maximum radiation level at any point on any external surface of a package under exclusive use shall not exceed 10 milli sievert per hour". The activity of the material is such that radiation levels at this level cannot occur.

Transport Categories.

It is expected that the individual packages of waste will be classified as type II-YELLOW for the purpose of individual transport. This is in compliance with Table IX of the Transport Code as it is not expected that the radiation dose rate will exceed 0.5 milli sievert per hour from a single package. For an ISO container holding 27 Tonnes of material it is expected that the dose rate will exceed 0.5 milli sievert per hour and the full freight container will be classified as type III-YELLOW for the purposes of transport under exclusive use.

Individual packages and containers of waste would need to be segregated during transport to comply with paragraphs 460 and 461, unless the transport is done as exclusive use. Dose limits to transport workers and the general public are given in paragraph 205. These are set as 5 milli sievert per year for transport workers and 1 milli sievert per year for the critical group of the general public.

Stowage for Transport

Paragraphs 462 to 466 set out requirements for stowage for transport of radioactive packages. Paragraph 465 (a) is relevant for the waste material to be produced by the monazite treatment plant. It states "For consignments of LSA-1 material there shall be no limit on the sum of transport indices".

Storage in Transit

Paragraphs 478 to 482 deal with storage in transit. The dose limits of paragraph 205 will apply but paragraph 481 states that the requirements of the maximum sum of transport index and total numbers of packages will not apply to LSA-1 material. There should, therefore, be no limit on the number of containers which can be stored awaiting transport or in transit.

Labelling.

Individual packages of waste will be labelled with type II-YELLOW transport labels. Containers of waste will be labelled with type III-YELLOW labels under exclusive use. Transport vehicles will be labelled according to paragraph 467 of the Transport Code i.e. if a road vehicle is involved it will be labelled with signs conforming with Figure 5 of the code on both sides and the rear of the vehicle and for a rail vehicle on the two sides. In addition since the loading will be exclusive use the Label of figure 6 will be incorporated into the sign of figure 5 and the United Nations number 2912 will be used indicating transport of Low Specific Activity material to comply with Appendix I of the Transport Code.

Disposal

Classification of Waste.

The waste is classified in the Code of Practice for the Near Surface Disposal of Radioactive Waste in Australia in section 2.5. The waste to be produced at the monazite treatment plant is clearly category C waste as it is "solid waste containing alpha-, beta- or gamma-emitting radionuclides with activity concentrations similar to those for Category B. However, this waste typically will comprise bulk materials, such as those arising from downstream processing of radioactive minerals, significantly contaminated soils, or large individual items of contaminated plant or equipment for which conditioning would prove to be impractical".

General Requirements

The general requirements for the waste to be disposed of are set out in Section 2.6.6 of the Waste Code. These requirements are that the waste does not contain materials which are either corrosive, flammable or combustible, capable of generating gases, capable of causing explosions, pyrophoric, biodegradable, toxic or pathogenic or contain chelating agents. Liquid waste should be solidified for disposal.

Activity Level

Generic activity level for Category C Waste to be disposed of at a remote arid site are set out in Table 3 of the Waste Code. Those isotopes of interest for the monazite waste are those for Radium 226, Thorium 232 and Uranium in equilibrium with progeny. These are given as activity concentrations of $5x10^5$ Becquerel per Kilogram for both 100 and 200 year institutional control periods. These convert to mass concentration limits of 12.5% by weight for thorium and 4% by weight for uranium.

Regulations

Limits on Releases

The regulations under the Radiation Safety Act impose limits on radioactivity and water released from registered premises. The activity concentration limits given in Schedule VIII of the regulation are derived from ICRP publication 2 and are generally considered to be out of date. Any release from the site should be controlled by general dose limits set in regulations. These impose a limit of 1 milli sievert per year for members of the public and 20 milli sievert per year for radiation workers. Specific limits for radioactivity in air and water will be derived and applied to conform with those limits.

Specification of the Waste

The specification for the waste is designed to meet the requirements set out above and describe the physical and chemical form of the waste to be disposed of.

The waste will be produced as a filter cake containing about 40% moisture. It will be packaged in to bags containing about 1.8 tonnes. Bagging will be automatic and the bags will be similar to those bags used for the transport of monazite. They are woven poly-propylene bags with a double poly-ethane plastic water-proof liner. Webbing straps which go under the bags provide lifting handles.

The waste will not contain any of the undesirable chemical properties listed in Section 2.6.6 of the Waste Code and summarised above.

The waste will consist of the components shown in Table 1. The final row is the Thorium content expressed as elemental thorium and is the number calculated from the concentrations of $Th(OH)_4$ and un-reacted Monazite calculated as 6% Thorium. This is the concentration which will need to meet the disposal code. Uranium Content will be 0.6% by weight.

Component	Dry Weight Percentage	Damp Weight Percentage*	Wet Weight Percentage
Water	0.0%	10.0%	40.0%
$RE(NO_3)_3$	5.0%	4.5%	3.0%
$Th(OH)_4$	22.0%	19.8%	13.2%
$UO_2(OH)_2$	1.0%	0.9%	0.6%
$BaSO_4$	38.0%	21.6%	22.8%
Monazite	10.0%	9.0%	6.0%
Gangue + Insoluble SO_4	24.0%	21.6%	14.4%
Thorium as Element	17.5%	15.7%	10.5%
Uranium as Element	0.8%	0.7%	0.5%

Table 1 Components of the Waste Stream.

(* The 'Damp Weight Percentage" refers to the reference moisture content of the waste after it reaches an equilibrium water content appropriate to the moisture content of the surrounding clay. This has been adopted as a reference level of moisture content for the purposes of determining compliance with the Code for Waste disposal. (Ref: Personal Communication, Office of Waste Management)).

A small quantity of absorbing agent such as clay or cement will be added to the waste to prevent the formation of free water form settling during transport. The addition of drying agent is not expected to make the waste go rock hard as not sufficient will be added for that to occur. This addition will be done automatically during the bagging stage.

In accordance with paragraph 4 of clause 2.6.3 of the Waste Code, the activity can be averaged over the volume of the disposal structure. The method of disposal will ensure that layers of inert material will cover bags to reduce radiation levels and dilute the waste by the ratio 1 part of waste to 0.43 parts of neutral material to meet the code requirements.

As all the radioactivity will report to the waste stream it is expected that the waste will be in close to secular equilibrium although there will be different chemical species involved. In any case secular equilibrium will be restored after about 30 years for the Thorium decay chain but not until about 10,000 year for the Uranium decay chain. These times are governed by the half lives of the Radium 228 and Radium 226 respectively.

Any minor contamination of other products from incomplete chemical separation will be monitored.

Verification of specifications

The specification of the waste will be confirmed by testing the waste at its point of production on a regular basis. The following test are proposed as generic tests to confirm the specifications. The details of the tests will be examined when waste is being produced and refined in accordance with best practice.

Thorium Content

This will be tested on a routine basis as part of the quality control of the chemical plant. The concentration will be tested and reported daily.

Uranium Content

This will be tested and reported daily.

Radioactive content

This will be tested to determine that the waste is close to secular equilibrium and that all radioactive components have reported to the waste. Other products will also be tested for radioactivity as part of the quality control of the process.

pH

pH will be tested daily to ensure that the waste is not corrosive and as part of the quality control of the process.

Moisture content

Moisture content will be tested both before the addition of drying agents.

Other tests

The other components of the waste will be determined as required to be sure that the nature of the waste does not significantly change. The other components are chemically inert.

Appendix F

APPENDIX F

COMMUNITY CONSULTATION WORKSHOPS

Prepared by

Nayton Communications

Rhône-Poulenc Rare Earth Project

Community Workshops

A program of community workshops has played an important role in planning the proposed Rhône-Poulenc Australia Ltd rare earth project. The workshops are part of a broad-based public consultation program undertaken by Rhône-Poulenc since April this year. More than 100 local residents and members of the conservation movement participated in five workshops held in May and June. Another three workshops are planned for September and October during the formal public review period for the project Environmental Review and Management Program (ERMP).

The results of the workshops, outlined in this document, have helped to shape a number of important aspects of the project plans. In addition, input from the company has broadened the scope of studies into environmental and social issues associated with the project. Some of the community priorities which have been incorporated into current project plans include -

- a company commitment to ensure public access to monitoring and assessment information
- a proposal for independent audits
- transport scheduling to avoid traffic conflict
- plans for training and resourcing volunteer emergency services on the waste transport route
- the introduction of criteria for local preference policies to ensure maximum regional benefits from the project
- an expanded ERMP to cover more than 200 specific issues raised by workshop participants.

The workshops were proposed by the WA Conservation Council and local community representatives as a way of involving the public in the early stages of project planning. The initiative complemented a series of earlier community consultation commitments by the company.

The first of the workshops was held at the Coolgardie Shire Hall on May 17, followed by workshops at Pinjarra Senior High School On May 18 and May 20. In each case, the program was advertised in local papers. The advertisements were supported by letters and phone calls to community groups and individuals with a possible interest in the project. Local authorities provided lists of people likely to participate in the workshops. All of the potential participants were sent summary documents outlining the project.

The issues were discussed with the WA Conservation Council at a special meeting at the council offices on May 23. The conservation council discussions were arranged as an informal meeting to deal with some of the technical issues. The meeting reviewed sections of a draft environmental impact statement.

A workshop at Southern Cross was delayed for three weeks to allow the completion of grain seeding in the district's farming areas. The forum went ahead on June 14 at the Southern Cross Recreation Centre.
The four community workshops were co-ordinated by independent facilitators to ensure an effective exchange of information between the company and the community. During the course of the program, the facilitators who ran the workshops were Dr Geoff Syme (a CSIRO social scientist who set up the workshop format), Gail Broady and Richard Leavitt.

At each workshop, key aspects of the project were outlined by company executives or consultants. The presentations were followed by questions from the community participants. After a light refreshment break, the audience broke into smaller groups - or worked as a single discussion group - to identify the major issues.

After each discussion, summaries - which included a list of all of the questions - were circulated to the people who attended. The participants were invited to add comments or questions to the reports.

The major issues to emerge from the workshops were -

- The potential impacts of waste transport.
- Transport arrangements for raw materials and reagents.
- Community objections to the transfer of waste from one region to another.
- Management of potential radiation risks to workers and the community.
- The need for independent monitoring and public access to information.
- Environmental management at the Pinjarra site and the Mount Walton East disposal site.
- Changes to the company's earlier rare earth proposal in 1988.
- The need for preference policies to ensure local benefits from the project.
- The need for training and employment of people recruited from the Murray Shire.
- Pinjarra's concern for Goldfields residents over issues of radioactive waste disposal.
- The need for effective public participation in the project planning and assessment.
- Concerns over prospect of Mount Walton East becoming a national waste repository.
- Responsibility for waste at the disposal site.
- Questions about the quality of Government groundwater information on Mount Walton East.
- Doubts about the value of community workshops.
- The company's French associations.

The issues have been addressed in the ERMP and separate reports to the workshop participants.

The workshops formed part of a wider community consultation program which the company intends to retain throughout the planning, development and operational stages of the project.
The key aspects of the program are:

- briefings to local authorities and community groups in the areas of major interest,
- community workshops,
- regular media statements, columns and advertisements,
- the establishment of an information centre,
- a free call information line,
- tours of the Pinjarra site,
- participation in community liaison groups, and
- direct mail circulation of information to residents.

More details of the community relations program are contained in the company's ERMP.

The following reports contain a list of all of the questions and concerns raised by participants in the community workshops. Also included is the company's response.

Report on the Coolgardie Community Workshop

Coolgardie Shire Hall - 17 May 1995

Background

International chemical company Rhône-Poulenc is planning a rare earth project to process Western Australian Monazite. The proposed plant at Pinjarra will extract elements used for high technology products. Waste, containing the radioactive elements thorium, uranium and radium will be transported to the Government's Intractable Waste Disposal Facility at Mount Walton East 140 kilometres north west of Coolgardie townsite.

Rhône-Poulenc has set up a series of community workshops to help identify key issues in planning and assessing the project. The first of the workshops, held at Coolgardie Shire Hall on May 17, was attended by 34 people - including 25 Goldfields residents. Additional workshops were planned to provide discussion forums for conservation groups, Pinjarra residents and local authorities on proposed transport routes. The discussions at Coolgardie were co-ordinated by two independent facilitators - Dr Geoff Syme of the CSIRO and Gail Broady of Integra.

Objectives of the workshops - Dr Geoff Syme

The workshops are intended to improve public participation in the project assessment and planning. The idea has the support of the State Environmental Protection Authority, which will review the plans and public submissions before making detailed recommendations to the WA Government. In this context, the workshops provide -

- a forum for local residents to raise concerns and ideas about the project, and
- an opportunity for Rhône-Poulenc to explain the company's plans.

Each participant was sent a summary of the proceedings and invited to comment on the contents. The questions and comments from the workshop were listed in the project environmental impact statement.

The workshop was divided into three sessions -

- an open forum for presentation by company representatives, with some questions from the audience,
- discussion groups to identity the key issues, and
- a review of the community concerns and company commitments by all of the participants.

Project outline - David Newton, Chief Executive, Rhône-Poulenc Australia

The plant

Rhône-Poulenc plans a $45 million rare earths plant on company owned land at Pinjarra. The plant will convert monazite, a byproduct of WA titanium minerals production, into rare earth nitrates for export to Europe and North America. At present, monazite has no commercial markets. The mineral is stockpiled or returned to mine sites for disposal.

The rare earth plant development will allow the company to resume production at its gallium plant - originally constructed in 1989 to share infrastructure facilities with the rare earth project. The $50 million gallium facility was placed on standby in 1990 when markets declined and the company's first rare earth proposal was shelved.

The new rare earth plant proposal will employ 150 people during construction and 60 employees in operations. Combined rare earth and gallium exports will be worth $50 million a year.

The products

Rare earth elements are used in a wide range of high technology products including catalytic converters to reduce vehicle exhaust pollution, low energy lighting, television colours, x-ray screens and electronics. Gallium is used as a replacement for toxic mercury and cadmium. One Australian company is developing a gallium amalgam to replace mercury in dental fillings.

The process

The Pinjarra plant will process monazite into three streams -

- rare earth nitrates, for export
- phosphates for use in fertiliser production, and
- a waste stream, containing radioactive elements, to be transported to Mount Walton in the Coolgardie Shire for disposal.

The waste disposal site

If the rare earth project is approved, the company will be directed to dispose of its waste at the Government's integrated waste disposal facility approximately 140 kilometres north west of Coolgardie townsite. Mount Walton has been chosen because the area is remote and comparatively dry. The deep clay subsoil and absence of fresh water aquifers makes the site ideal for secure, long term waste disposal. By contrast, the mining districts which produce monazite are in sandy areas with comparatively high rainfall and high water tables.

The waste

In full production, the rare earth project would be expected to produce about 6000 tonnes of waste a year. A moist clay-like material, the waste will contain the radioactive elements thorium, uranium and radium. Management of the material will be subject to strict safety measures, auditing and quality assurance procedures. The complete program will be audited by an independent body.

Although the company will take its safety responsibilities very seriously, Mr Newton believes there has been a tendency to overstate the hazards associated with the waste. The material is classified as a low level radioactive residue which will not affect members of the public or most employees in normal operating conditions. The waste is hazardous only to someone in contact with the material for an extended period - more than 30 hours. The material is less hazardous to the public than petrol, LPG or sodium cyanide.

Radiation safety - Dr Bruce Hartley, Curtin University

Dr Hartley is the former Physicist in Charge of the Radiation Health section of the WA Health Department and secretary at the WA Radiological Council. He is consulting to Rhône-Poulenc on the measures required to ensure public and employee safety.

There are three possible means of radiation exposure -

- external gamma radiation
- inhalation of dust, or
- ingestion of the material.

The potential for exposure arises during transport, processing disposal or radiation releases from the site. However, Dr Hartley is confident that design features of the plant can provide an effective management for all possible pathways of radiation exposure.

Detailed planning and adherence to relevant safety codes during normal operations will prevent any detectable impact on the public. Appropriate emergency procedures will be designed to keep the exposure well within safety limits in the event of an accident. Occupational health procedures and safety measures will aim to keep exposure levels for truck drivers and plant workers at less than 50 per cent of limits imposed by regulation. These regulations are based on international and Australian recommendations.

Waste transport and disposal - Terry Waters, Dames and Moore Engineering and Environmental Consultants.

The Pinjarra rare earth plant is expected to produce 6000 tonnes of low level radioactive waste a year. This material will be stored in two-tonne bulka bags which will be transported in steel containers - each holding 20 tonnes of waste.

The company is examining three potential options for transport of the waste:

- ☐ Rail from Pinjarra to Koolyanobbing (or an alternative unloading point).
- ☐ A road-rail combination
- ☐ Road from Pinjarra to Mount Walton East.

Rail

The rail option will involve the construction of new sidings at Pinjarra and - possibly - the goldfields. Containers would be transported on narrow gauge to Forrestfield and transferred to standard gauge rolling stock for transport to Koolyanobbing, where the containers would be loaded on to trucks for the trip to Mount Walton.

Road-rail

Under the road-rail plan, containers would be trucked to Forrestfield and transferred to standard gauge rail wagons for the trip to Koolyanobbing and subsequent road haulage to Mount Walton.

Road

Road transport would mean trucking the containers on B-double units from Pinjarra to Mount Walton.

The preferred option

The company's preferred option is likely to be road transport from Pinjarra to Mount Walton. "Door-to-door" road haulage will reduce double handling, improving efficiency safety procedures. B-double units would probably use South Western, Albany, Roe, Tonkin and Great Eastern Highways. Based on a payload of 40 tonnes, the transport operation would involve three trips a week.

Emergency response

The trucks would be equipped with high frequency radios and global positioning systems to pinpoint the location of vehicles at all times. If a vehicle makes an unscheduled extended stop, an alarm will sound at the company's Pinjarra control room, triggering the first stages of an emergency response procedure. As part of a special management program, the company will be required to detail an emergency response plan in line with established procedures for dealing with hazardous goods. The company will train emergency service workers in procedures for dealing with a waste transport accident.

Disposal

The waste will be buried in trenches 15-20 metres deep. Each trench will hold two years' supply of waste. The bulka bags of waste will be unloaded into the trenches, packed with sand and progressively covered with layers of clay. The top five metres of each trench would be filled with rock and clay before rehabilitation.

Community concerns

During the presentations and discussions, workshop participants raised a number of broad issues identified as key community concerns. These included -

The transfer of wastes from one region to another

Many of the workshop participants objected to the concept of transporting waste produced in the South West of the State to the Goldfields. Speakers wanted Rhône-Poulenc to "keep its rubbish in the company's back yard". If the material was safe it could buried in the South West. If it wasn't safe the waste should be kept out of the Goldfields. One mining industry worker made the point that no Goldfields mining operators had tried to export waste to another region.

In reply, company representatives said that one of the State Government objectives in establishing the Mount Walton facility was the management of monazite process wastes. The selection of the site was based on the geology, climate and development potential of the area. The South West coastal plain which produced monazite was based on sandy soil with high water tables and, in some cases, high population densities.

The prospect of a national disposal site

Local residents believe the existence of the waste disposal facility means the region will be shortlisted for a national radioactive waste repository. In this context, the rare earth project becomes part of the "thin end of the wedge." Speakers at the workshop said they had been assured by former WA Health Department officials that the site would be used only for hospital waste.

Government company representatives told the Coolgardie workshop that one of the specific objectives of the Mount Walton project was the disposal of Western Australian monazite process waste. Any alternative proposals would have to go through the same rigorous assessment process facing Rhône-Poulenc.

Changes to the company's position

Community representative Shyama Peebles listed a series of apparent contradictions between the company's first proposal in 1988 and the most recent proposals. The issues - which included relative radioactivity levels, radium extraction, rail transport, possible phosphate contaminants, volume changes and reasons for the closure of monazite export markets - are detailed in the list of questions in the report.

The company was asked to provide scientific data - not motherhood statements in its new documents.
Company representatives gave a commitment to provide objective, relevant data - including a response to all of the workshop questions.

The quality of State Government groundwater information.

One of the reasons for selecting Mount Walton East as the waste disposal site was the reported absence of high quality aquifers. However, a number of speakers disputed information - suggesting that up to seven freshwater soaks had been located near the disposal site. There were additional questions about the destination of stormwater filtered through the soil profile at Mount Walton.

Office of Waste Management Assistant Director of Waste Disposal, Noel Davies said his department had commissioned approximately 60 test bores over an area five kilometres square. None of them had encountered fresh water. He said the site management program called for another 65 bores to be drilled this year. He offered to organise a public site visit and open day when the new holes were being drilled so that people could see some of the results first hand.

The workshop formula

A number of participants questioned the company's motives for establishing community workshops. Some of the questions dealt with

- ☐ The use of a CSIRO representative to act as an independent facilitator. As a Government agency, the CSIRO might be expected to have a vested interest in the development of the project.
- ☐ The probable outcome of the workshops. Several participants claimed that neither Government nor company were likely to take any notice of the community viewpoint. Previous petitions and community submissions opposing the Government waste disposal facility had been ignored.
- ☐ The public relations factor. Opponents of the workshops criticised the program as a device to legitimise a project which was opposed by a majority of Goldfields residents.

David Newton said the idea of the workshops had been suggested by the WA Conservation Council and community representatives. The discussions had been planned as a forum to examine the genuine community issues raised by the project. He said Rhône-Poulenc was under no obligation to go through the consultation program. Instead, the company could have lodged an environmental impact statement and responded to public submissions. However, he said that Rhône-Poulenc wanted to address community concerns and questions during the early stages of the project plans.

Questions and specific concerns

TRANSPORT

How will volunteer groups on the transport route be trained and equipped to deal with accidents?

Emergency procedures will be prescribed in a management plan developed by the Proponent prior to the commencement of transporting the waste material. This plan would be based on the Western Australian Hazardous Material Emergency Management Scheme (WAHMEMS). Emergency response teams, located at various towns along the transport route, will be trained in the emergency procedures for safety and clean-up following an accident. The team will comprise selected personnel from the Police Department, Western Australian Fire Brigade, Health Department and Department of Minerals and Energy. Training courses will be held in regional centres and the necessary equipment will be supplied to the team controller.

Section 6.2.2.3 and Appendix H

Will the company investigate more rail options - including the prospect of "piggyback" or dual purpose road-rail vehicle?

Rhône-Poulenc's aim is to minimise handling and maximise use of trained personnel. Use of any available equipment to achieve these would be considered, however, Westrail has advised that these options are more expensive than straight rail.

Will the company examine a worst case scenario for transport - say, a waste truck colliding with a tourist bus?

A worst case scenario of an accident occurring in the middle of a town or at a site remote from the trained emergency teams has been assessed. The 'worst case' assumes that a truck has rolled and the container has opened spilling the bulk bags which in turn have been pierced exposing the waste. Another factor was added to the scenario of extreme conditions of heat or rain. The emergency and clean-up procedures are documented in the ERMP and will also be detailed in an Emergency Management Plan. There would be no long term impacts associated with a spill of the gangue residue as it is immobile, insoluble and in a form which could be readily retrieved and replaced into suitable containers for transport and disposal. There will be minimal hazard to the clean-up team or general public by exposure to this material for the time taken for clean-up procedures.

The immediate priority of the emergency crews is for the safety of any persons involved in the accident. Any person who may require medical treatment will be attended to as a priority as there is no risk of emergency crews or the injured person receiving harmful levels of exposure in the time taken for rescue operations. Once rescue operations are complete, clean-up procedures will commence.

Section 6.2.2.3

What is likely to happen if an accident occurs during heavy rain?

The gangue residues has extremely low solubility and in the event of an accident occurring in heavy rain, it is unlikely that the material will travel any distance, due to its insolubility and density. Standard emergency procedures will apply with the first priority to treat and rescue any injured persons and then commence clean-up procedures. Any spilt material will be retrieved and if any has been disposed away from the immediate area, it can be located by a gamma counter and retrieved.

Section 6.2.2.3

How would the company deal with a bogged truck on the Mt Walton access road?

Each truck will be fitted with a GPS tracking system and radio communication system. If a vehicle becomes bogged and the driver requires assistance he will be able to communicate with the base who can in turn relay messages to the nearest person able to assist.

What happens if someone takes waste away from the scene of an accident?

There should be no reason why anybody would want to remove low level radioactive waste from the scene of an accident. It is unlawful for an unlicensed person to obtain low level radioactive material under the Radiation Safety Act.

Will the company lobby for more passing lanes on Great Eastern Highway?

Rhône-Poulenc would expect development of highways to follow the policy established by the State Government using traffic study analysis. The plan is to transport only 3 loads of gangue residue (of relatively low hazard), per week to Mt Walton East, therefore Rhône-Poulenc does not have much influence on the Government. However, the company does support passing lanes for intensively used highways such as the Great Eastern Highway.

Will trucks be clearly marked to identify the load?

Trucks will be labelled according to paragraph 467 of the Commonwealth Code of Practice for the Safe Transport of Radioactive Substances, 1990 (Commonwealth of Australia, 1990), that is if a road vehicle is used for transport it will be labelled with signs conforming with the code on both sides and rear of the vehicle. Containers will be labelled with Type III-Yellow transport labels (Figure F1). Individual packages of gangue residue will be labelled with Type II-Yellow transport labels (Figure F1).

Section 6.4.4.8

How will Rhône-Poulenc avoid unnecessary emergency response to unscheduled stops which are not emergencies?

The first reaction to an alarm triggered from the GPS tracking system will be for the base operators to contact the driver by radio-telephone to establish the reason for the stop. If the driver cannot be contacted or the driver confirms that an accident has occurred, then the relevant Senior Police Officer, as On-site Controller of an emergency response under WAHMEMS, will be notified and he would determine the status of the vehicle. The appropriate emergency response would then be implemented.

Section 6.2.2.3

How will Rhône-Poulenc control panic driving by truck drivers to meet deadlines?

The contract with the transport company would be set-up so that there are no penalties incurred for slow delivery and no incentive for fast delivery of waste. B-double trucks, as part of their licensing requirements, are fitted with a speed limiting device (105km/hr). The vehicles will also be fitted with computer recording equipment which will enable the company and the transport operators to determine if any driver exceeds the speed limit.

Why are previous arguments in favour of rail transport no longer considered valid?

In 1988, rail was considered the safest mode of transport by the EPA. However, more recent studies have indicated that each transport operation needs to be assessed on a case-by-case basis and a general conclusion cannot be made as to rail being the safest option and vice-versa. In the absence of a suitable siding at Pinjarra and at the IWDF site, road transport at both ends of the route would be necessary which would require additional transfer handlings than if the containers were transported directly on trucks from plant site to disposal site.

There is currently no rail service to transport material from Pinjarra, however, the containers may be added to the train between Forrestfield and Koolyanobbing servicing the salt operations. Again this would require additional handling operations of the container. The containers would also have to be transferred from narrow to standard gauge line at Forrestfield.

Section 2.4.2 and Appendix D

RADIATION SAFETY

What is the definition of low level radioactive waste?

There is no uniform definition of low level radioactive waste, but in Australia this term is used to describe waste material which has a level suitable for disposal by shallow land burial.

Why are workers' exposure limits higher than public limits?

The International Commission on Radiological Protection (ICRP) recommends different exposure limits for workers and the general public. The differences is mainly due to:

- the varying levels of risk which the community finds acceptable in different circumstances;
- the public consists of a wider range of people of varying ages and health;
- workers chose to work in the plant and receive a benefit for doing so; and
- workers are monitored for exposure levels and are trained in safety procedures associated with radiation management.

How do Australia's exposure limits compare to international standards, including world's best practice?

Radiation standards follow those set by the ICRP. Australia was one of the first countries to adopt occupational health limits with Western Australia being the first state in Australia to adopt the limits. Rhône-Poulenc has set design criteria at around half the limits for transport and plant operations.

Section 6.4.4.1

Will the specifications of the waste comply with the requirements for disposal at the site?

Tests will be undertaken at the Pinjarra site to ensure that the waste meets specifications and the waste will not leave Pinjarra if it does not meet those specifications. Independent auditing of testing and recording will be conducted. The gangue residue will be press filtered at the Pinjarra plant and sufficient absorbent agent will be added to ensure that no draining of free liquid occur and that it meets the specifications of a solid, as defined by both the Code of Practice for Near-Surface Disposal of Radioactive Waste in Australia (NHMRC, 1952) and the operators of the IWDF. The waste will need to meet the specifications as described in the Code of Practice for the Near-Surface disposal of Radioactive Waste (NHMRC, 1992), waste specifications are presented in Appendix E of the ERMP.

Disposal operations and management of such operations will be in accordance with the following requirements:

- existing Ministerial conditions for operations of the IWDF site;
- applicable legislation;
- the NHMRC Code for Near-Surface Disposal of Radioactive Waste;
- the EMP for the operation; and
- the IWDF site radiation management plan.

Sections 3.4.2, 6.3.3 and Appendix E

DISPOSAL

Can the waste be cast in concrete?

Yes, however, this would increase the volume of the waste threefold. The proposal would require large quantities of concrete, creating operational difficulties and inefficiencies. It would have no significant impact on radiation exposure or environmental management.

What happens to storm water and surface run-off at the Mt Walton site?

A surface water management system will be implemented to control water erosion of the cover and to divert water away from any partially filled disposal structure. The flow of surface runoff water into the trenches will be prevented by the use of diversion ditches and bunds. Water collected in an open trench will be pumped into an adjacent evaporation pond.

Appendix D

What are the risks of continuous disposal compared to occasional disposal campaigns?

There is no real significant difference in terms of risk.

Will the company research waste mixing at the site?

No, as there is little potential of wastes being mixed at the IWDF site as the *in situ* clay and distance will provide the barrier between areas of the site allocated for different wastes.

Will the bulka bags burst on impact or rupture in the trenches?

The bulka bags will be lowered and placed in the trenches by either a tractor/fork lift configuration or a crane, therefore the bags will not be subjected to loads which could cause rupture during the unloading and placement. Some rupturing may occur during compaction and covering. However, this will not pose a problem as the purpose of the bulka bag is for adequate packaging during transport. The bags are not intended to contain the waste for long-term disposal, as the surrounding clay and geological structure of the site provide the containment.

Appendix D

PRODUCTION

How will the company deal with human error during production, transport or disposal?

Quality systems will be implemented to minimise the risk of error. All of the management plans will be prepared and designed to minimise human error. Waste disposal operations including transport will be subject to an annual audit to assess if the operations comply with the relevant regulations and environmental approvals given for the project. Contingency plans addressing possible emergencies such as operational accidents, spillages and other sources of potential releases from the designated disposal area will be prepared and will be subject to Health Department and DEP assessment and approval.

Sections 6.3.3.3 and 6.3.3.4

How can the company guarantee the specification of the waste?

One of the auditor's principal roles for the disposal operations will be to:

- confirm that waste specifications have conformed with those in the Commonwealth Code of Practice for the Safe Transport of Radioactive Substances (Commonwealth, 1990) and the Code of Practice for the Near-Surface Disposal of Radioactive Waste in Australia (NHMRC, 1992).

Section 6.3.3.4

Can Rhône-Poulenc undertake a waste minimisation program to reduce the tonnage of waste?

No, as 12,000 tonnes of monazite is processed there will be 6,000 tonnes of waste. By reducing the volume of waste, the radioactivity in the waste would be concentrated and may exceed the specification for waste disposal at the IWDF or require dilution on-site.

MANAGEMENT

What happens to the waste management after Rhône-Poulenc has closed?

The Government is responsible for the waste at the IWDF site, however, the Proponent will be required to contribute to long term monitoring of the site.

Section 6.3.2.3

Will Mt Weld Rare Earth project waste be added to the Pinjarra waste?

No, the Mt Weld waste would have a much lower thorium content and it is suitable to be disposed of back at the Mt Weld mine site.

Could the waste be hijacked and used for blackmail?

No, there is no significant health risk associated with a truck of waste. If a person wanted to hijack a truck for blackmail there would be much more dangerous substances that could be hijacked.

Local residents want 24-hour security at the Mt Walton site.

Security of the IWDF is the responsibility of the Government. However, the Office of Waste Management is planning for a substantially increased presence at Mt Walton if the rare earth project goes ahead. The actual disposal operational area will be surrounded with a chain-wire security fence. Signs stating that unauthorised entry to the area is prohibited and displaying the standard Dangerous Goods label will be placed on the fence to warn people of the use and hazard of the area. The fenced area will be locked when no one is in attendance at the site.

Rhône-Poulenc's responsibilities at the site are not defined. The company should have some responsibilities in case of Government mismanagement.

In essence, the Government would take responsibility of the waste at the IWDF site, however, the Proponent will be required to fund:

- all costs of transport;
- disposal costs including those relating to excavation of the trench burial of the waste, backfilling of the trench and rehabilitation;
- contributions to long term monitoring of the site;
- contributions to the maintenance of the IWDF access road; and
- a provision for maintenance and any costs of remedial work necessary in the first five years after a disposal operation.

Section 1.4

There is no provision for community control over the site.

The Proponent will liaise with the Mt Walton East Consultative Committee, local shires and interest groups on the transport, disposal, safety and environmental issues relating to the low level radioactive waste.

Section 6.16

Is there any possibility of waste retrieval to fuel a thorium nuclear reactor?

Security of the waste will be controlled by the Government. Thorium is not a primary nuclear fuel and other sources of thorium may be less expensive than recovery from the waste at the IWDF.

Will Rhône-Poulenc be subject to a bond for rehabilitation?

Rhône-Poulenc will enter into an agreement with the Government for fees for disposal. This fee will include contributions to monitoring and rehabilitation.

Section 1.4

What is Coolgardie Shire Council's position?

Rhône-Poulenc is unable to comment on the Coolgardie Shire's position. The Shire has been contacted and provided with details of the project.

Will the council support community opposition to the waste disposal site?

Rhône-Poulenc cannot answer for the council. However, the IWDF has been set-up and approved through the environmental assessment process.

GENERAL

Why is this project subject to a Public Environmental Review, not a more comprehensive Environmental Review and Management Program?

The project is now subject to an ERMP.

Will the level of detailed information be equivalent to an ERMP?

Yes.

Have criticisms of the company's previous ERMP been addressed?

Yes, the Proponent has changed the process to eliminate the generation of ammonium nitrate which caused the main critical comments in the previous ERMP.

How long will the project last?

Plant operations are expected to continue for a at least 20 years.

Section 1.5

The community was promised the site would be used only for waste stored at QE2.

A proposal, subject to a Public Environmental Review for the Integrated Hazardous Waste Disposal Facility at Mt Walton was approved by the Minister for the Environment in 1988. The proposal specifically included:

- a high temperature incinerator for the disposal of organochlorines; and
- an area for the burial of low level radioactive intractable wastes arising from the processing of mineral sands and phosphate rock.

Subsequently other industrial, medical and research wastes were added by means of an EMP (Health Department, 1989).

What is the company's response to claims that a beach was polluted by Rhône-Poulenc in France?

This claim was refuted by the official reference body (SCPRI) for radioactive issues in France who stated that "the radioactivity on the beach is insignificant" (Professor Pellerin, State Director SCPRI - Services Control for Protection against Ionising Radiation).

Residents do not trust either Government or companies. There is a suspicion of collusion or even corruption.

Comment noted. Rhône-Poulenc would hope our business practices will command the respect of all communities concerned with our activities.

Is there insurance to cover farmers against damages?

Yes, Rhône-Poulenc has comprehensive public liability insurance to protect third parties in case they are damaged by its operation.

What are Rhône-Poulenc's intentions in relation to a proposed plant at Port Pirie?

Rhône-Poulenc has evaluated participation in the Port Pirie venture. The Pinjarra project is the preferred choice by Rhône-Poulenc.

Western Australia should get more value adding and downstream processing as a compensation for keeping the waste.

Monazite has no present markets. When the mineral was last sold for exports, WA production was worth $5 million a year. If the Pinjarra project goes ahead, rare earth exports from monazite processing will be worth $30 million a year.

Report on Pinjarra
Community Workshops
Pinjarra Senior High School - May 18 and 20, 1995

Background

International chemical company Rhône-Poulenc is planning a rare earth project to process Western Australian Monazite. The proposed plant at Pinjarra will extract elements used for high technology products. The site selected for the project is the location of the company's existing gallium plant - 10 kilometres east of Pinjarra townsite. Waste, containing the radioactive elements thorium, uranium and radium will be transported to the Government's Intractable Waste Disposal Facility at Mount Walton East 140 kilometres north west of Coolgardie townsite.

Rhône-Poulenc has set up a series of community workshops to help identify key issues in planning and assessing the project. The first Pinjarra workshop, held at held at Pinjarra Senior High School on May 18, was attended by 28 people. Additional workshops have been planned to provide discussion forums for conservation groups, Coolgardie residents, the Southern Cross community and local authorities on proposed transport routes. The discussions at Pinjarra on May 18 were co-ordinated by independent facilitators - Dr Geoff Syme of the CSIRO and Gail Broady of Integra. The May 20 proceedings were co-ordinated by Richard Leavitt.

Introduction - David Newton, Chief Executive, Rhône-Poulenc Australia

The company has arranged the community workshops to provide for public participation in the project planning. The idea was suggested by the WA Conservation Council and Coolgardie community representatives who wanted to provide residents with an opportunity for detailed discussion of the key issues. Two workshops were arranged for Pinjarra to give people the option of attending during the afternoon or evening.

The idea is to provide information about the project to interested residents - and appropriate responses to community questions and concerns. In addition, the company will be able to modify its plans to accommodate some community concerns. Already some aspects of the company plans are under review as a result of feedback from the first workshops. Major issues to be addressed at the Pinjarra forum included:

-environmental management,
-transport,
-safety, and
-waste disposal.

Each participant was sent a summary of the proceedings and invited to comment on the contents. The questions and comments from the workshop have been listed in the project environmental review - a formal environmental impact assessment document to be released for public submissions. This process will give the community and authorities an opportunity to see how the company has responded to the public priorities.

Project outline - David Newton

The plant

Rhône-Poulenc plans a $45 million rare earths plant on company owned land at Pinjarra. The plant will convert monazite, a byproduct of WA titanium minerals production, into rare earth nitrates for export to Europe and North America. At present, monazite has no commercial markets. The mineral is stockpiled or returned to mine sites for disposal.

The rare earth plant development will allow the company to resume production at its gallium plant - originally constructed in 1989 to share infrastructure facilities with the rare earth project. The $50 million gallium facility was placed on standby in 1990 when markets declined and the company's first rare earth proposal was shelved.

The new proposals provide for 150 construction jobs, with employment for 60 people during full time operations. Combined rare earth and gallium exports will be worth $50 million a year.

The products

Rare earth elements are used in a wide range of high technology products including catalytic converters to reduce vehicle exhaust pollution, low energy lighting, television colours, x-ray screens and electronics. Gallium is used as a replacement for toxic mercury and cadmium. One Australian company is developing a gallium amalgam to replace mercury in dental fillings.

The process

The Pinjarra plant will process monazite into three streams -

- rare earth nitrates, for export
- phosphates for use in fertiliser production, and
- a waste stream, containing radioactive elements, to be transported to Mount Walton in the Coolgardie Shire for disposal.

Changes to the original rare earths concept

Rhône-Poulenc sought approval for a rare earth plant in 1989. The second stage of the original proposal was rejected by the State Environmental Protection Authority because of plans to dispose of ammonium nitrate and traces of radium in evaporation ponds at the Pinjarra site. The long term disposal of nutrients at the site was seen as a potential threat to the Peel-Harvey Inlet system. The new plan has addressed this key environmental issue by eliminating the need for ammonium nitrate production. All radium and other radioactive wastes will be taken to Mount Walton in Coolgardie Shire for disposal.

The waste

In full production, the rare earth project would be expected to produce about 6000 tonnes of waste a year. A moist clay-like material, the waste will contain the radioactive elements thorium, uranium and radium. Management of the material will be subject to strict safety measures, auditing and quality assurance procedures. The complete program will be audited by an independent body.

Although the company will take its safety responsibilities very seriously, Mr Newton believes there has been a tendency to overstate the hazards associated with the waste. The material is classified as a low level radioactive residue which will not affect members of the public or most employees in normal operating conditions. The waste is hazardous only to someone in contact with the material for an extended period - more than 30 hours. The material is less hazardous to the public than petrol, LPG or sodium cyanide.

Environmental Management - Cathy Gupanis, Dames and Moore Engineering and Environmental Consultants

On the basis of present community and technical input, the environmental assessment of the rare earth project appears likely to focus on three key issues -

- Transport
- Waste disposal
- Radiological issues

Other issues include - Flora and Fauna; Noise; Visual; Economic; Historical, Ethnographical and Archaeological Sites; Social; Neighbour Concerns including Land Values; General Management; Decommissioning and Rehabilitation Programme.

The transport studies will deal with monazite haulage from the Capel and Eneabba-Geraldton regions and process chemicals from Kwinana to Pinjarra. In addition, the assessment will look at the transport of products from the Pinjarra - including rare earth nitrates to Fremantle, waste to Mount Walton and fertiliser feedstock to Kwinana. Traffic generated by service vehicles and employee transport will be included in the report. Wherever possible, heavy vehicles will bypass Pinjarra townsite.

Most of the waste from rare earth production will be transported to Mount Walton (discussed in more detail later in this summary). Evaporation ponds on site will be used for the disposal of process wash waters and salt. The ponds will be used as temporary storage for tri-calcium phosphate - a feedstock for agricultural fertiliser manufacture.

Radiation safety - Dr Bruce Hartley, Curtin University

Dr Hartley is the former Physicist in Charge of the Radiation Health section of the WA Health Department and secretary at the WA Radiological Council. He is consulting to Rhône-Poulenc on the measures required to ensure public and employee safety.

There are three possible means of radiation exposure -

- external gamma radiation
- inhalation of dust, or
- ingestion of the material.

The potential for exposure arises during transport, processing disposal or radiation releases from the site. However, Dr Hartley is confident that design features of the plant can provide an effective management for all possible pathways of radiation exposure.

Detailed planning and adherence to relevant safety codes during normal operations will prevent any detectable impact on the public. Appropriate emergency procedures will be designed to keep the exposure well within safety limits in the event of an accident. Occupational health procedures and safety measures will aim to keep exposure levels for truck drivers and plant workers at less than 50 per cent of limits imposed by regulation. These regulations are based on international and Australian recommendations.

Waste transport and disposal - Terry Waters, Dames and Moore Engineering and Environmental Consultants.

The Pinjarra rare earth plant is expected to produce 6000 tonnes of low level radioactive waste a year. This material will be stored in two-tonne bulka bags which will be transported in steel containers - each holding 20 tonnes of waste.

The company is examining three potential options for transport of the waste:

- ☐ Rail from Pinjarra to Koolyanobbing (or an alternative unloading point).
- ☐ A road-rail combination
- ☐ Road from Pinjarra to Mount Walton East.

Rail

The rail option will involve the construction of new sidings at Pinjarra and - possibly - the Goldfields. Containers would be transported on narrow gauge to Forrestfield and transferred to standard gauge rolling stock for transport to Koolyanobbing, where the containers would be loaded on to trucks for the trip to Mount Walton.

Road-rail

Under the road-rail plan, containers would be trucked to Forrestfield and transferred to standard gauge rail wagons for the trip to Koolyanobbing and subsequent road haulage to Mount Walton.

Road

Road transport would mean trucking the containers on B-double units from Pinjarra to Mount Walton.

The preferred option

The company's preferred option is likely to be road transport from Pinjarra to Mount Walton. "Door-to-door" road haulage will reduce double handling, improving efficiency safety procedures. B-double units would probably use South Western, Albany, Roe, Tonkin and Great Eastern Highways. Based on a payload of 40 tonnes, the transport operation would involve three trips a week.

Emergency response

The trucks would be equipped with high frequency radios and global positioning systems to pinpoint the location of vehicles at all times. If a vehicle makes an unscheduled extended stop, an alarm will sound at the company's Pinjarra control room, triggering the first stages of an emergency response procedure. As part of a special management program, the company will be required to detail an emergency response plan in line with established procedures for dealing with hazardous goods. The company will train emergency service workers in procedures for dealing with a waste transport accident.

Disposal

The waste will be buried in trenches 15-20 metres deep. Each trench will hold two years' supply of waste. The bulka bags of waste will be unloaded into the trenches, packed with sand and progressively covered with layers of clay. The top five metres of each trench would be filled with rock and clay before rehabilitation.

Community concerns

During the presentations and discussions, workshop participants raised a number of broad issues identified as key community concerns. These included -

Transport

Transport arrangements have been a major issue at all the community workshops. Apart from the most controversial question of radioactive waste transport, participants at the second Pinjarra workshop have asked for details on the transport of raw materials, products and process chemicals. Participants have sought assurances from the company that bulk transport units would be kept out of the town centre. The residents have particular concerns relating to:

- public safety during radioactive waste transport
- vehicle schedules and routes
- traffic congestion, and
- the likely preference for road, instead of rail, transport of wastes.

The company has given a series of commitment to ensure public safety during transport. Measures will include appropriate scheduling, vehicle and driver safety features and a detailed emergency response plan. The company will continue to examine rail options - although rail transport proposals to date have passed significant practical problems.

Public Radiation risks

One issue which dominated the Pinjarra workshops was a concern that the community might face radiation risks from the project. Questions focussed on the potential for radiation releases from the plant site; the risk to motorists and pedestrians during waste transport; and radiation levels which might affect volunteer emergency workers attending an accident.

In response, the company's radiological consultant, Dr Bruce Hartley, told the forum that the radioactivity would not affect people outside a small section of the rare earth plant site. The transport operations would be managed to prevent public radiation impacts, unless the waste containers ruptured in a serious accident. Under those circumstances, expected radiation levels reaching members of the public would be well within the safety limit of one millisievert a year (the average annual exposure to Australians from natural sources is 2.5 millisieverts a year).

Workforce Safety

Most of the workforce for the rare earth plant is likely to be drawn from the Pinjarra area, and local residents want assurances on the health protection and safety of people working with radioactive materials at the plant. Concerns were raised about the fact that workers are allowed higher radiation exposure levels than members of the public. Many of the questions sought information on the long term health affects of low level radiation on workers and subsequent generations. Workshop participants requested comparisons between rare earth production and other industries - and the safety limits of Australian and overseas regulatory authorities.

Company representatives outlined targets aimed at keeping workplace radiation levels to less than 50 per cent of national and international safety limits. Australia has adopted the world's strictest titanium minerals industry radiation safety standards. The restrictions set for the rare earth plant will match the conditions at production sites identified as safe workplaces.

The need for independent monitoring

Many of the workshop participants wanted unrestricted public access to monitoring and technical information. In addition, Shire representatives recommended the involvement of independent experts to review environmental impact studies. One Aboriginal community representative suggested that expert opponents of the project should attend any future workshops.

Rhône-Poulenc agreed to release environmental monitoring reports. In addition the company will support the establishment of a Shire community consultative group.

Environmental management at the Pinjarra plant

Although the project has been redesigned to address the environmental concerns raised over the company's previous rare earth project, residents want detailed assurances covering the latest proposals for operations at Pinjarra. Questions at the workshop sought information on -

- materials to be stored in the on-site evaporation ponds
- the risks of chemicals leaching into the groundwater and affecting the Peel-Harvey Inlet system
- environmental risks from the pipelines between Alcoa and Rhône-Poulenc
- public access to monitoring information.

Evaporation ponds at the site - which will contain wash waters, salts and phosphates being stored for sale to fertiliser manufacturers - have been designed to prevent any leaching. Measures in place should prevent environmental damage from the pipelines, which carry caustic and bauxite process liquid. The company has given a commitment to allow public access to all environmental monitoring reports.

Employment, training and business

Pinjarra residents want a comprehensive policy to maximise the local benefits of the project. The program would depend, in part, on agreements to train local people for work at the rare earth plant. In addition, community representatives sought a preference policy for local business, incentives for employees to live in the Murray Shire and a commitment to establish and community consultative group.

The company believes that most of the workforce can be recruited locally and trained for jobs at the plant. Local companies will be given preference for up to $10 million a year in service and supply business, providing the businesses can offer competitive prices and quality. The company is supporting the concept of a local consultative group.

The need for preference policies

If the project is approved, local residents believe that the Murray Shire should be entitled to most of these benefits. Recommended measures included-

- a local employment policy
- preference for local businesses
- incentives for employees to live in the Murray Shire
- local training schemes
- sponsorship for community organisations

In this context "local" would mean Murray Shire - not the Peel Region or Western Australia.

Concern for Goldfields residents

Participants at the Pinjarra workshop supported the concerns of Goldfields residents opposed to "imported" waste disposal in their region. The residents are worried about long term environmental management issues and the prospect of the Goldfields becoming a national waste disposal repository.

The Mount Walton East site is 140 kilometres north west of Coolgardie. The area was selected by the State Government for waste disposal because of the deep clay soil structure, dry climate and remote location.

Questions and specific concerns

TRANSPORT

What happens if the waste containers rupture during transport?

Waste will be placed in heavy duty bulka bags inside containers there will be 10 bulka bags per container and the containers will be carefully loaded in one layer. It is unlikely that the bags will rupture, however, the waste is in the form of a moist clay like material so it will not flow or dust from the bag. Containers will be designed for easy cleaning inside, with the internal joints and connections seal welded to prevent trapping of waste between structural components.

Section 6.2.2.3

What happens in the event of a spillage; how is it managed; what are the long term impacts?

In the event of a spillage of waste, prescribed clean-up procedures will be followed by trained emergency response teams. Details of the emergency clean-up procedures are documented in the ERMP. All the spill will be collected and repackaged for transport and disposal. As the material is immobile and insoluble it is unlikely to disperse into the environment, however, any material that may have dispersed from the immediate vicinity of the spill will be detected by a gamma counter and retrieved. There will be no long term impacts on the environment if a spill occurs and minimal hazard to emergency team members and the general public by exposure to this material for the time taken for clean-up procedures.

Section 6.2.2.3 and Appendix H

How will the trucks be scheduled - in the mornings, or evenings?

Trucks transporting the waste will be scheduled to leave the Pinjarra plant site at the most appropriate time to avoid travelling through Pinjarra and the Perth metropolitan area during peak traffic hours. Most of the other truck movements of raw materials and products are expected to occur during normal business hours Monday to Friday.

Section 6.2.2.1

How will emergency response teams be organised and equipped - who pays?

Emergency procedures would be prescribed in a management plan developed by the Proponent based on the WAHMEMS. Emergency response teams will be trained in emergency response and clean-up procedures. Training will be funded and co-ordinated by the Proponent. The organisation for dealing with emergencies are those set out in WAHMEMS with the Control Authority most likely to be the Senior Police Officer designated as the On-site Controller. Several teams will be trained at regional centres along the transport route.

Section 6.2.2.3 and Appendix H

Will the local emergency crews be aware of the transport movement from Pinjarra to Mt Walton?

All trucks will be fitted with a Geographic Positioning System (GPS) so that the plant base and, if necessary, response teams can locate the trucks during the journey.

Section 6.2.2.3

How will tourists and other motorists be able to recognise waste trucks?

All vehicles will be clearly marked with Radioactive Transport class labels Type III-Yellow (Figure F1) on both sides and the rear of the vehicle. In addition, code emergency information panels identifying the goods being transported and emergency contact number, will also be displayed on the vehicle.

Sections 6.2.2.3 and 6.4.4.8

What labelling is required for the vehicles?

See above.

Sections 6.2.2.3 and 6.4.4.8

What will B-doubles be used to transport?

B-double truck configurations will be used to transport the waste and most likely the lime, sulphuric and nitric acids. It has yet to be decided if B-doubles are to be used to transport the rare earth nitrate product and monazite, but it is most likely.

Sections 6.2.2.1 and 6.2.2.3

Will B-double units be able to negotiate all of the corners en-route to the plant?

Intersections along the route will be reviewed in conjunction with the Shires and Main Roads Western Australia. The review will comprise a dimensional assessment of truck turning circle, road widths, layout of traffic islands and, where applicable, the distance from the rail crossing to the intersection such as at the Pinjarra-Williams Road/South Western Highway intersection.

Why is road the preferred option?

Road transport of the waste residue has occupational health, management and economical advantages over the road/rail options. There are less handling operations of the containers, thereby, reducing the number of people involved in loading and transfer operations, hence minimising potential radiation exposure to the workers. The Proponents, together with the transport contractors will have control over the container movements for the entire route as responsibility will not transfer between the contractor and Westrail. Road transport would also eliminate the need to establish both a siding on the Pinjarra line and a suitable hardstand area at a Goldfields siding.

Section 2.4.2

Why won't the company use rail - possibly the line to Alcoa?

The option of establishing a siding on the Alcoa line was only considered in the early stages of the project. Westrail has indicated that this option would have several restrictions due to the flow of Alcoa's own materials.

Section 2.4.2

Rail is the preferred option of some community representatives:

- **safer;**
- **fewer trips; and**
- **the built-in safety zone of the rail reserve.**

The Proponent's preferred option for transport of the gangue residue is by road as it has occupational health, management and economical advantages on the road/rail option. There are less handling operations of the containers, the transport operation is of shorter duration and is a much more cost efficient exercise.

Section 2.4.2 and Appendix D

Why can't Alcoa's spur line be used for rail transport?

Alcoa's line is already fully utilised.

Section 2.4.2

Why isn't Westrail keen to carry the waste?

Westrail has advised that the quantity of waste requiring movement is too small to be economic.

Would the company consider a separate forum on transport?

Yes, if the demand exists.

Will the company spell out a disaster scenario - possibly an accident victim trapped in spilled waste?

A 'worst case' scenario is presented in the ERMP. Emergency response and clean-up procedures are detailed in the ERMP. The immediate priority of the emergency crews in the safety of any persons involved in the accident. Any persons who may require medical treatment will be attended to as there is no risk of emergency crews or the injured person receiving harmful levels of exposure in the time taken for rescue operations.

Section 6.2.2.3

Workshop participants urged the company to run the transport operations - in preference to the employ-

- Safety and Quality Policies;
- adoption of AS 3902 or ISO 9002;
- vehicle inspections and maintenance procedures;
- tyre replacement policy;
- maintenance audits; and
- use of trained drivers who have satisfied a list of required qualities.

Section 6.2.2.3

Will there be an escort vehicle with the trucks?

No, the GPS tracking system makes this unnecessary and is currently not regarded as being necessary for the transport of other radioactive materials.

Large quantities of nitric acid are required. Where does it come from? How is it transported?

Approximately 15,000 tonnes per annum of nitric acid is required in the process. This results in approximately 8 x 40 tonne trucks per week transporting nitric acid from the suppliers to the Pinjarra plant. Nitric acid is likely to be sourced in Kwinana and will be transported in purpose-built trucks consisting of stainless tankers on a B-double truck configuration.

Sections 3.3.2 and 6.2.2.1

What route will the company use to transport acid?

Acids will be sourced from Kwinana. The most direct route for trucks transporting materials from Kwinana to the Pinjarra site is via Russel Road - Stock Road - Mandurah Road - Mandurah Bypass - Pinjarra Road - Pinjarra-Williams Road. This route follows dual 2-lane roads for the major portion of the route. The alternative route for these trucks is to travel along Russel Road - Thomas Road - South Western Highway - Pinjarra-Williams Road which are single carriageways for most of the route. Main Roads has identified the improved safety aspects of heavy vehicles travelling along dual 2-lane roads compared to single carriageways. Therefore, it is likely that the companies transporting materials from Kwinana will use the Mandurah-Pinjarra route.

Section 6.2.2.1

What problems will occur in the event of an acid spillage?

Industries supplying the chemicals will have the ultimate responsibility for their transport. Transport handling methods will conform to the requirements of the "Dangerous Goods Regulations, 1992 minimising the risks of accidental spillage during transport. Suppliers of these goods have a 24-hour emergency service with an emergency response plan based on the WAHMEMS. Drivers contracted to these companies are specifically trained in accordance with the Australian Code for Transport of Dangerous Goods by Road and Rail (Federal Office of Road Safety, 1992a).

Section 6.2.2.1

Will the company detail the schedule, numbers and movements of all workforce and service vehicles?

The operations workforce will be in the order of 50 with the majority working shift hours. These will comprise three shifts of eight hours per day, seven days a week. The workers are all expected to live in the local region. In a worst case situation where every worker drives a vehicle to and from work, 100 vehicle movements a day can be expected. These will be concentrated into three main time periods, at the beginning and end of shifts. This maximum vehicle movements represents an increase of 5% in existing traffic conditions on the Pinjarra-Williams Road. It is estimated that at the most there may be a maximum of 25 vehicles on the Pinjarra-Williams Road at any changeover time period.

Service vehicles, such as for maintenance, cleaning, lunches, supplies etc. will also be required for the operations of the plant. The frequency of such vehicles cannot be accurately determined but can be estimated between 4-6 per day.

Section 6.2.2.2

Where is the monazite produced and how will it be transported?

Monazite will be sourced from the Geraldton/Eneabba region (65%) and from the Bunbury/Capel region (35%). It will be transported by truck as has been the practice over the last 25 years.

Section 6.2.2.1

Will the company explain its "endeavour" to control truck routes; will the company make bypassing Pinjarra townsite a condition of their transport agreement?

Main Roads Western Australia has recommended the Mandurah-Pinjarra route as the safest option for transporting material from Kwinana to Pinjarra due to the quality of the roads. In time the Pinjarra bypass will ease this situation.

What happens if an accident contaminates private land? Will there be adequate compensation from the company?

If a waste spill occurs on private land, the Proponent will clean up the spill to ensure there is no waste remaining on-site. Clean-up procedures will be as detailed in the ERMP and will be to the satisfaction of the Radiological Council and DEP. Rhône-Poulenc has comprehensive public liability insurance against accidental damage to third parties.

SOCIAL AND ECONOMIC ISSUES

What is the company's policy on local employment?

The majority of the workforce will be sourced from the local area and preference will be given to those suitable applicants living in the Shire of Murray and Peel Region.

Section 3.7.3

How will the company define "local" people?

The Proponent defines local people in the following order:

1. Shire of Murray residents.
2. Residents of the Peel Region.
3. Western Australia residents.

How many workers will be recruited locally?

Plant operations are expected to provide in the order of 50 permanent jobs. The final number of Rhône-Poulenc employees will depend upon the number of local contractors engaged in such duties as maintenance, janitorial and other services. The majority of the workforce will be sourced from the local area.

Section 3.7.3

What percentage of the workforce will be skilled people "imported" for the project?

There will be a small team of overseas specialists (5-10%, 3-5 persons) required for engineering and commissioning and one specialist (2%) may remain.

Section 3.7.3

Will local workers be trained - and will they be competent to manage all radiation issues?

Yes, all employees will be trained to perform their duties and also trained in radiation safety. A Radiation Safety Officer will be appointed to oversee that radiation safety procedures are adhered to.

Will the company consider a comprehensive social analysis, identifying positive and negative impacts, including:

- **Aboriginal issues;**
- **property values;**
- **business; and**
- **tourism.**

An Aboriginal site survey of the plant site was conducted in August 1987 and comprised ethnographic and archaeological components. The ethnographic survey was aimed at locating and consulting with the traditional Aboriginal custodians of the area to ensure that the development did not pose a threat to Aboriginal sites, as defined by the Western Australia Aboriginal Heritage Act (1972-80). This survey revealed a now disused Aboriginal camp located close to the southern bank of the small creek which runs through the plant site. This site was occupied by an Aboriginal couple (now deceased) for approximately 20 years during the 1930s and 1940s. There is now no physical sign to mark the site of this camp and its mapped location is based totally on memory of the Aboriginal people consulted.

The company has recently engaged a licensed property valuer to assess the change in values of a number of adjoining properties. These valuations have shown an increase in value of all of these properties well in excess of CPI in the period January 1987 to March 1995. This period covers the time before Rhône-Poulenc first announced its intention to build a Gallium and Rare Earth Plant at Pinjarra and before the commencement to reopen these projects early this year.

Currently there is some lack of buyer interest in several properties that have been on the market for up to one year. This is thought to be as a result of some incorrect adverse publicity regarding the environmental impacts of the proposed plant. It is expected that the property market in the immediate vicinity of the plant will recover quickly once the proposal is approved. There is no indication that property values elsewhere in Pinjarra have been even temporarily affected.

With the creation of 60 permanent jobs and 150 construction jobs the project can have only positive impacts on businesses in the district.

Tourism is not likely to be affected as the plant is not unsightly and is well screened by landscaping and a buffer zone. Experience in other locations where monazite is produced (Bunbury, Capel, Geraldton) does not indicate tourism is affected by the handling and transport of chemicals and low level radioactive materials. Rhône-Poulenc's own experience, at La Rochelle in France where a Rare Earth Plant has been operating for many years, indicates that tourism, business, fishing, boating and agricultural production is not affected in any way.

Rhône-Poulenc has conducted many tours of its Pinjarra plant since 1988 and more so in recent months. Visitors have found these tours to be interesting and informative.

Aboriginal communities should have been contacted before the workshops.

An Aboriginal site survey was conducted in 1987 as mentioned above. The workshops were advertised in the local newspaper as an invitation for all members of the community to attend. A direct approach has now been made to local Aboriginal representatives.

Section 5.4.5

Will the company consider sponsorship of local organisations?

Yes, when the plant is established.

What is the company's track record in terms of corporate citizenship?

Rhône-Poulenc's policy is to have active participation in the local community.

Isn't there enough industry in Pinjarra, already?

In practice, the rare earth plant will form an extension of the company's existing gallium plant. The project will be operated as an unobtrusive element of the local economy, generating 60 jobs and $10 million a year in business opportunities.

Are there any alternatives to the Pinjarra site?

The Proponent has already constructed a Gallium Plant and the associated infrastructure at their Pinjarra site. The Gallium Plant comprises a number of facilities that can be shared with a Rare Earth Plant, including:

- a system of evaporation ponds;
- infrastructure such as water, power, gas and communications;
- administrative offices, laboratory and maintenance workshops; and
- pipelines from Alcoa supplying caustic soda and water.

Substantial economic and environmental benefits will accrue from locating the Gallium and Rare Earths Plants at the same site.

Section 2.1

Will Rhône-Poulenc provide medical and hospital support services?

Medical and hospital services are already available in the community. Rhône-Poulenc will provide a health monitoring programme for their employees.

Will the company's management live in the Murray shire? Will the company encourage the workforce to live in Pinjarra?

Rhône-Poulenc's current plant management lives in the Murray Shire and the company will encourage employees to live in the Pinjarra region.

Would the company release details of its feasibility studies to provide information on what the company can afford?

No, this information is commercially sensitive and confidential.

Will the company consider compensation for nearby landowners? Will the company address any impact on property values - especially close properties? Will the company consider buying out affected properties?

The plant site is located in an industrial zone nearby to Alcoa's operation and adjacent to the Gallium Plant so it is not a greenfield site. The plant is located on a property with a large buffer area with 500m to its nearest boundary. Compensation for loss of value is not commonly practiced.

This project has been added to the area recently, unlike the Alcoa refinery which has been here for thirty years. Therefore a consultative group would be an important community benefit.

Rhône-Poulenc is actively pursuing establishing a Community Liaison Committee which will encourage the active involvement of local residents and Shire of Murray officials in the monitoring process at the Pinjarra plant site.

Section 6.16

What industrial awards would be applied to the workforce?

Competitive wages and employment conditions will apply to the plant.

Are there any plans for further investment in 'clean' industries in Pinjarra?

This project is environmentally sound and 'clean'.

Is there a market for tricalcium phosphate?

Tricalcium phosphate is a valuable source of phosphate and it will be sold to the fertiliser industry as feedstock for superphosphate production.

Section 3.4.1

What is gallium?

Gallium is a metal melting at 29°C used in the electronic industries.

ENVIRONMENTAL MANAGEMENT

Can the company identify what might happen in abnormal plant operations?

With the benefit of the advanced instrumentation at the plant, any excursion from normal plant conditions will be immediately identified and rectified.

How will the evaporation ponds be used and what will they contain?

The most significant materials which will be either disposed of or stored temporarily in the evaporation ponds are:

- tricalcium phosphate;
- calcium phosphate;
- sodium sulphate;
- sodium chloride; and
- water.

The effluent disposed of in the evaporation ponds will comprise non-radioactive liquid process wastes containing sodium salts, water from plant washdown areas, and, if necessary, water from stormwater ponds.

Tricalcium phosphate along with the other precipitated salts (ca, PO_4, Na_2SO_2) will be recovered daily from the pond via a specially-designed sump facility. It will then be filtered and collected as a moist cake and transported to the fertiliser industry.

The operation, monitoring and decommissioning of the evaporation pond system will be regulated by a licence issued to Rhône-Poulenc in by the Water Authority and the DEP.

Sections 3.5.1 and 6.3.2

Will there be any radioactive material in the ponds?

There will be no significant radionuclide streams being disposed of in the ponds.

Sections 3.4.1 and 6.3.2

Will there be dust suppression on the ponds?

Sufficient water will be maintained in the ponds to ensure a continuously wet condition so that dusting does not occur.

Section 6.3.2

Will the waste be packed into bags immediately and how is it stored prior to transporting?

The gangue residue will be automatically placed into heavy duty 2 tonne bulka bags of the type widely used for many years in the mineral sands and other industries. The bags will be initially stored in a dedicated building before being loaded directly into either standard ISO steel shipping containers mounted on trucks or into dedicated trucks for transporting.

Section 3.5.2.1

Will the company detail its "walkaway" plan for decommissioning?

A decommissioning and rehabilitation programme will be undertaken for the Pinjarra site at the end of the plant's life. The strategies for both decommissioning and rehabilitation are presented in the ERMP. The objectives of the programme will be to:

- eliminate unacceptable health hazards;
- restore the site to a condition such that it may be returned to its former land use, or such other use as may be appropriate at the time of decommissioning; and
- ensure that the state does not incur any ongoing liability with regard to the plant.

Decommissioning by the Proponent will be undertaken in accordance with statutory requirements in force at the time and in a manner acceptable to the Minister for Environment.

Section 7.0

Who will be at the plant to ensure that the company complies with all of the regulations?

Rhône-Poulenc has committed to operate to ISO 9002 certified procedures. The Operations Manager will be responsible for overall compliance with regulations. A Plant Radiation Safety Officer will be appointed to ensure compliance with radiation standards and the plant will be inspected regularly by officers from DOME and the Radiological Council. Auditing through NATA or similar independent authority will be an ongoing requirement as part of the ISO quality programme to maintain ISO Certification.

An independent auditor will also be appointed as committed in the ERMP to periodically check that the composition of the waste agrees with the specification.

Do any future extensions or modifications have to go through a separate environmental assessment involving the Environmental Protection Authority?

Any extensions or significant modifications to those proposed in the ERMP will need to be referred to the EPA and the EPA will determine if an assessment is required and if so the appropriate levels will be set.

Should the community opt for the Mt Weld project - involving a site closer to the disposal area?

The Mt Weld Meenar project does not currently appear commercially viable and is a matter for the proponent of that project, Ashton Mining.

Based on the experience with the gallium plant, some residents are concerned about noise levels from the project.

Experience with other processing plants operated by the Proponent indicates that plant operations will be relatively quiet. The combined noise level from both the Gallium and Rare Earth Plants operating simultaneously will be required to meet the requirements of the Draft Environmental Protection (Noise) Regulations 1995 of 35dB(A) at the closest residence between 2200hrs and 0700hrs. Due to the large buffer area surrounding the plant, it is unlikely that there will be any noise impact from the plant. A noise survey will be conducted by the Proponent prior to and during plant operations. Appropriate actions will be taken by the Proponent to rectify any noise problems should levels exceed those in the regulations and to ensure they meet the noise limits in the regulations.

Section 6.9

What will be the short/long term effects to the Peel-Harvey Estuary System?

There will be no short or long term impact on the Peel-Harvey Estuary system due to the project. Of previous concern to the EPA was the potential impact of long term disposal of ammonium nitrate at the Pinjarra site. The Proponent has since modified their process to eliminate this waste stream. The effluent requiring disposal in the ponds contains mainly sodium salts and not nitrogen.

Tricalcium phosphate will be stored temporarily in the ponds, prior to being retrieved, filtered and transported to the fertiliser industry.

Section 6.3.2 and Appendix J

When the plant is decommissioned what can it be used for if there is radiation left on the site?

There will be no radioactive materials left on site when the plant is decommissioned.

Rehabilitation requirements currently aim that as far as radiation is concerned the site should be restored to pre-project levels. It is not expected that there would be any relaxation to these conditions in future. Future land use would not be affected as a result of the site's use for rare earth processing.

Section 7.0

Will the company outline environmental monitoring arrangements for noise, radiation (including radon gas) and baseline studies?

Environmental management and monitoring for the project is presented in the ERMP containing a detailed Environmental Management Plan (EMP) and Radiation Management Plan (RMP) which will be prepared and submitted for approval to the relevant authorities being DEP, Radiological Council and DOME. The plans will also be discussed with the Pinjarra Community Liaison Committee (once established).

Section 6.11, 5.5 and 6.4.4.6

What has changed so that the company is no longer producing ammonium nitrate?

The purification of the rare earth is continued such that all significant radioactivity is removed and the rare earth is left in nitrate form as a solid.

Sections 1.3, 2.2 and 3.2

Does the pipeline from Alcoa pose any threat to the environment - in particular the waterways?

Caustic soda will be delivered via the pipeline from Alcoa. Monitoring is conducted at each end of the pipeline to measure flow rate, pressure and temperature. In the unlikely event of a pipeline rupture the Programmable Logic Controller (PLC) monitoring will allow the pipeline to be shutdown immediately thereby minimising the loss of caustic soda to the environment.

Any spillage will be localised and would not extend to the main waterways. Caustic soda when exposed to the air changes to sodium carbonate which is not harmful.

Section 6.5

Is any material returned via pipelines to Alcoa?

There is one pipeline to return spent Bayer liquor from the Gallium plant to Alcoa's Pinjarra Refinery. This liquor is returned to Alcoa's process stream.

If monazite is returned to its original location does this pose a problem for the environment and future residential developments?

Monazite is currently returned to the minesite by the mineral sands companies. The monazite is mixed with other mine overburden to meet with disposal specifications. By conforming with the requirements of DOME and disposal regulations the disposal of monazite should not pose a problem to the environment and its presence alone should not inhibit any future residential developments. The IWDF at Mt Walton is considered to be a better location for disposal of radioactive wastes owing to its geology.

Will the company be prepared to make its monitoring results available to the public - and will these be sent to the neighbours?

Rhône-Poulenc will present their monitoring results in the form of reports which will be submitted to the DEP at a frequency determined by the DEP. These reports can be viewed by the public either through arrangements with the DEP or with Rhône-Poulenc. It is likely that the reports will be reviewed by the Pinjarra Community Liaison Committee (once established).

Personnel health monitoring results will be available to the employees and a summary would be discussed with the site committee.

Does the project have any effect on the district horse trail?

No. The company was involved in a joint project with the Murray Shire in establishing this trail in 1987. There is no reason why this should be curtailed.

Has there been any contamination from the company's plant in La Rochelle?

None. All product and by-products are controlled by strict regulations in France and the company operates in strict accordance with the regulations.

RADIATION SAFETY

Can the company guarantee the safety of local workers' and residents' children and grandchildren?

Local workers' and residents' children will not be exposed to any radiation changes. The company guarantees the safety of these individuals.

What kind of exposure can emergency workers expect at accident scenes?

Emergency response team members will be properly trained in clean-up procedures to minimise exposure time. Team members would have to be in contact with the waste material for many hours before exposure levels are exceeded. In the time taken to attend to any injured persons and to clean-up spilt material, the dose received by emergency response teams will be much less than the time needed to exceed allowable exposure times.

Has the company considered the potential for accidents during loading and unloading?

If the preferred transport mode of road directly from plant site to IWDF site is instigated, there will be only one loading and one unloading of the containers. Loading will be on the Pinjarra site, where Rhône-Poulenc will have stringent loading management procedures, and at the IWDF site, where Rhône-Poulenc and the operators of the site will have control and management of those involved in the disposal operations who will all be fully trained. With only two handlings of the waste, the risk of an accident occurring is restricted to the two sites. If a road/rail option is chosen this increases the chance of an accident because there would be multiple transfer handling operations. However, all operations will be supervised by those responsible for the activities. Handlers will be trained in management and emergency clean-up procedures.

Is there a risk of waste attaching to the wheels and exteriors of vehicles?

The only potential for the material to attach to the wheels is if there happens to be a spill and the truck drives over the spill. In this event the truck can be directed to a bunded area in which the wheels can be cleaned. Vehicles will be checked both at the Pinjarra site and at the IWDF site to ensure that no radioactive material is attached to the truck.

Will the company consider a public education program to address concerns over radiation?

Rhône-Poulenc would be happy to participate in a public education programme, however, to reach a large number of the public it is a matter for education authorities, the media and other public bodies. Rhône-Poulenc will continue to provide information to the community in the form of workshops, an information centre, free call information line, information leaflets on the project and Rhône-Poulenc's operations and products. General information on radiation and safety aspects will be an important component of this programme.

Will the solubility of radiums contained in the waste, pose a problem to the environment, such as groundwater at the disposal site and surface water during transport?

Radiums contained in the waste during transport will be in the form of insolubilised barium sulphate co-precipitates. Therefore there is no potential for them to get into surface water during transport, as any spill will be cleaned up.

Radiums produced from the decay of thorium, in time, at the disposal site will not leach into groundwater at the site as the groundwater is isolated from the disposal trenches by a layer of clay and rock many metres thick. This is one of the reasons the IWDF site was selected.

Will the workforce have a say in occupational health and safety?

Rhône-Poulenc will establish safety committees at the plant site as required by Occupational Health Legislation. These committees will consider any radiation questions raised by the workforce or any other matters of occupational health and safety.

Will there be any restriction of the employment of women, in particular those of child bearing age?

The only restrictions considered necessary are those recommended by the National Health and Medical Research Council which is that following the declaration of a pregnancy the employee should be given the same level of protection as the general public. This would mean the employee would have an exposure limit of 1mSv for the term of the pregnancy.

Has there been any research on the effects of radiation on male reproduction?

There have been studies on elevated level of exposure. Employees will not be at risk at the maximum level of exposure to be allowed at the plant.

What is the difference in the effects of radiation on children and adults?

The biological effects are similar but specific limits for inhalation or ingestion may differ. These differences are not likely to exceed by a factor of two fold.

What is a lethal radiation dose?

In order to be life threatening (50% of cases) a dose of 200-500 times the maximum level allowable for workers would be required and the exposure would need to occur in a short period of time (less than one month). Such doses are not possible from monazite processing.

What are Australia's exposure limits; how do they compare with international levels; how will they effect neighbours in the long term?

Australia's radiation limits are based on international recommendations. These are:

- 20mSv per annum averaged over 5 years with a limit of 50mSv in any one year for designated workers; and
- 1mSv per annum average over 5 years with a limit of 5mSv in any one year for the general public.

These limits are comparable with the standards in other countries. There will be no effect on neighbours from radiation exposure.

Section 6.4.4.1

Why do workers have the highest level of exposure?

The community accepts different levels of risk for different groups of people and in general allows risks to workers to be higher than for the general public. Workers comprise a group of healthy persons who have regular checks on their health status. They are trained in radiation management and gain the benefits of employment from working in such an industry. General public include a much larger number of people of a wider range of ages and health conditions and do not receive a direct benefit from employment.

Will transport containers absorb radiation?

Steel containers shield radiation according to the thickness of the steel. Alpha and beta radiation is stopped by a steel barrier. To reduce gamma radiation either a thicker layer of steel or a water shield is required. The irradiation does not result in the container retaining any residual radioactivity.

Will the fertiliser material contain low level radiation?

Like the majority of natural minerals and soils, tricalcium phosphate is slightly radioactive. It will conform to all regulations in this area and will not contribute significantly to the average level of radioactivity in the areas of application.

Section 3.4.1

On a global scale can this plant be put into perspective compared to an operating nuclear power station?

Risk from this plant can be considered at least one million times less important than a nuclear reactor. It will not generate any radioactivity which is not already present in the natural mineral used raw material.

How would the one milli sievert level to the public be checked?

Exposure is calculated by estimating the maximum exposure to a source of radioactivity which may be released from the plant. These will be measured in an ongoing environmental monitoring programme which must have the approval of DOME and the Radiological Council. The methods and means of these calculations will be discussed with the Pinjarra Community Liaison Committee (once established) and may be subject to an Environmental Radiation Monitoring Programme approved by the Radiological Council and DOME.

DISPOSAL AT MT WALTON

Will this mean that IWDF will be a national waste deposit?

Approval conditions for the IWDF preclude the disposal of waste from other states. Any changes to this arrangement would require legal changes to the status of the site - and a change in government policy.

Who is responsible for the waste once it reaches Mt Walton?

The Government would take responsibility for the waste at the IWDF site, however, the Proponent will fund the operations and will ensure that the composition of the waste arriving at the site conforms to specifications agreed with the EPA. The practices at the IWDF will be derived from proposals presented by the Proponent to the EPA.

Section 1.4

How is the waste disposed of at Mt Walton?

Disposal operations are described in the Environmental Management Program (EMP).

The gangue residue will be removed from the containers and placed into trenches of approximately 15m deep. Each three-bag layer will be covered with a layer of soil at least 0.5m thick. The top layer of bags will be covered with at least 5 metres of clay, rock and soil. The waste will be disposed of in a series of these trenches.

How long will the waste be monitored at Mt Walton and who will pay?

Monitoring will continue for a period of at least 100 years after the final disposal operation. Rhône-Poulenc will contribute to the long term monitoring of the site and management of the waste through the contract and disposal fees set by the Government.

Why are bags preferred over drums for waste disposal?

Bulk bags have been used to transport monazite for many years and have been found to be reliable and safe. Drums have a much smaller capacity and require significantly more man hours to fill and load, therefore increasing the potential radiation exposure to the workers.

Section 2.4.2

What is the performance record of bulka bags - and how long before they break down after disposal?

Information has been obtained from the Mineral Sands Companies on their experience with the performance of bulk bags used for transport of monazite. Their experience is that bulk bags made to the appropriate standards are a reliable, efficient packaging medium and no problems have been experienced with breakage or spillage during transport operations. The bags will eventually break down in the trench, however, containment of the waste in the trench is provided by the surrounding clay.

Section 3.5.2.1

What happens if the waste dries out after an accident - will the dust be contained?

In order to simulate the unlikely event of the waste being exposed for sufficient time, following an accidental spill, to allow it to dry completely (therefore represent a potential dust source), samples of similar material have been both air and oven-dried. In these circumstances the waste behaves as a typical clay and binds it into a solid which does not dust unless mechanical effort is applied. If a machine is required to clean up any spill the emergency clean-up team members may be required to wear face masks to prevent the inhalation of any material.

Sections 6.2.2.3 and 6.4.4.8 and Appendix H

Why was the IWDF site chosen and who chose the site?

The site was chosen by the WA Government for its ideal geological structure.

What is the geology of the site including details on aquifers and seismic risk?

The main criterion to be met for the disposal of low level radioactive wastes is that the area is geologically stable. This criterion is paramount as the wastes will remain radioactive, albeit at a low level for an extremely long time. Such stability is afforded by the Yilgarn Block which covers much of the southern part of Western Australia. The IWDF is located in the Yilgarn Block. This region comprises of a massive thickness of granite with generally low seismic activity (EPA, 1988b).

The region is typically underlain in parts by hypersaline groundwater which is unlikely to be exploited for domestic or agricultural use. The only major use for the water in the goldfield region is for gold processing. The waste disposal site is all relatively distant from local sites of potential gold mineralisation (EPA, 1988b).

GENERAL

Will the company establish a local consultative committee to monitor the project?

Rhône-Poulenc supports the establishment of a Community Liaison Committee in the Pinjarra region, which will encourage the active involvement of local residents and Shire of Murray officials in the monitoring process at the Pinjarra plant site.

Section 6.16

Will all monitoring results be published?

Monitoring results from the Pinjarra plant site will form part of reports which will be submitted to the DEP at a frequency to be determined by the DEP and nominated in their licensing conditions. The Community Liaison Committee (once established) will review the monitoring results. A regular independent audit of operations at Pinjarra will also be set up with results available to the public.

Monitoring at the IWDF will be conducted by the Government, and it is understood that these results can be reviewed by the public through the DEP.

Why were the workshops organised without alternative experts - to balance the company viewpoint?

The intentions of the workshops were for Rhône-Poulenc to brief the community on the project and for the community to relay their concerns to Rhône-Poulenc. All the concerns were noted and will be addressed in the ERMP. Expert consultants attended the workshop to provide technical information and answers based on their professional knowledge.

Some community representatives urged the appointment of a panel of independent experts to represent the community.

The Environmental Review and Management Programme will be subject to a review by members of the public including independent experts. The EPA/DEP has the role of an independent body to review the company's plans as part of the environmental assessment process. The EPA/DEP have independent experts to assess the project.

Is the company aware that Belmont is a nuclear-free zone and might not allow the transport of radioactive waste through its district?

The transport route does not pass through Belmont. Also the 'nuclear-free zone' title would not impact on transport of low level radioactive waste as there is no nuclear waste i.e. there have been no man-induced nuclear reactions, only naturally occurring radioactive elements.

Will the company consider epidemiological studies of workers?

Health monitoring of workers will be undertaken and will be described in the ERMP.

Can Rhône-Poulenc provide information on the company's industrial track record?

Rhône-Poulenc has a very good industrial track record and employees number around 500 in Australia alone. Accident records are below the national average and standards are rigorously maintained.

Will the company consider arrangements for bonds and penalties to address any future compensation requirements?

A contract will be established between Rhône-Poulenc and the Government in relation to waste disposal, monitoring and contingency costs.

The company was asked to incorporate the workshop findings in a formal policy and action plan - rather than a list of questions and answers.

Where appropriate, findings from the workshops have been and will continue to form part of action plans and formal policy for the project. Part of those action plans and policies are documented in the ERMP and will be incorporated in detailed operation procedures for the plant.

Some workshop participants said that mining and mineral processing companies had poor reputations for environmental management and community relations.

Rhône-Poulenc has undertaken to provide the community with information relating to the project from the early planning stages through to construction and operations. Rhône-Poulenc is also committed to the Chemical Industries Responsible Care Programme which includes effective environmental management.

What constitutes radiation levels - low, medium high?

There is no agreed classification in Australia, however, in general 1mSv per year is considered a low level of radiation, 20mSv per year as medium and 1mSv in a short time would be considered as a high level.

What is the radioactive level of the monazite and the waste?

Monazite contains about 6% thorium and 0.3% uranium. Data from the Minerals Sands Companies have shown that the external radiation dose from a bag of monazite to be up to 100µSv at zero distance from the bags. The gangue residue contains about 12% thorium and 0.6% uranium and it is expected that the radiation dose from a single bag of residue will be around 200µSv/hr at zero distance or 40µSv/hr at 1 metre or 0.4µSv/hr at 10 metres.

Sections 3.3.1, 3.4.2 and 6.4.4.8

What air emissions will be produced, i.e. dust, any other?

There will be little or no generation of radioactive dust at the plant, therefore, there will be no radioactive dust emissions transported off-site.

The only release of radioactive materials will be the radioactive inert gases radon and thoron. The maximum radon emission resulting from the process is likely to be around 10% of the expected natural radon emanation from the soils over the Proponent's property (based on world average values of radon release from soil).

Section 6.4.4.4

Is there likely to be any leaching from the ponds? If there is what is the impact on groundwater?

The evaporation pond system was designed and constructed following extensive consultation with appropriate authorities and experienced engineering consultants and has effectively been subject to a full-scale operational trial utilising Gallium Plant effluents. Monitoring has indicated that no leaching has occurred from the ponds. Design features of the evaporation ponds include an extensive underdrain system. The system comprises 500mm of sand over a minimum thickness of 500mm *in situ* clay. The underdrains have been isolated from the pond contents by a 1m thick compacted clay liner (Figure F2). These features will ensure that, in addition to the minimisation of leachate from the ponds, any material seeping through the clay liner will be intercepted and returned to storage.

Management of potential leachates will also be facilitated by the groundwater monitoring system that is already in place at the plant site. This system allows abstraction from the bores as well as groundwater level and quality determination and will thus indicate any development of leachate plumes in the subsurface and allow for plume recovery. Materials disposed in the ponds will consist mainly of sodium salts, therefore if any leaching does occur there will be minimal impact on the groundwater. Tricalcium phosphate will be stored temporarily in the ponds and due to the insoluble nature of this material, its potential for leachate is minimal.

Section 3.5.1.1 and 6.3.2, and Appendix J

Transport route for each of the raw materials etc? Breakdown of truck loads.

Table F1 summarises the raw materials and products required for the project.

TABLE F1

SUMMARY OF RAW MATERIALS AND PRODUCTS TRANSPORTED BY ROAD TO AND FROM THE PLANT SITE

	Tonnage (per annum)	Origin/Destination	Frequency of Transport Trucks/Week
Monazite	12,000	Geraldton, Eneabba, Bunbury, Capel/Pinjarra	7**
Other Raw Materials	29,430	Kwinana/ Pinjarra	15***
Product - Solid	15,000	Pinjarra/Fremantle	16**
Tricalcium Phosphate	23,000	Pinjarra/Kwinana	12*
Gangue Residue	6,000	Pinjarra/Mt Walton IWDF	3*
TOTAL	85,430	-	53 2,438 trucks per annum (based on 46 weeks)

Source: Rhône-Poulenc, pers. comm.

Notes:
* Assumes 20 tonne trucks.
** Assumes 40 tonne trucks.
*** Mixture of 20 and 40 tonne trucks.

Monazite will be transported from Geraldton/Eneabba via Great Northern, Roe, Tonkin, Albany and South Western Highways to Pinjarra-Williams Road and then along Napier Road to the site. Some monazite will be transported from the Bunbury/Capel area via South Western Highway, Coolup Road, Burnside Road, Pinjarra-Williams Road to Napier Road. Acids and lime will be sourced from Kwinana via Russel Road, Stock Road, Mandurah Road, Mandurah Bypass, Pinjarra Road to Pinjarra-Williams Road. Trucks transporting the tricalcium phosphate by-product from Pinjarra to Kwinana will also use this route. Trucks transporting the solid rare earth nitrate product to Fremantle will travel either the same route as for the acids and then along Stock Road to Fremantle or via Napier Road, Pinjarra-Williams Road, South Western Highway to Thomas Road to Fremantle.

Section 6.2.2.1

Is Napier Road/Pinjarra-Williams Road intersection adequate?

The adequacy of the intersection will be reviewed in conjunction with the Shire of Murray and Main Roads Western Australia. The review will comprise a dimensional assessment of truck turning circles, road widths, layout of traffic islands and the distance from the rail crossing to the intersection.

Is there a certain distance the public will need to be away from trucks? Particularly during stops.

Radiation exposure is reduced by distance but there is no specified distance that the public must be from the truck. Labelling on the trucks will be of a size large enough, as specified in the Australian Code for the Transport of Dangerous Goods by Road and Rail and the Code of Practice for the Safe Transport of Radioactive Substances (Commonwealth of Australia, 1990, Federal Office of Road Safety, 1992) to be visible for at least 10 metres. Radiation exposure at this distance will be very low. It is estimated that for a person to exceed the exposure limit of 1mSv, they would have to be in contact with the side of the truck for at least five hours. At a distance of 10 metres, an exposure time of 40 days would be necessary to exceed the public limit.

Rail is the preferred option from the Pinjarra plant site.

In the absence of a suitable siding near the plant site and at the IWDF site, the transport of rail from Pinjarra site to the IWDF site is not feasible. Therefore, a combination of road/rail would have to be used if rail was selected for part of the route. The road/rail option involves a greater number of handling operations without the complete control and management of Rhône-Poulenc. By loading onto trucks at the Pinjarra site and road transport directly to the IWDF site for unloading, results in less handling and complete control of transport contractors by Rhône-Poulenc.

Section 2.4.2

If an accident occurs and a waste is spilt on the property will there be adequate compensation from the company?

Rhône-Poulenc has comprehensive public liability insurance to compensate for accidental damage to third parties.

It is clear land owners along Napier Road do not wish to remain if Rhône-Poulenc is given the go ahead. Will Rhône-Poulenc buy them out at current market value given that Rhône-Poulenc was not there, thus giving the company a decent size buffer zone.

The buffer zone Rhône-Poulenc presently has, is more than adequate for plant operations. The total land holding is 515ha of which only 23ha will be developed for the Gallium Plant, Rare Earth Plant and the evaporation ponds. The Rare Earth Plant will occupy only 1ha and will be over 800 metres from the plant site to the nearest private residence.

Approximately 200ha is currently planted to hardwood plantation and vegetation for screening, and the remainder will be used for rural purposes.

Four of the seven nearest properties have been purchased by the recent owners in the last 2 years - well after Rhône-Poulenc announced its plans in early 1987 for a Gallium and Rare Earth Plant at Pinjarra . However, the company is well aware of the concerns of its nearest neighbours. As a result it has commissioned a licensed valuer to provide information on property values in the vicinity of its plant. These valuations show the properties have increased in value from January 1987 to May 1995 well in excess of C.P.I.

Any impact on property demand in the locality may be due to some unfounded adverse publicity. Property values are expected to recover once the decision on the project is made.

What problems are associated with dust from the plant that may settle on neighbours roofs and be washed into rainwater tanks, also on vegetables and fruits? As radioactivity accumulating if ingested how much of a serious problem will this be? Especially on small children and over a long period of time?

There will be no dust emissions from the plant as it is a wet process and all potential dusting sources will be protected by dust collectors. This will be verified by the dust monitoring as required by the Radiological Council and DOME.

Ingested dust does not accumulate as it is expelled by normal body functions.

How can the public be guaranteed that the PER is accurate and simply not company propaganda?

The ERMP is a technical Environmental Review and Management Program to allow the public and relevant authorities to assess the project on environmental aspects. The company has commissioned technical consultants to assess all the environmental and radiological issues associated with the project.

Rhône-Poulenc guarantees the information will be accurate based on the information available at the time of document preparation.

* * *

WA Rare Earth Project
Briefing for the WA Conservation Council
Conservation Council Offices, Stirling St., Perth
May 23, 1995

Rhône-Poulenc and the WA Conservation Council met on May 23, 1995, to identify some of the key issues to be addressed in the company's rare earth project assessment. Draft copies of the environmental impact statement were discussed at the meeting. The following summary covers the principal discussion points.

Attendance

Noel Davies (Office of Waste Management)

Cathy Gupanis (Dames and Moore)

Bruce Hartley (Radiological adviser to Rhône-Poulenc)

Elaine Horne (Conservation Council)

Jean Horner (Pinjarra resident)

Phil Jennings (Conservation Council)

John Nayton (Community relations adviser to Rhône-Poulenc)

David Newton (Rhône-Poulenc)

Cameron Schuster (Office of Waste Management)

Rachel Siewert (Conservation Council)

George Stewart (Dwellingup resident)

Terry Waters (Dames and Moore)

Max Webb (Rhône-Poulenc)

The major issues to emerge from the discussions were -

1. The need for effective public participation in the project planning and assessment
2. Concerns over the long term role of Mount Walton East as a waste disposal site.
3. Responsibility for the waste at the Mount Walton East site.
4. The significance of changes to the plans for monazite processing.
5. Transport
6. Radiation safety - for employees
   - transport operators
   - Pinjarra residents
   - residents on the transport route, and
   - people at the Mount Walton site
7. The company's French associations

Background - David Newton, Chief Executive, Rhône-Poulenc Australia.

The first proposal

Rhône-Poulenc first sought approval for a rare earth plant at Pinjarra in 1988. The project was planned to share infrastructure with a gallium plant (which extracts gallium from the Pinjarra Alcoa Alumina Refinery process liquor) on the same site. The gallium plant and the first stage of the rare earth project were approved by the State Environmental Protection Authority. However, the rare earth plant second stage was rejected because of concerns over the disposal of ammonium nitrate in evaporation ponds at Pinjarra. The EPA was concerned about the potential for long term nutrient contamination of the Peel Inlet system. In addition the authority considered that the plant did not adequately address the long term storage of radiums.

Rhône-Poulenc investigated alternative plans for rare earth processing but decided not to go ahead because of marketing problems.

The new plan

Since 1988, circumstances have changed. Markets have improved and the company has developed a new process plan which eliminates the need to produce ammonium nitrate. In addition, the Government has established an intractable waste disposal site at Mount Walton in Coolgardie Shire. Under the revised plans, monazite will be processed to three streams -

- rare earth nitrate for export,
- phosphates for use in fertiliser manufacture, and
- a waste gangue for transport to the Mount Walton waste disposal site.

Alternative projects

Two alternative ventures have been proposed - one at Northam using ore from Mount Weld and another in South Australia planned by Essex Holdings. Neither of the two alternative projects - requiring investment in new mining and processing infrastructure - appear viable under present market conditions. The Rhône-Poulenc project has the advantage of using monazite produced already as a by-product of the titanium minerals industry. At present, monazite is returned to the mine site for disposal or storage. The Pinjarra project will use established infrastructure built for the gallium plant.

Radiation safety

Based on advice from Dr Bruce Hartley, the former Physicist in Charge of the Radiation Health Section of the WA Health Department, the company has developed a comprehensive radiation safety strategy. The maximum exposure for any worker will be half of the accepted national limits. There will be no discernable increase in radiation levels at the boundaries of the site. Maximum exposure for transport drivers will be two millisieverts per year, compared to the safety standard limit of five millisieverts per year.

Community consultation

The company is committed to an extensive community consultation program as part of the project planning process. To date, the program has included briefings for local authorities and special interest groups. A series of workshops has been arranged at the suggestion of Dr Phil Jennings and Coolgardie community representative Shyama Peebles. The company is asking people attending the workshops to identify the major issues which should be addressed in the environmental review.

Mr Newton said that Rhône-Poulenc was adopting a more open and enlightened approach to project planning. He said that the company's previous consultation with the public had been insufficient. As part of its current application, Rhône-Poulenc was making a positive and genuine attempt to consult with the communities affected by the project.

The waste

Technical aspects of waste disposal were covered by Dames and Moore engineering consultant Terry Waters. Speaking on the policy approach to environmental management, Mr Newton committed the company to a responsible stewardship of the waste from the processing site to Mount Walton. He said that all operations would be managed under quality assurance procedures. The company would recommend to the EPA that an independent auditor be appointed to oversee the waste disposal operations. The auditor should be independent of both the company and the site operator, the Department of Environmental Protection.

Although the company will take its safety responsibilities very seriously, Mr Newton believes there has been a tendency to overstate the hazards associated with the waste. The material is classified as a low level radioactive residue which will not affect members of the public or most employees in normal operating conditions. The waste is hazardous only to someone in contact with the material for an extended period - more than 30 hours. The material is less hazardous to the public than petrol, LPG or sodium cyanide.

Waste transport and disposal - Terry Waters, Dames and Moore Engineering and Environmental Consultants.

The Pinjarra rare earth plant is expected to produce 6000 tonnes of low level radioactive waste a year. This material will be stored in two-tonne bulka bags which will be transported in steel containers - each holding 20 tonnes of waste.

The company is examining three potential options for transport of the waste:

- Rail from Pinjarra to Koolyanobbing (or an alternative unloading point).
- A road-rail combination
- Road from Pinjarra to Mount Walton East.

Rail

The rail option will involve the construction of new sidings at Pinjarra and - possibly - the goldfields. Containers would be transported on narrow gauge to Forrestfield and transferred to standard gauge rolling stock for transport to Koolyanobbing, where the containers would be loaded on to trucks for the trip to Mount Walton.

Road-rail

Under the road-rail plan, containers would be trucked to Forrestfield and transferred to standard gauge rail wagons for the trip to Koolyanobbing and subsequent road haulage to Mount Walton.

Road

Road transport would mean trucking the containers on B-double units from Pinjarra to Mount Walton.

The preferred option

The company's preferred option is likely to be road transport from Pinjarra to Mount Walton. "Door-to-door" road haulage will reduce double handling, improving efficiency safety procedures. B-double units would probably use South Western, Albany, Roe, Tonkin and Great Eastern Highways. Based on a payload of 40 tonnes, the transport operation would involve three trips a week.

Emergency response

The trucks would be equipped with high frequency radios and global positioning systems to pinpoint the location of vehicles at all times. If a vehicle makes an unscheduled extended stop, an alarm will sound at the company's Pinjarra control room, triggering the first stages of an emergency response procedure. As part of a special management program, the company will be required to detail an emergency response plan in line with established procedures for dealing with hazardous goods. The company will train emergency service workers in procedures for dealing with a waste transport accident.

Disposal

The waste will be buried in trenches 15-20 metres deep. Each trench will hold two years' supply of waste. The bulka bags of waste will be unloaded into the trenches, packed with sand and progressively covered with layers of clay. The top five metres of each trench would be filled with rock and clay before rehabilitation.

* * * * *

Conservation Council Concerns

WA Conservation Council representatives raised 27 specific concerns and questions to be addressed in the ERMP. In addition the discussions identified a number of major issues which would have to be resolved.

1. Public participation

Rhône-Poulenc has implemented a comprehensive consultation program - including workshops and briefings recommended by the Conservation Council. However, Council representatives at the May 23 meeting sought assurances that the process would involve genuine public participation in the project planning and assessment. Phil Jennings said that proposed liaison committees should include representatives of groups which had a genuine interest in the project. The committee structure should ensure that community representatives were not intimidated. George Stewart said the company should consider more than one liaison committee to cater for different communities and project issues.

2. The role of Mount Walton

Discussions at the briefing included a debate over the reasons for establishing and maintaining the Mount Walton Waste Disposal Facility. The company argued that the site had been established to take monazite processing residue, in addition to hospital waste and other incidental radioactive materials. Elaine Horne said the Health Department had given an assurance that Mount Walton was "a very specific project to deal with waste already stockpiled in WA." She said that opponents of the Mount Walton facility felt duped by recent claims that the site had been established for monazite waste. Office of Waste Management acting director, Cameron Schuster, said he was unaware of any Health Department statement on restrictions at Mount Walton. He offered to investigate the report and provide a reply in writing.

3. Responsibility for the waste

Conservation council representatives sought detailed explanations of the agreements between the State Government and Rhône-Poulenc to cover the cost and control of waste management. In particular, the group wanted information on the arrangements for long term monitoring - and the commitments to deal with any future unexpected problems.

Rhône-Poulenc will be responsible for transporting the waste to Mount Walton. In addition, the company will pay the cost of waste disposal and future monitoring. However, the management of the waste at the site will be the responsibility of the State Government. The State Office of Waste Management will use contributions from Rhône-Poulenc to set up a trust fund for long term monitoring and management.

4. Process changes

The company believes that revised process plans will address the major concerns of the State Environmental Protection Authority. When a rare earth project was proposed for Pinjarra in 1988, the second stage of the development was rejected because of plans to dispose of ammonium nitrate and traces of radium at the plant. The EPA was concerned about the long term risk of nutrient leaching into the Peel Inlet system.

Under the new plans, monazite would be processed to rare earth nitrate for export, phosphates for use in fertiliser production and solid wastes to be transported to Mount Walton. The change will prevent any potential contamination of the inlet system.

Questions at the Conservation Council discussions dealt with the use of the plant evaporation ponds; the security of materials stored in the ponds; temporary storage of waste and reagents and decommissioning plans. The company was asked to provide assurances that export products and phosphates would not create any contamination risks.

5. Transport

Transport has been one of the major concerns of most workshop groups and discussion . Local residents have highlighted the risk of trucking accidents and ruptures of the bags and steel containers. Shires on the transport route have sought some involvement in the preparation of emergency plans.

Rhône-Poulenc is still examining the rail and road options for transport. Road is likely to be favoured to avoid repeated double handling. The company is committed to a comprehensive emergency response procedures - involving local authorities on the likely transport route.

6. Radiation Safety

Radiological issues were a principal focus of discussions at the Conservation Council meeting. Council representatives asked for activity and radiation data for monazite and the process waste. Elaine Horne asked for the inclusion of additional details on radioactive materials in the ERMP. The group identified a number of specific concerns over the safety of

- transport operators,
- plant workers,
- baggers and loaders, and
- emergency workers who might be required to attend accidents.

The company was asked to include detailed information on the regulations covering radiation safety.

Adviser to Rhône-Poulenc on radiological issues, Dr Bruce Hartley, outlined the safety measures which were designed to limit workplace radiation levels to less than 50 per cent of statutory limits. The company agreed to provide the detailed information requested by the Conservation Council.

7. The company's French associations

Rhône-Poulenc is a former French-Government-owned company, prompting questions about the Government's continuing influence and interest in the company's projects. Council representatives sought additional information on the international spread of shareholdings.

David Newton said that - after recent privatisation - the French Government owned less than one per cent of the company. He agreed to research the information on current worldwide shareholdings.

Questions and specific concerns

ENVIRONMENTAL MANAGEMENT

What provision has been made for decommissioning the plant?

A decommissioning and rehabilitation programme will be undertaken for the Pinjarra site at the end of the plant's life. Strategies for decommissioning are detailed in the ERMP.

Decommissioning by the Proponent will be undertaken in accordance with statutory requirements in force at the time and in a manner acceptable to the Minister for Environment.

Section 7.0

Is there a risk of evaporation ponds overflowing during heavy rainstorm?

The first pond (B-1) in the evaporation pond system will operate at a constant adjustable level and will overflow into the second pond (B-2), hence overtopping of the first pond cannot occur. The second pond will be operated with a minimum freeboard of approximately 1.5 metres.

The storm ponds are designed to accommodate 100mm of rain from the plant site area. The operating philosophy of the storm ponds is to direct clean rainwater to the adjacent creeks and contaminated water to the evaporation ponds. Allowing for no diversion and up to 100mm of rainfall, this would increase the depth of the second evaporation pond by an additional 130mm. Combining the effects of heavy rainfall on the plant site and the pond system, together with the maximum operating level intended in the ponds, still leaves approximately 1.3 metres of freeboard.

Section 6.3.2 and Appendix J

What provision has been made for a pond rupture in the event of an earthquake?

Records from the Australian Geological Survey Organisation (formally the Bureau of Mineral Resources) indicate that only nine earth tremors above II on the Modified Mercalli Scale (MMII) have occurred at the Pinjarra site since 1941. MMII is classified as the level at which tremors may be felt by a few persons at rest indoors, especially on upper floors (Standards Association of Australia, 1979). The highest intensity was in 1968 (the Meckering earthquake) where an intensity of MMV was experienced in Pinjarra.

The peak ground intensity contour map (Gaull, B.A. *et al.*, 1990) indicates that Pinjarra has a risk of an intensity MMVI to MMVII for a 1:500 year return event. From the definition of Modified Mercalli intensities, it is not until tremors reach an intensity of MMIX that dam structure may be seriously damaged (Standards Association of Australia, 1979).

Data indicates that there is very low probability of the evaporation pond walls being breached due to an earthquake, however, there remains a finite possibility of a breach occurring so the consequences of such a breach was considered in Appendix G.

Appendix J

Will the company publish a full table of all radioactive elements - their half lives and biological effects?

The radioactive activity of the monazite (thus the waste) is related to ^{232}Th and ^{238}U and their decay products. Members of the ^{232}Thu and ^{238}U decay series are listed in Attachment 1.

What quantities of reagents and other hazardous materials will be stored on site?

Process chemicals will be stored in a dedicated liquid storage area of the plant. Storage tanks will be provided for sulphuric acid (H_2SO_4) ($100m^3$) hydrochloric acid (HCl) ($50m^3$) and nitric acid (HNO_3) ($150m^3$). Each tank will be contained in a separate bunded area to avoid any possible mixing of chemicals in the event of an accidental spill. Storage tanks for the sulphuric and hydrochloric axis and the bunded area for the nitric acid storage tank have already been constructed for the Gallium Plant, therefore only the construction of the nitric acid storage tank is required. The design layout and storage of the acids will be in accordance with the Dangerous Goods Regulations (1992). Storage tanks for the Bayer Liquor Streams (Input - $30m^3$; Output - $100m^3$) are located in a separate bunded area together with the two caustic soda tanks ($50m^3$ each).

Section 3.3.2

Will there be any radioactive cross-contamination of fertiliser material?

Nearly all of the radioactive elements (99%) in the monazite mineral are extracted during the purification process for rare earths and are contained in the waste stream. Both the rare earth and the tricalcium phosphate have extremely low levels of radioactivity.

Section 3.4.1

WASTE DISPOSAL

Does the company believe it has permission to dispose of radioactive waste at Mt Walton?

Disposal at the Mt Walton IWDF of low level radioactive waste, resulting from mineral processing such as monazite, was previously proposed by the Health Department (Maunsell, 1988) and was subsequently given conditional approval by the Western Australian Minister for the Environment.

Rhône-Poulenc is submitting this ERMP to seek approval for the disposal of the specific low level radioactive waste resulting from this project at the IWDF site.

The State Government has warned that no new industry can expect approval to dispose of waste at Mt Walton. Is the company aware of government commitments to limit the waste disposal at the site?

Rhône-Poulenc are not aware of any Government commitments to limit disposal of Western Australian waste at the IWDF site. However, the site has been approved for the disposal of monazite residue by the Minister for the Environment in his determination on the EPA Report and Recommendations on the establishment of the Integrated Waste Disposal Facility at Mt Walton East (EPA, 1988b). It is expected that any significant changes to the operating condition of Mt Walton East would require environmental impact assessment.

What levels of radiation are acceptable for materials to be buried at the Mt Walton site?

The IWDF site has been approved for the disposal of low level radioactive waste as long as it conforms with the appropriate codes and regulations, such as the National Health and medical Research Council Code for Near-Surface Disposal of Radioactive Waste (NHMRC,1992).
The waste will be required to meet the specifications documented in the Code for Disposal (NHMRC, 1992).

Sections 3.4.2, 6.4.4.9

What happens to materials that are too radioactive for Mt Walton?

There will be no such materials generated by the project at Pinjarra.

Who will have responsibility for the waste until it reaches the pit at Mt Walton?

Rhône-Poulenc will be responsible for the transport of the waste from the Pinjarra site to the IWDF site. The Government would then take responsibility of the waste for disposal, however, the Proponent will be required to fund:

- all costs of transport;
- disposal costs;
- contributions to long term monitoring of the site;
- contribute to the maintenance of the IWDF access road; and
- a provision for maintenance and any costs of remedial work necessary in the first five years after a disposal operation.

Section 1.4

What steps have been taken to manage a flash flood at the disposal site?

Surface water management systems will be detailed in the EMP and incorporated in the design of the disposal operations.

The systems will be used to:

- divert water away from the partially filled trench or trenches;
- minimise the quantity of water collected in the trenches at any one time;
- facilitate disposal by evaporation of any water collected within the trench; and
- control water erosion of the cover.

Will the disposal fees cover the costs of dealing with a misadventure at Mt Walton?

Yes.

Who will unload the waste at Mt Walton?

The waste will be unloaded by the fully trained drivers involved in the transport operations and Government personnel at the Mt Walton IWDF.

How will containers be unloaded from the trucks?

Bulka bags will be removed from the containers by use of either a tractor/fork lift configuration or an overhead crane depending upon the final choice of loading/unloading operations and type of containers. The tractor/fork lift configuration will have a telescopic arm which can be guided to pick up the bags, allowing the tractor to remain at a distance from the container hence reducing operation exposure. The tractor would then place the bags in the trench. If a top loading container is selected, then an overhead 'crane' would be used to extract the bags from the containers and place them in the trench.

TRANSPORT

Who is responsible for management of the waste in transit?

Rhône-Poulenc will have overall responsibility for the transport of the waste. The transport companies will also have responsibility to ensure that their drivers and trucks conform to the contract agreement between Rhône-Poulenc and themselves.

Section 6.2.2.3

What kind of contingency plans are in place to deal with accidents?

Emergency procedures would be prescribed in a management plan developed by the Proponent prior to the commencement of transporting the waste materials. This plan will be based on the Western Australian Hazardous Materials Emergency Management Scheme (WAHMEMS). Emergency response teams located along the transport route, will be trained in emergency and clean-up procedures. Training courses will include specific training on emergency procedures for the clean-up of radioactive waste. Drivers will also be trained in emergency procedures as part of the driver training courses.

Details on the Emergency and clean-up procedures are described in the ERMP.

Section 6.2.2.3 and Appendix H

Radium will be added to the waste in new proposal. How radioactive will this make the waste?

Whether radium is present at the beginning or not, radium is generated from both thorium and uranium radioactive decay, the waste will contain radium within a short time after its separation. Radium-224 will reach equilibrium in about 20 days. Radium-228 in about 30 years and Ra-226 after about 10,000 years. Ra-226 is a member of the uranium decay chain and thus is a minor component of the waste.

How much radiation will the truck drivers receive each year?

Dose limits for truck drivers, defined in the Code of Practice for the Safe Transport of Radioactive Substances, 1990 (Commonwealth of Australia, 1990) is 5mSv/yr. Rhône-Poulenc has set a design objective of 2mSv/yr. Doses will be measured in the driver's cabin and drivers will also be monitored.

Rhône-Poulenc will install a water tank if necessary as an additional shield between the driver and the load. This shield will reduce exposure levels to less than half the limit set in the Code for Transport.

Section 6.4.4.8

What material will be transported to Fremantle?

A solid rare earth nitrate will be the final product from the process which will be concentrated by evaporation, cooled and packaged for export from Fremantle. The annual quantity of the rare earth nitrate product will total 15,000 tonnes. Solid rare earth nitrate will be in granular form and will not be radioactive, corrosive or combustible.

Section 3.4.1

SOCIAL AND ECONOMIC

How will the rare earth project facilitate a restart of the gallium plant?

The shared infrastructure at the site (evaporation ponds, raw material/chemical storage, energy supply, maintenance service etc.) reduces the cost of both plants. Whilst the gallium market is improving, prices are still at a low level which requires maximum operating economies for a restart. In addition, the effluent from the Rare Earth Plant and the Gallium Plant together are compatible as they neutralise each other as one is acid and the other alkaline.

There are benefits to be achieved by sharing the cost of infrastructure and personnel between the Gallium and Rare Earth Plants. While the gallium market is growing, it is still not viable as a stand alone project. Hence the Rare Earth Project, by the sharing of these costs, will enable an earlier restart of the Gallium Plant.

How will the proposed consultative committees be structured?

A committee will be set up in Pinjarra, similar in concept to the Mt Walton East Consultative Liaison Committee in the Goldfields, to allow a full and regular exchange of views with interested Murray Shire residents. The committee would include representatives of the Shire, residents, rate payers, special interest groups and Rhône-Poulenc. The final structure would be determined in consultation with appropriate representative groups.

Rhône-Poulenc would like to participate in the existing Mt Walton East Consultative Liaison Committee.

Why did Rhône-Poulenc abandon its project so quickly after China began producing rare earth?

The price of finished product based on ytterium fell to one quarter of its original price. These products were the mainstay of Rhône-Poulenc's profitability in rare earths and the business went heavily into loss. It has taken Rhône-Poulenc until now to recover from this situation.

If the project has been stopped once, will it be stopped again?

Rhône-Poulenc has invested heavily in Research and Development over the last five years in spite of the poor profitability. This should allow Rhône-Poulenc to sustain its position in the market which requires a continuous input of high technology such as automotive control, high performance magnet alloys and low energy using lamps.

If this project is so fragile economically, should it be considered at all?

The project allows Rhône-Poulenc to become more independent of Chinese and American competitors by working together with Australian partners to put value into an otherwise valueless mineral byproduct, generating A$30 million of exports for Western Australia in the process. This appears to Rhône-Poulenc to be a very worthwhile venture both for Rhône-Poulenc and for Western Australia, including the individuals who will serve out the new jobs created by the venture.

Is Rhône-Poulenc a French government owned company?

No. In 1993 Rhône-Poulenc was fully privatised, returning to the situation it had prior to the nationalisation of 1982. Its shared are quoted on the New York and Paris stock exchanges.

What is the present international distribution of the company's shareholdings?

15% of Rhône-Poulenc shares are listed on the New York stock exchange. As is the case with many international companies a considerable portion of shares listed in Paris are held overseas some through superannuation Trust Funds. It is not possible to identify the exact level of overseas shareholding.

* * *

Report on the Southern Cross Community Workshop

Southern Cross Recreation Centre - 14 June 1995

Background

International chemical company Rhône-Poulenc is planning a rare earth project to process Western Australian Monazite. The proposed plant at Pinjarra will extract elements used for high technology products. Waste, containing the radioactive elements thorium, uranium and radium will be transported to the Government's Intractable Waste Disposal Facility at Mount Walton East 140 kilometres north east of Southern Cross.

Rhône-Poulenc has set up a series of community workshops to help identify key issues in planning and assessing the project. The Southern Cross workshop held at Southern Cross Recreation Centre on June 14, was attended by 26 local residents.

Introduction - David Newton, Chief Executive, Rhône-Poulenc Australia

The Southern Cross workshop is one of several arranged to discuss production, transport and disposal options for the proposed Rhône-Poulenc rare earth project. Other workshops have been held at Coolgardie, Pinjarra and the WA Conservation Council. Additional discussions have been organised for local authorities on the likely waste transport route.

The Southern Cross workshop was delayed for four weeks to allow completion of grain seeding operations in the district farming areas. The forum was organised because of local concerns about the operation of the Mount Walton East waste disposal site in the Goldfields region. One of the transport options involves road haulage of low level radioactive waste on Great Eastern Highway through Southern Cross.

The workshops have given local residents a chance to raise concerns and questions about the project. A number of community recommendations for changes or modifications to the company's plans are under review. Some are likely to be implemented in the project.

Each participant has been sent a summary of the proceedings and invited to comment on the contents. The questions and comments from the workshop will be listed in the project environmental review - a formal environmental impact assessment document to be released for public submissions. This process will give the community - and authorities - an opportunity to see how the company has responded to the key public issues.

Project outline - David Newton

The plant

Rhône-Poulenc plans a $45 million rare earths plant on company owned land at Pinjarra. The plant will convert monazite, a byproduct of WA titanium minerals production, into rare earth nitrates for export to Europe and North America. At present, monazite has no commercial markets. The mineral is stockpiled or returned to mine sites for disposal.

The rare earth plant development will allow the company to resume production at its gallium plant - originally constructed in 1989 to share infrastructure facilities with the rare earth project. The $50 million gallium facility was placed on standby in 1990 when markets declined and the company's first rare earth proposal was shelved.

The new proposals provide for 150 construction jobs, with employment for 60 people during full time operations. Combined rare earth and gallium exports will be worth $50 million a year.

The products

Rare earth elements are used in a wide range of high technology products including catalytic converters to reduce vehicle exhaust pollution, low energy lighting, television colours, x-ray screens and electronics. Gallium is used as a replacement for toxic mercury and cadmium. One Australian company is developing a gallium amalgam to replace mercury in dental fillings.

The process

The Pinjarra plant will process monazite into three streams -

- rare earth nitrates, for export
- phosphates for use in fertiliser production, and
- a waste stream, containing radioactive elements, to be transported to Mount Walton in the Coolgardie Shire for disposal.

The waste disposal site

If the rare earth project is approved, the company will be directed to dispose of its waste at the Government's Intractable Waste Disposal Facility approximately 140 kilometres north west of Coolgardie townsite. Mount Walton has been chosen because the area is remote and comparatively dry. The deep clay subsoil and absence of aquifers make the site ideal for secure, long term waste disposal. By contrast, the mining districts which produce monazite are in sandy areas with comparatively high rainfall and high water tables.

The waste

In full production, the rare earth project would be expected to produce about 6000 tonnes of waste a year. A moist clay-like material, the waste will contain the radioactive elements thorium, uranium and radium. Management of the material will be subject to strict safety measures, auditing and quality assurance procedures. The complete program will be audited by an independent body.

Although the company will take its safety responsibilities very seriously, Mr Newton believes there has been a tendency to overstate the hazards associated with the waste. The material is classified as a low level radioactive residue which will not affect members of the public or most employees in normal operating conditions. The waste is hazardous only to someone in contact with the material for an extended period - more than 30 hours. The material is less hazardous to the public than petrol, LPG or sodium cyanide.

Radiation safety - Dr Bruce Hartley, Curtin University

Dr Hartley is the former Physicist in Charge of the Radiation Health section of the WA Health Department and secretary at the WA Radiological Council. He is consulting to Rhône-Poulenc on the measures required to ensure public and employee safety.

There are three possible means of radiation exposure -

- external gamma radiation
- inhalation of dust, or
- ingestion of the material.

The potential for exposure arises during transport, processing disposal or radiation releases from the site. However, Dr Hartley is confident that design features of the plant can provide an effective management for all possible pathways of radiation exposure.

Detailed planning and adherence to relevant safety codes during normal operations will prevent any detectable impact on the public. Appropriate emergency procedures will be designed to keep the exposure well within safety limits in the event of an accident. Occupational health procedures and safety measures will aim to keep exposure levels for truck drivers and plant workers at less than 50 per cent of limits imposed by regulation. These regulations are based on international and Australian recommendations.

Waste transport and disposal - Terry Waters, Dames and Moore Engineering and Environmental Consultants.

The Pinjarra rare earth plant is expected to produce 6000 tonnes of low level radioactive waste a year. This material will be stored in two-tonne bulka bags which will be transported in steel containers - each holding 20 tonnes of waste.

The company is examining three potential options for transport of the waste:

- ☐ Rail from Pinjarra to Koolyanobbing (or an alternative unloading point).
- ☐ A road-rail combination
- ☐ Road from Pinjarra to Mount Walton East.

Rail

The rail option will involve the construction of new sidings at Pinjarra and - possibly - the Goldfields. Containers would be transported on narrow gauge to Forrestfield and transferred to standard gauge rolling stock for transport to Koolyanobbing, where the containers would be loaded on to trucks for the trip to Mount Walton.

Road-rail

Under the road-rail plan, containers would be trucked to Forrestfield and transferred to standard gauge rail wagons for the trip to Koolyanobbing and subsequent road haulage to Mount Walton.

Road

Road transport would mean trucking the containers on B-double units from Pinjarra to Mount Walton.

The preferred option

The company's preferred option is likely to be road transport from Pinjarra to Mount Walton. "Door-to-door" road haulage will reduce double handling, improving efficiency safety procedures. B-double units would probably use South Western, Albany, Roe, Tonkin and Great Eastern Highways. Based on a payload of 40 tonnes, the transport operation would involve three trips a week.

Emergency response

The trucks would be equipped with high frequency radios and global positioning systems to pinpoint the location of vehicles at all times. If a vehicle makes an unscheduled extended stop, an alarm will sound at the company's Pinjarra control room, triggering the first stages of an emergency response procedure. As part of a special management program, the company will be required to detail an emergency response plan in line with established procedures for dealing with hazardous goods. The company will train emergency service workers in procedures for dealing with a waste transport accident.

Disposal

The waste will be buried in trenches 15-20 metres deep. Each trench will hold two years' supply of waste. The bulka bags of waste will be unloaded into the trenches, packed with sand and progressively covered with layers of clay. The top five metres of each trench would be filled with rock and clay before rehabilitation.

Community concerns

During the presentations and discussions, workshop participants raised a number of broad issues identified as key community concerns. These included -

Waste transfer to the Goldfields region

Many people in the Southern Cross district have objected to the transport of waste from a South West processing plant to the Mount Walton area. Participants at the workshop said the radioactive materials should be returned to the mine sites which produced the raw material - monazite - in the Eneabba and Capel areas of the State. Alternatively the monazite should be left in the ground. Questions challenged the concept of the Goldfields as a "remote" region.

In response, company representatives said Mount Walton was established by the State Government as an intractable waste repository because of the area's deep clay; the absence of high quality groundwater; and dry climate. By contrast, the monazite is produced in sandy coastal regions with extensive groundwater resources and the prospect of future development. The waste from monazite processing is made up of fine particles which have been chemically altered, increasing the long term potential for movement through sandy soils. The mineral is a byproduct of titanium minerals production and must be either processed, or returned to the mine sites for disposal.

The company expects that waste disposal at the Mount Walton site would be one of the conditions of environmental approval for the project.

Increased waste disposal at Mount Walton

The Rhône-Poulenc project will mean a significant increase in waste disposal operations at Mount Walton. A number of community representatives said that Southern Cross residents had been told by Government officials that the site would be used only for low level radioactive hospital waste. The community was assured that any new projects would have to go through a detailed assessment involving a complete Environmental Review and Management Program (ERMP) - the highest level of assessment set by the State Environmental Protection Authority. Yet, Rhône-Poulenc was planning to complete a less comprehensive Public Environmental Review (PER). In addition, residents were concerned about the amount of ground which would be disturbed by bulk waste disposal operations at the site.

The company believes the PER process will involve similar technical detail and public input to an ERMP. Reports on the establishment of the Mount Walton waste disposal facility show that the site was set up to take monazite processing waste. Rhône-Poulenc has estimated that its waste disposal operations will disturb less than 0.5 per cent of the site.

(NB: The State Government subsequently upgraded the level of assessment to an ERMP)

Management of the Mount Walton operation

Many of the questions and comments dealt with the practical aspects of waste burial. Workshop speakers sought detailed information on engineering and geological issues which would have to be covered in the company's plans. The company was also asked about bonds and guarantees to cover the cost of dealing with any long term environmental problems.

Although the waste will be transported to the site for disposal by the company, responsibility for management and monitoring of the site will rest with the State Government Office of Waste Management. The cost of disposal and monitoring will be covered by the company, which will contribute to a trust fund for long term management of the site. The disposal procedures, which were discussed in detail at the workshop, will be outlined in the environmental review.

Transport safety

The waste is likely to be transported on Great Eastern Highway through Southern Cross to Mount Walton. Residents are concerned about the existing concentration of heavy traffic on the highway. Additional trucks - even the three per week proposed by Rhône-Poulenc - will increase the risk of accidents. Workshop participants asked for detailed information about emergency response procedures, and the potential risks to volunteers attending the scene of an accident.

In addition, the company was asked to consider setting up an emergency response unit at Southern Cross. A company commitment to train and equip a local unit was seen as one of the few potential benefits to Southern Cross from the rare earth project.

The company has agreed to consider the emergency unit plan. Details of the comprehensive emergency response plant are being developed for the environmental review.

Questions and specific concerns

TRANSPORT

Rhône-Poulenc's waste transport operations face a high risk of accidents because of heavy transport on the Great Eastern Highway.

With fully trained and experienced drivers and the global positioning system (GPS) in each truck, Rhône-Poulenc believes we will have very safe vehicles.

Experience with the transport of mineral sands and other Dangerous Goods has shown load transport to be a safe operation due to highly trained drivers and well maintained trucks. The incidence of accidents involving licensed Dangerous Goods vehicles is very low compared to the overall accident rates for all vehicles.

Section 2.4.2

Who decides the transport option?

Rhône-Poulenc proposes road transport as the preferred transport mode as it has occupational health, management and economical advantages over the road/rail options. However, it will be up to the EPA and other Government bodies to determine which transport methods are environmentally acceptable.

What is the company's attitude to putting an emergency/safety unit in the Shire?

An emergency response procedure will be established within each region that the vehicles will pass through. Fortunately dealing with an accident in this case will not involve use of highly specialised or difficult to use equipment. The company proposes to provide training and coordination of emergency response personnel along the transport route. The company will consider assisting with emergency equipment of appropriate locations including the Southern Cross Shire. Discussions will be held to determine how best to support such services.

Section 6.2.2.3

What are the potential benefits to the Southern Cross community - perhaps a new ambulance?

Rhône-Poulenc would like to liaise with all communities associated with project operations and would certainly like to contribute in some way to those communities who work with the company to establish a satisfactory and safe way of operating.

What will be the effect of rain on a waste spillage?

The radioactive component of the material is dense and insoluble, therefore, in the event that heavy rain mobilises some of the spill it is unlikely that it would travel any great distance. Material that has dispersed and accumulated away from the immediate spill can be located by a radiation detector and collected.

Section 6.2.2.3

Will the Government or the company be responsible for upgrading the Mt Walton access road?

The access road to the IWDF is owned by the Health Department of Western Australia and its maintenance is currently managed, on behalf of the Health Department by the Office of Waste Management. The Health Department recognises that the roads need to be upgraded including raising the foundation, placement of unsealed gravel, pavement and flattening of hill crests. The Government will be responsible for the upgrading. Rhône-Poulenc will contribute to the cost of road maintenance during the life of plant operations. The total cost will be shared with other major uses of the road such as mining companies.

Wouldn't the company save money by building a rail link to Mt Walton site?

The establishment of a siding at Pinjarra and at Mt Walton would be an extremely expensive exercise for little benefit. In addition to the sidings a dedicated rail service would also have to be established, which would be an enormous waste of Westrail resources for the movement of a relatively small quantity of material compared to Westrail's normal tasks.

Rail is best adopted for moving large quantities of material some of which currently is transported by road. The quantity of waste for this project is well below the optimum level for rail transport. The lack of suitable sidings at Pinjarra, the need to transfer from narrow to standard gauge at Forrestfield marshalling yards and the lack of a suitable siding at Mt Walton make the rail option not preferable.

The company should keep trucks off the road in the interests of the district's tourist industry.

Much more hazardous materials travel on both country and city roads at a much greater frequency than is proposed for the waste (3 truck movements of waste per week). The truck movements of waste will have no significant impact on the tourist industry as the waste material is only hazardous if people are in contact with it for an extended period of time.

What happens if the global positioning system fails?

The GPS is not mandatory however, Rhône-Poulenc believe it will minimise emergency response time. In addition to the GPS, all truck cabs will be fitted with a two way communication system to enable drivers to call for assistance or for the base to contact the drivers. The movement of each truck will be regularly monitored in this way.

Section 6.2.2.3

Does the company have insurance cover for the impacts of a waste spill on or near farms?

Rhône-Poulenc and the transport operators will have public liability insurance in the event of damage to personal property or loss of income. If a spill does occur on a farm, all the material will be recovered and removed to the satisfaction of the Radiological Council and the landowners. The material is easily identified and recovered.

If a B-double unit overturns and blocks Great Eastern Highway, how long would motorists have to wait before a team of radiation specialists clear the road?

Trained Emergency Response Teams will be located at various locations along the transport route, therefore, the nearest emergency team will be mobilised to ensure a rapid response. The Control Authority, most likely the Senior Police Officer designated as the On-site Controller, will be responsible for ensuring that the clean-up is performed in a timely manner. Clean-up operations are not complex and would not require specialised equipment with the exception of a radiation detector such as a gamma counter which would be used to check that no material has dispersed into the environment.

Are emergency service volunteers at risk if the waste adheres to clothing or skin for long periods?

Gangue material is only hazardous if there is contact with it for many hours which is unlikely to occur in the time taken for clean-up operations. Emergency Response Teams will be trained to handle the waste and suitable clothing and equipment will be available in the event of a clean-up of spilt material.

Section 6.4.4.8

Is the Southern Cross workshop part of the Public Environmental Review - or is the forum a public relations exercise?

The workshop is an initiative of Rhône-Poulenc after consultation with the EPA and other interested parties. It is considered to be totally consistent with the Environmental Review Process. It has an objective of providing information on the project to the public listening to questions, discussing issues and responding to questions.

Can any members of the public inspect the site?

There have already been opportunities for any member of the public to visit the Pinjarra site and there will be opportunities in the future. Any person interested should contact 531 7200 and ask for details on the next opportunity. Public representatives will be involved in the management of Mount Walton East. In addition, the WA Office of Waste Management is planning an open day at the Intractable Waste Disposal Facility.

Is monazite processed anywhere else in the world - to allow the community to make some comparisons between existing practice and Rhône-Poulenc's plans?

Rhône-Poulenc has processed monazite for many years at their plant in La Rochelle, France. Monazite processing plants are also located in India and China and a new project is being established in South Africa. Plants also operate in the United States.

WASTE DISPOSAL

If Rhône-Poulenc is only concentrating natural radiation why not return the material to its native site?

The preferred solution is to dispose of the residue at the IWDF rather than at the minesites, as the IWDF site was selected by the Government for its suitability for the disposal of such wastes.

Why should the Southern Cross community have local ground contaminated with waste from another region?

Local ground will not be contaminated. The residue will be effectively contained within the deep clay zone at the IWDF within the Coolgardie Shire. This area was chosen for its suitability and one of the reasons was the location is well away from existing settled areas.

Wouldn't it be more prudent to leave the monazite where it is?

Monazite is currently produced by the mineral sands companies in mining for other mineral sands. The low level radioactive monazite should be mixed with overburden and returned to the mines. By returning of the monazite to the minesite, a valuable resource is being disposed of as a waste at a cost to the mineral sands industry.

What is the half life of the radioactive waste?

The radioactivity of the waste is related to ^{232}Th and ^{238}U and their decay products. Members of the ^{232}Th and ^{238}U decay series and their half lives are presented in Attachment 1.

Will the disposal site be affected by mine blasting ten kilometres away?

Vibrations from such blasting would be negligible at the disposal site and would therefore not affect the integrity of any of the disposal facilities at the site.

Why not take the waste to Maralinga?

The IWDF is a satisfactory site in Western Australia and is for Western Australia waste. It is not necessary to go further to Maralinga. Maralinga is an atomic bomb test site, it is not a disposal site and may not be suited for the disposal of this type of waste.

What is the particle size of the waste?

Particle size measurements obtained by scanning electron microscopy and using particle size instrumentation were found to be $<1\mu m$.

Will radioactive waste spread through the soil at the site?

The formation of the clay is to prevent migration in any direction. This has been demonstrated at all other sites where this technique has been used. The level of radioactivity around the trenches will be regularly monitored to detect any deviations from the expected performance.

What heavy metals will be contained in the waste?

The composition of the waste will reflect the composition of the original monazite which contains some lead, a product of the decay of thorium and uranium. The heavy metal content in the gangue residue is expected to be less than 0.5%.

Section 3.4.2

Will the company detail:

- **the trench construction techniques;**
- **the volume of material removed;**
- **expected swell factors;**
- **compaction techniques; and**
- **the expected height of overburden mounds?**

Some of this information is provided in the ERMP. However, a detailed design will be prepared by the operator of the IWDF prior to commissioning of the Rhône-Poulenc plant. The details of this design will be available to the public.

What area of land will be disturbed by the waste disposal?

The total area of the IWDF site is approximately 2,500ha and an area of 6ha would be required for 20 years disposal of waste from the Rare Earth Plant. This represents 0.25% of the total site area.

Section 6.3.3.2

How does the company classify a "remote site"?

The company uses the definition employed for the selection of the IWDF i.e. no habitation, no mineral prospectivity, not suitable for agriculture etc.

Is the material colloidal?

No. The material is solid. Soluble thorium compounds hydrolyse in natural waters and sometimes form colloidal suspensions. The conditions at the IWDF will not be such that thorium could become soluble.

Does 6,000 tonnes a year of waste represent the maximum capacity of the plant?

Yes, any increase in capacity would require further environmental review.

Originally the waste was to be encased in concrete. Why has this proposal been dropped?

Rhône-Poulenc never stated the waste would be encased in concrete. A proposal to concrete the waste was examined and whilst it did not improve radiation safety in disposing it introduced significant occupational hazard and increased the volume and mass of waste by about a factor of three and therefore required significantly more transport movements.

Is any future use envisaged for the waste?

No.

How much geological data has been produced to provide information on the Mt Walton site. Can the company guarantee the stability of the area?

A great deal of data has been obtained on the IWDF site and the region it is located is to ensure Mt Walton East is suitable for an IWDF (Maunsell, 1988). However in-fill data is required for specific disposal activities such as the monazite waste. Geologically the Yilgarn block is very old and stable and not prone to seismic activity.

Can the company guarantee the specification of the waste?

Yes, Rhône-Poulenc will and can guarantee the specification of the waste. Rhône-Poulenc will be required to ensure that the waste meets the specification for transport and disposal as outlined in the relevant codes: Code for Transport (Commonwealth of Australia, 1990); and Code for Disposal (NHMRC, 1992), and any other specification established by the DEP. Quality procedures will be implemented to ensure specification of the waste. It will also be subject to independent audit.

Sections 3.4.2, 6.3.3.3 and Appendix E

Could the community arrange for an independent expert to test the specification of the waste?

An independent quality assurance audit on the waste generation will be conducted. This will include reviewing recording of waste specification, transport movements and disposal operations.

Section 6.3.3.4

Will Rhône-Poulenc undertake a waste minimisation program to reduce the material for disposal?

Approximately 12,000 tonnes of monazite will be processed per annum resulting in 6,000 tonnes of waste. This amount of waste cannot be reduced as it derived from the content of the mined mineral.

What is the long-term stability of the waste?

The material is a clay like substance, insoluble, neutral pH and non-organic. All "soluble" elements have been dissolved in firstly caustic and then nitric acid. Therefore nothing "soluble" is left.

RADIATION SAFETY

Is the waste proposed for Mt Walton expected to be more radioactive than the waste described in a previous company proposal?

The radium content of the monazite previously proposed to be disposed of with the ammonium nitrate stream, will now be contained in the low level radioactive waste as an insoluble co-precipitate of barium sulphate. However, the addition of the radium to the waste will not significantly alter the radioactivity of the gangue residue. Even without this radium, the waste quickly reaches equilibrium as the radium re-establishes itself by decay of the thorium and uranium.

Section 1.3

If the radioactivity levels are low, why is there a need for a water shield behind the cabin of the road transport units?

Dose limits for truck drivers, as defined in the Code of Practice for the Safe Transport of Radioactive Substance 1990, is 5mSv/yr. Rhône-Poulenc has set design criteria for the transport operation to reduce the driver's dose to a maximum of 2mSv/yr. To achieve this lower design criteria, a water shield may be required between the cabin and the first container. This level is lower than the average person receives from the natural environment (2.5mSv/year).

Section 6.4.4.8

What protects people who are loading and unloading bulka bags?

Both loading and unloading will be conducted by a machine which maximises the distance from the operator to the bags. The machine may be a tractor/fork lift configuration with a telescopic arm or it may be an overhead crane. The handling of bulka bags will not be a full time job per individual, so the exposure to these workers will be only for a short duration of their potential working day.

Section 6.4.4.5

How radioactive is the waste?

The waste is radioactive due to its thorium content of about 12.5%. This has an activity of 5×10^5Bq/Kg.

Section 3.4.2

Will people unloading the waste be subjected to initial bursts of high level radiation?

No. The radiation does not build up as a result of the containment. Gamma radiation is absorbed by material or penetrates it, similar to light or radio waves. There is no accumulation.

Will the containers become radioactive?

The containers will not become radioactive as the radiation is not absorbed and retained.

If the waste dries out will the dust become airborne and possibly inhaled by people at the scene?

It is unlikely that the waste material will dry and dust after a spill as the material if allowed to dry, as tests have shown that samples of similar material that were either air or oven dried result in forming a hard solid which does not dust unless mechanical effort is applied. Should material become dry during an emergency involving a spill, it may be necessary for some emergency workers to wear a face mask to reduce inhalation of radioactive dust. It is however, almost inconceivable that significant exposures will result

Section 6.4.4.8

What are the background radiation levels at places like the Capel beach front?

Radiation levels are very variable. No particular radiation has been noted on Capel's beaches. Mininnup which is between Capel and Bunbury was once mined for mineral sands which were on the beach front and in the foredunes. Pre-mining levels were measured at up to 1.6μGy/hr whilst the current maximum level is 0.72μGy/hr. The average level ranges between 0.1 to 0.4μGy/hr (Toussaint, 1985). Mineralised material, which apparently occurs in an offshore deposit, has been replaced on the beach by natural processes. The levels are well within the range of natural exposure levels in other parts of the world or even in some parts of Western Australia.

What are the long-term results of limited doses of radiation?

The effects of low doses of radiation are not well known as it has not been possible to identify any specific health effects of radiation levels consistent with background levels. The health risks of radiation are, however, known from radiation exposure to much higher levels and the assumption is made that the effects are the same but reduced in frequency. Studies of persons known to have been exposed to levels of radiation of about 200mSv demonstrate increased incidence of some types of cancers. Natural background radiation levels are some hundred times less than these levels. From the known effects at high doses it is estimated that exposure to 1mSv gives a risk of a fatal cancer of 1 in 25,000. Such levels of risk are considered to be small and are comparable to the risk from natural background radiation of about 2.5mSv/yr.

What happens if a person ingests some of the waste during an accident or emergency?

Ingested material passes quickly through the lower body. Being insoluble it will not be taken up by organs and tissues.

Section 6.4.4.8

Can expert views be trusted given recent changes in medical opinion on breast X-rays?

Expert opinion is based on the experience to date. It is the latest available information on which to gauge.

Will the containers become radioactive?

The containers will not become radioactive as the radiation is not absorbed and retained.

ASSESSMENT AND MANAGEMENT

What approval process is required to allow monazite waste disposal at Mt Walton?

Disposal at the Mt Walton IWDF of low level radioactive waste, resulting from mineral processing such as monazite, was previously proposed by the Health Department of Western Australia and was subsequently given conditional approval by the Western Australian Minister for the Environment (EPA, 1988b).

Section 6.3.3.1

Mt Walton has never been approved for a burial site for monazite waste. The only materials approved for disposal is waste from the QE2 medical centre. In this case why isn't the company doing a full ERMP instead of a PER?

See above response. The project is subject to an ERMP.

What is Rhône-Poulenc's credibility? Can the community expect the company to honour its commitments?

Rhône-Poulenc's corporate policy is that it has a social and ethical responsibility to protect the environment. Its progress and performance towards its objectives in this area is improving year by year.

How many years will the project last?

Plant operations are expected to continue for at least 20 years.

Section 1.5

Will the company guarantee to fix any problems at the site?

The DEP is responsible for the management of the IWDF site. Rhône-Poulenc will pay for the operations relating to waste disposal from the Rare Earth Plant including a bond which will provide for unforeseen problems.

In view of experiences at Maralinga, will Rhône-Poulenc put up enough money to remove the material if necessary?

The funding provision will be sufficient to cover all eventualities that can reasonably be expected. As the IWDF is the optimum location for this type of disposal operations, removal of material from the site does not seem a likely option.

What waste burial records will be kept?

Both Rhône-Poulenc and the operator of the IWDF will maintain:

- waste quantity;
- waste specifications;
- location; and
- burial specifications.

Will an overall plan of waste burial be produced?

Yes, a full plan will be produced.

How can the public check that Rhône-Poulenc's technical answers are correct?

The EPA will assess the ERMP on technical grounds. There will also be an independent audit of performances. The Mt Walton East Consultative Liaison Committee will have access to the information. Pubic responses will be prepared by various Government bodies according to statutory requirements.

Section 6.3.3.4

What will the company do if Mt Walton is declared a sacred Aboriginal site?

Rhône-Poulenc would be very surprised as the site has already been thoroughly assessed for Aboriginal sites.

Will the company detail the disposal schedule - and how long waste bags will remain uncovered?

Yes, the intention is that bags will be covered during the period immediately after deposition. No bags will be left uncovered during times when no one is in attendance on-site.

What is the on-site management structure for Mt Walton?

Trained personnel will be present at the site whenever vehicles are received or depart. A structure for management and responsibility will be detailed in a Radiation Management Plan for Mt Walton.

Will the public be involved in the management of the site?

Only trained personnel approved by the DEP will be involved in management of the IWDF. The Mt Walton East Consultation Committee will be able to review and comment on management practices and procedures.

Australia should get more benefits - in the form of value adding - in return for keeping the monazite waste.

A factor of 10 value added is earned by Western Australia compared with the previous prices paid for monazite. The current value for monazite is zero or negative owing to the cost of disposal. The activity at Pinjarra is the most important part of the value added claim for rare earths and could provide an opportunity for downstream processing and value added industries.

Figure

(a) Category II - YELLOW label

(b) Category III - YELLOW label

The background colour of the upper half of the label shall be yellow and of the lower half white, the colour of the trefoil and the printing shall be black, and the colour of the category bars shall be red.

Rare Earth Plant - ERMP

Figure F1
CATEGORY II AND CATEGORY III - YELOW LABELS

SOURCE: Code of Practice for the Safe Transport of Radioactive Substances, 1990.

ATTACHMENT F1

DECAY DATA FOR Th-232 and U-238 CHAINS

TABLE A1.1(b)

Decay data for U-238

Isotope	Decay Mode	Half-life ($T_{1/2}$)	Relative Concentration * (Mass)
U-238	Alpha	4.47×10^{9} y	1.00
Th-234	Beta(99.8%)	24.1 d	1.43×10^{-9}
Pa-234	Beta	1.17 m	0.49×10^{-15}
U-234	Alpha	2.44×10^{5} y	0.54×10^{-4}
Th-230	Alpha	7.7×10^{4} y	1.72×10^{-5}
Ra-226	Alpha	1.60×10^{3} y	3.41×10^{-7}
Rn-222 (radon gas)	Alpha	3.82 d	2.14×10^{-12}
Po-218	Alpha (99.98%)	3.05 m	1.19×10^{-15}
Pb-214	Beta	26.8 m	1.00×10^{-14}
Bi-214	Beta (99.98%)	19.9 m	0.75×10^{-14}
Po-214	Alpha	1.64×10^{-4} s	1.02×10^{-21}
Pb-210	Beta	22.3 y	4.35×10^{-9}
Bi-210	Beta (100%)	5.01 d	2.68×10^{-12}
Po-210	Alpha	138 d	0.74×10^{-10}
Pb-206		Stable	

* Mass of isotope in equilibrium with parent isotope

Symbols:
- y = year
- d = day
- h = hour
- m = minute
- s = second

ATTACHMENT 1 - DECAY DATA FOR Th-232 AND U-238 CHAINS

1.1 DECAY TABLES

Decay data from ICRP30 are given on Table A1.1(a) and A1.1(b). The following features should be noted:

- o the relative concentration data apply to secular equilibrium conditions;
- o the decay mode for each isotope results in either alpha or beta-emission, as well as gamma radiation in most cases;
- o the wide range in half-life and mass concentration values and the approximate inverse relationship of these quantities.

1.2 ISOTOPE ACTIVITIES UNDER CONDITIONS OF SECULAR EQUILIBRIUM

Under conditions of secular equilibrium, the activities of the daughter isotopes are all equal to the activity of the parent (Th-232 or U-238) for the given decay chain. The equilibrium activities in Bq (disintegrations/s) per kg of parent material is given by:

$$\frac{0.693}{T_{1/2,p}} \times \frac{6.023 \times 10^{26}}{A}$$

where: $T_{1/2,p}$ = half life of parent in s,
A = mass number of parent isotope.

1.3 RELATIVE MASSES OF DAUGHTER ISOTOPES IN EQUILIBRIUM WITH PARENT

The relative mass of each daughter isotope in secular equilibrium with unit mass of the parent is:

$$\frac{A_d}{A_p} \times \frac{T_{1/2,d}}{T_{1/2,p}}$$

where A_p and A_d are the mass numbers of the parent and daughter, respectively, and $T_{1/2,p}$ and $T_{1/2,d}$ are the respective half-lives.

TABLE A1.1(a)

Decay Data for Th-232

Isotope	Decay Mode	Half-life ($T_{1/2}$)	Relative Concentration * (Mass)
Th-232	Alpha	1.40×10^{10}y	1.00
Ra-228	Beta	6.75 y	0.47×10^{-9}
Ac-228	Beta	6.13 h	0.49×10^{-13}
Th-228	Alpha	1.91 y	0.14×10^{-9}
Ra-224	Alpha	3.66 d	0.68×10^{-12}
Rn-220 (thoron gas)	Alpha	55.6 s	0.12×10^{-15}
Po-216	Alpha	0.15 s	0.32×10^{-18}
Pb-212	Beta	10.6 h	0.79×10^{-13}
Bi-212	Alpha (34%) Beta (66%)	1.01 h	0.75×10^{-14}
Po-212	Alpha	3.05×10^{-7} s	0.40×10^{-24}
Tl-208	Beta	3.07 m	0.14×10^{-15}
Pb-208		Stable	

* Mass of isotope in equilibrium with parent isotope

Symbols:
- y = year
- d = day
- h = hour
- m = minute
- s = second

Appendix G

APPENDIX G

RHÔNE-POULENC POLICIES

RHÔNE POULENC'S POLICY

Meeting humanity's fundamental needs while preserving its natural heritage is our responsibility as industrialists. A responsibility that we are determined to make known to an ever-increasing public.

Jean Marc Bruel
Vice President of Rhône-Poulenc

Rhône-Poulenc's Environmental Policy is based on five guiding principles.

Take environmental protection into consideration at every stage in the life of a product.
From design to destruction, every phase of a product's life must include environmental protection, from research and production through successive transport and packaging, use by the customer and finally, elimination or recycling.

Develop clean technologies.
The objective is to use less raw material and energy and to create a minimum of effluents and waste. By providing both economic as well as ecological benefits, clean prcesses and technologies are more competitive
This also implies seeking to recover and recycle residues before writing them off as wastes to be destroyed.

Strictly manage the elimination of waste and effluents.
The basic principle is to give priority to waste treatment at the source. When its destruction is technically impossible, waste must be treated under totally safe conditions.
In cases where treatment is handled by outside firms, the Group maintains control over shipment and carefully chooses the transport companies and sub contractors.

Control technological hazards and accidental pollution.
This involves avoiding accidents through preventive measures (danger studies), company training programs, operating procedures etc.
If an accident occurs despite these precautions, all possible remedial action must be anticipated in order to minimize damage to the environment (for example, measures to prevent toxic gases from escaping from certain installations, containment tanks for polluted waters etc.).

Strengthen communications.
Rhône-Poulenc is committed to a frank and open policy in regard to its personnel, the authorities, the public and the media. Information is disseminated regularly to the population of the areas in which our plants or research laboratories are located. The information covers the activities of these facilities, the potential hazards and the contingency measures to be taken in case of accident.
A production or transportation accident, in fact, any incident that could have an impact on the environment, is reported in a press release citing the facts and possible hazards.

In 1993, Rhône-Poulenc created the Environmental Services sector, which aims to provide manufacturers and local communities with the service solutions best adapted to their environmental needs.

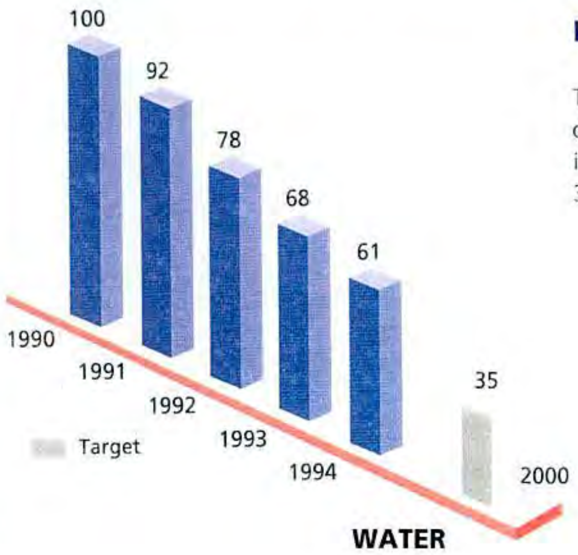
This activity grew out of the desire to serve and to extend our technical skills in the areas of recycling, regeneration and the treatment of water, air and industrial waste, throughout the group.

PRODUCTION FACILITIES THAT RESPECT THE ENVIRONMENT

Environment Indices: Water, Air, Solid Waste

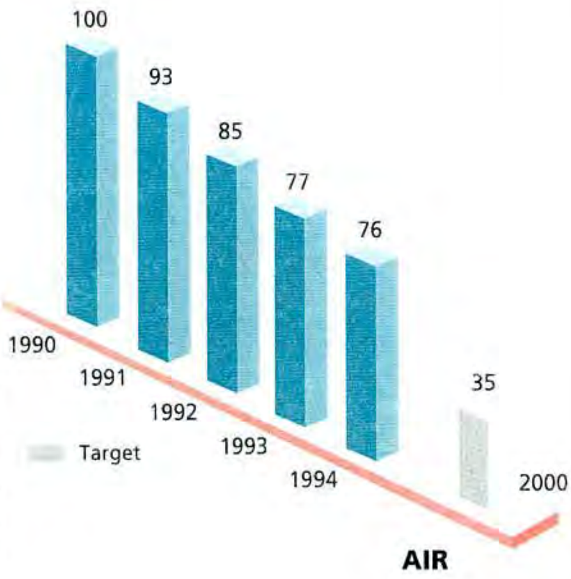
Rhône-Poulenc has set an ambitious goal: to reduce effluent and waste by 50% by 1995 and by 65% by the year 2000, using 1990 as a reference date (base 100)

Each of the three indices reflects a different situation.



Improvement since 1990

This year again, the water index has improved considerably, up 11 % over 1993, despite the increase in industrial production. Total progress since 1990 is 39 %.



Improvement since 1990

Progress made in 1994 was very slight (just over 1%). This situation is linked in part to economic factors and to the improvement in the measurement of emissions, particularly transient emissions, with regard to volatile organic compounds (VOC). Total progress since 1990 has been 24%. Identified investment (nitrogen oxide) and the application of the VOC research program will improve the position in the years ahead.

Improvement since 1990

1994 saw new progress in the area of waste with an improvement of 9%, giving a total gain of 25% since 1990. The main improvements were achieved in American plants. The low level of the 1994 index over 1993 in Brazil is explained by the ending of business at the Cubatao plant.

GUIDELINES FOR ACTION

Our Vision

- *To be a company where men and women are proud to work on a personal and professional basis, and who find in their work, opportunities for development commensurate with their commitment.*
- *To be part of a global company, a world leader in life sciences and chemistry, and to rank among the very best in each of our activities.*
- *To create, through innovation, products and services that will improve the well-being of mankind.*
- *To earn the loyalty of our shareholders and their continued contribution to the growth of the Group by ensuring satisfactory returns on their investments.*

Our Management Principles

- Be customer-focused
Our customers are the reason for our existence. We should always be attentive to them, anticipate their needs and provide solutions for them in keeping with Total Quality principles.

- Encourage personal development
All managers should encourage the skill and career development of those who work for them. They must establish an environment of confidence and mutual openness, as well as favor communication and dialogue.

- Enhance specificity
Units and managers should seek a thorough understanding of their particular business and implement the organization best suited to that area of activity.

- Be Group minded
In all our decisions and actions, we should consider, not only the interest of our particular area of activity, but also those of the Group.

- Foster entrepreneurship
Organization and management style must, at each level, encourage innovation in every field as well as foster individual and joint initiatives.

- Promote subsidiarity
Whatever can be accomplished at a given level must not be done by a higher level. Employees must be given the appropriate tools and resources needed to accomplish their goals.

- Be accountable
The consultation that comes before decision has to be genuine. Through all our actions we must demonstrate personal commitment and assume responsibility for our decisions. We must make sure that all concerned parties are properly informed.

Our Values

- Respect for people
Our attitude and our behavior should reflect our respect for all people, for their diversity as well as for the culture.

- Safety and Environment
The safety of people, sites and products, and the protection of the environment are essential obligations for each of us.

- Integrity
We all have the duty, not only to obey the laws of the country in which we work, but also the ethical rules or our professions. We must always act in an upright and honest way.

- Performance
We can achieve growth and long-term viability only through individual and collective performance. We all have the duty to contribute to this goal through our skills and our commitment.

- Teamwork
The spirit of team work and mutual support is essential to our effectiveness.

RHÔNE-POULENC

RHÔNE-POULENC AUSTRALIA GROUP

Appendix H

APPENDIX H

OUTLINE OF EMERGENCY RESPONSE PLAN FOR TRANSPORT OF GANGUE RESIDUE

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TABLE OF CONTENTS ***(cont'd)***

APPENDIX H
OUTLINE OF EMERGENCY RESPONSE PLAN FOR TRANSPORT OF GANGUE RESIDUE

H1.0 INTRODUCTION

H1.1 AIM

The aim of the Emergency Response Plan is to detail arrangements and procedures to cope with emergencies associated with the road transport of gangue residue (low level radioactive waste) from the Rhône-Poulenc plant site at Pinjarra to the Intractable Waste Disposal Facility (IWDF) in the Eastern Goldfields.

H1.2 OBJECTIVES

The objectives of the Plan are to:

- prescribe the organisation, key principles, responsibilities and procedures for State departments and agencies, community service groups and Rhône-Poulenc in handling of emergencies in order to minimise detrimental effects on human health and the environment;
- establish a basis for co-ordination between the relevant State Government Departments and agencies, community service groups and Rhône-Poulenc with respect to emergencies associated with the transport of gangue residue;
- provide a basis for the provision and co-ordination of resources to cope with emergencies; and
- expedite the recovery of the community from any effects of such emergencies.

H1.3 SCOPE

The Plan shall apply to all emergencies associated with the transport of gangue residue from the Rhône-Poulenc plant site at Pinjarra to the IWDF.

The procedures and responsibilities detailed in this Plan are established for the compliance of all departments and agencies of State Government, community service groups and Rhône-Poulenc in relation to emergencies associated with the transport of gangue residue.

H1.4 PRODUCT DATA

Gangue residue generated by the Rare Earth Plant will be radioactive due to its thorium content and the presence of the decay products of the thorium decay chain. It will be approximately twice as radioactive as the monazite feedstock for the plant. No additional radioactive material will be generated but the process concentrates the radioactive materials by that factor.

The waste will be insoluble and will mostly be comprised of ground rock material, unreacted monazite, barium sulphate and water. It will be non-toxic and will not be a chemical hazard. It will be classified as Low Specific Activity type I (LSA-I) material for the purpose of transport which is the lowest category of hazard for the transport of radioactive materials. The hazard of the material is very low when compared with other radioactive materials regularly transported throughout the state such as; industrial radiography sources, radio-pharmaceuticals and some industrial sources. Such sources are capable of delivering very high doses to people exposed to them, however, gangue residue cannot deliver doses which could cause immediate harm. It is also low in hazard when compared with the transport of other common hazardous materials such as LPG, petrol, sodium, cyanide, chlorine and chlorine compounds or many other chemicals regularly transported by road.

The material is in the form of a moist clay so it will not flow or dust even in the event of a spill. There is only a potential risk of persons receiving a hazardous radiation dose if they are in contact with the residue for long periods of time as it would take a person to be in physical contact with the waste for 5 hours before exceeding recommended public health limits. Special management measures will be incorporated in the transport operations to ensure exposure levels are well within regulatory limits for employees, the public and emergency response personnel.

Emergency and clean-up procedures will be implemented, as for any accident, with teams trained in safety procedures involving low level radioactive material. The Proponent will incorporate detailed emergency and clean-up procedures in the emergency plans which will ensure that hazards to team members and the public are minimal. Procedures will be relatively straightforward as any spill can be easily retrieved in comparison to a liquid spill and if any has been dispersed from the immediate vicinity of the spill it can be located by a radiation detector and retrieved.

Details of its composition and radioactivity level will be presented on a Material Safety Data Sheet (MSDS) which will be included in the Plan and provided to emergency response organisations and the transport contractor.

H1.5 RELATED DOCUMENTS

The Plan will be complementary to State, Regional and Local Emergency Response Plans.

The Plan will be consistent with the Western Australian Hazardous Materials Emergency Management Scheme (WAHMEMS).

The Plan will be part of Rhône-Poulenc's Safety and Environmental Management Plan for the Rare Earth Project.

H1.6 RELATED ORGANISATIONS

The co-ordination with other organisations will be detailed in the plan. However, the principal organisations are:

- Police Department;
- Western Australian Fire Brigade;
- Bush Fires Board;
- Radiation Health Section, Health Department of Western Australia;
- Department of Environmental Protection;
- Main Roads;
- Water Authority;
- Department of Minerals and Energy;
- Local Government Authorities; and
- State Emergency Service.

H2.0 KEY PRINCIPLES

The key principles of the Plan are:

- Prevention:
  - measures designed to prevent or reduce the likelihood of accidents and lessen effects of any unplanned release of gangue residue;

- Preparedness:
  - activities which prepare the emergency services, Rhône-Poulenc and the community to respond to any emergency;

- Response:
  - urgent actions taken during and immediately after the impact of an emergency;

- Recovery:
  - activities which are intended to return the community to normal following the impact of an emergency.

H3.0 PREVENTION

H3.1 INTRODUCTION

Prevention encompasses those measures designed to:

- prevent or reduce the risk of accidents and spillages; and
- lessen the effects on human health and the environment resulting from the spillage of gangue residue.

H3.2 RELEVANT LEGISLATION

The principle Western Australian legislation which controls the transport of the gangue residue is:

- Radiation Safety Act, 1975-1981, including the Radiation Safety (General) Regulations, 1983 and the Radiation Safety (Transport of Radioactive Substances) Regulations 1991;
- Environmental Protection Act, 1986 (as amended January 1994);
- Explosives and Dangerous Goods Act, 1961-1979;
- Dangerous Goods Regulations, 1992;
- Australian Code for the Transport of Dangerous Goods by Road and Rail (ADG Code), 1992;
- Code of Practice for the Safe Transport of Radioactive Substances, 1990;
- Health Act 1911; and
- Occupational Health Safety and Welfare Regulations, 1989.

The relevance of these and other applicable legislation will be described in the Plan.

H3.2 TRANSPORT CONTRACTOR

H3.2.1 Selection

Criteria for selection of a transport company will include:

- an appropriate licence under the Radiation Safety Act for the transport of radioactive substances;
- company organisation including levels of management and quality systems;
- equipment quality and replacement policy;
- emergency response capability;
- vehicle inspections and maintenance procedures; and
- driver requirements and training programme.

H3.2.2 Accreditation

The transport company will be accredited according to the requirements of the "Requirements and Procedures for Carrier Accreditation" published by the Competent Authorities Sub-Committee of the Advisory Committee on the Transport of Dangerous Goods. Details of this accreditation will be listed in the Plan.

H3.2.3 Driver Licensing and Training

In accordance with Division 5 of Part 6 of the Dangerous Goods Regulations the drivers will also be required to:

- be at least 21 years of age and be the holder of a driver's licence appropriate to the type of vehicle on which the goods are carried;
- pass a medical fitness test; and
- renew the licence every 3 years if under the age of 50 or every year if over 50.

In addition to these requirements and others under the Radiation Safety Act, the drivers will attend approved driver training courses including specific training for the transport of radioactive materials. These requirements are detailed in Section H4.3 of this Plan.

H3.3 VEHICLE REQUIREMENTS

Vehicles used to transport the gangue residue will comply to the requirements of the ADG Code. In particular they will be required to comply with Sections 7.1, 8.3.3 and 8.3.5 with respect to design, construction, roadworthiness and maintenance.

The vehicles will be licensed in accordance with the requirements of Division 2 of Part 6 of the Dangerous Goods Regulations.

The vehicles will also be required under the Road Traffic Act 1974 to pass brake testing performed by Main Roads before they are licensed.

Details of these requirements will be presented in the plan.

H3.4 PACKAGING OF GANGUE RESIDUE

The gangue residue will be packaged in such a manner to minimise the risk of damage to the containers and subsequent spillage. The packaging will be in accordance with the requirements of the ADG Code, the Code for Transport and the Dangerous Goods Regulations.

The gangue residue will be placed into heavy duty two tonne bulka bags which will be designed and made to meet the requirements of Australian Standard AS 3688-1987 and Supplement 2 to the ADG Code. The bags are made of woven polypropylene and lined with 60μm thick polyethylene film. The bags will be sealed after filling.

The bulka bags will be loaded into steel shipping containers which will be made to the relevant ISO standards.

H3.5 TRANSPORT ROUTE

The transport route has been selected on the following criteria in order to minimise the risk of accidents and the subsequent impacts of any accident on human health and the environment:

- road classification in terms of suitability for transport of dangerous goods;
- use of four lane and/or divided roads where possible;
- access to emergency response resources; and
- approval by Main Roads for the use of B-double trucks.

H4.0 PREPAREDNESS

H4.1 INTRODUCTION

These activities are those which prepare the emergency response personnel, Rhône-Poulenc, the transport company and the community to emergencies. They include:

- planning;
- training;
- public information and education; and
- monitoring, testing, exercising and review of the Plan.

H4.2 PLANNING

The Plan will be consistent with the following emergency planning policies:

- Metropolitan Emergency Management Committee;
- Local Government Authorities through which the transport route passes; and
- the Local Emergency Management Advisory Committee outside the Perth metropolitan area or in its absence the Senior Police Officer whose jurisdiction includes the Local Government Area.

The Plan will define its relationships to these policies and the role of the Hazardous Materials Emergency Management Team.

H4.3 TRAINING

H4.3.1 Truck Drivers

The ADG Code requires the drivers to have adequate knowledge in the following:

- the nature and hazardous properties of the Dangerous Goods being transported;
- the actions to be taken to ensure the prevention of accidents, injury or damage to persons or property;
- to assist in any emergency that may arise in the course of transporting the goods:
- the designation and description of Dangerous Goods;
- the packaging, handling and marking of goods; and
- safety issues relating to the goods and their transport.

In addition, the driver must conform with relevant legislative requirements with respect to:

- the vehicle;
- marking of the vehicle;
- stowage and segregation;
- appropriate documentation;
- responsibilities of drivers and others with respect to the transport of Dangerous Goods; and
- competence and fitness to drive a Dangerous Goods vehicle.

The drivers will be required to be qualified to these requirements.

In order to obtain these qualifications, drivers will attend training courses approved by the Chief Inspector of Mines and obtain a pass mark of at least 75%.

In addition to this training, drivers will attend a course specifically designed for the transport of radioactive materials and which is approved by the Radiation Health Section of the Health Department of Western Australia and obtain an acceptable pass mark.

The driver training courses will consist of initial courses with subsequent refresher courses at least yearly.

All these driver training requirements will be written into the contract between Rhône-Poulenc and the transport company.

H4.3.2 Emergency Response Personnel

Each of the individual organisations involved in the Plan are responsible for training specific to their normal emergency response tasks. However, specialist awareness and task specific training will be provided which will include:

- the structure of this Plan;
- the nature of the gangue residue;
- exposure limits;
- human health and environmental effects;
- emergency scenarios and relevant responses;
- communications; and
- clean-up operations.

Such training will be provided for all organisations involved in emergency response along the transport route.

H4.4 SPILL SCENARIOS AND RESPONSES

The "Worst Case" spill scenario is discussed in Section 6.2.2.3 of the ERMP. This and other possible scenarios, and appropriate response actions for each scenario will be described in the Plan.

Such scenarios will be included in training courses.

H4.5 EMERGENCY RESPONSE EXERCISES

Emergency response exercises will be held with the emergency services, the transport company and Rhône-Poulenc. These will be held as part of the overall training programme.

The exercises with be held at various locations along the transport route so that many of the possible emergency scenarios are staged and the influence of distances from response personnel and resources are tested.

Further information on the organisation, frequency and location of these exercises will be presented in the Plan.

H4.6 SAFETY EQUIPMENT IN VEHICLES

Satellite communication equipment as part of the GPS satellite tracking system will be provided to communicate with the Central Control Room (CCR) at the Pinjarra plant site on a 24 hour basis. This would enable the driver, when he is not incapacitated, to advise the CCR the nature of the emergency. The CCR will monitor the progress of the vehicles and initiate communications in the event of unscheduled stops and if appropriate trigger the emergency response procedures.

At least three double-sided road-safety reflector signals complying with the appropriate Australian Standard will be kept in the cabin of the vehicle. These will be kept clean and in good condition will be used by the driver, where feasible, in breakdown or emergency situations.

In accordance with the ADG Code each vehicle will carry one 60B or two 30B dry chemical type fire extinguishes.

Other equipment may be identified during preparation of the detailed Plan.

H5.0 EMERGENCY RESPONSE ARRANGEMENTS

H5.1 ORGANISATION AND RESPONSIBILITIES

The organisation for dealing with emergency responses will be detailed in the Plan and will be based on the WAHMEMS.

A diagram showing the organisation structure will be included in the Plan.

In essence the field response team will comprise:

- an **On-site Controller** who is responsible for control of the entire operation. This will be the Senior Police Officer;
- a **Combat Authority** responsible for the physical aspects of combating the emergency. Depending on the location, the Combat Authority will be the WA Fire Brigade or the Volunteer Bush Fire Brigade. They will execute any First Strike Action to minimise the hazard to health and the environment.
- **Clean-up Team** will be either the Combat Authority acting under the direction of a **Specialist** from the Radiation Branch of the Health Department or Rhône-Poulenc, or a specialist Rhône-Poulenc clean-up team;
- **Local Advisory Group** comprises representatives of the Departments on the State Hazardous Materials Emergency Management Team, where they are represented in the local area. Their function is to provide advice to the On-site Controller and Combat Authority consistent with the contents of this Plan; and

- **Support Organisations** such as the State Emergency service who may assist with control of any bystanders and traffic and communication.

H5.2 NOTIFICATION AND DEPLOYMENT

H5.2.1 Introduction

Identification of an incident can be made by one or more of the following:

- GPS truck tracking system which will set off an alarm in the CCR at Pinjarra if the truck deviates from its defined route, makes an unscheduled stop or stops too long at a designated stop;

- the truck driver who notifies the CCR by radio or satellite communication; and

- a member of the public.

H5.2.2 Rhône-Poulenc GPS System

When the GPS tracking system sets off an alarm the CCR operator at Pinjarra attempts to contact the driver by radio or satellite communication. If this is unsuccessful, the CCR operator notifies:

- the relevant police station and requests them to investigate the situation;
- advises the other emergency response organisations of a possible emergency; and
- Rhône-Poulenc response personnel and the transport company of a possible emergency.

Procedures for warning and call-out will be defined in the Plan.

These procedures will minimise response time of personnel.

H5.2.3 Truck Driver

If the truck driver is capable he will notify the CCR operator and the Police of any emergency.

H5.2.4 Member of the Public

As required by the ADG Code and the Dangerous Goods Regulations standard Emergency Information Panels will be attached to the truck. These will advise of the nature of the dangerous goods and emergency contact telephone numbers. These numbers will be for the Police and a free-call number to the CCR at Pinjarra.

The numbers, locations, dimensions and information to be presented on these signs will be defined in the Plan.

H5.2.5 Target Response Timing

The aim is to minimise the response time as much as practicable.

This will be achieved by:

- the use of the GPS satellite tracking system as described in Section H4.6;

- the training of the drivers and emergency response personnel as described in Section H4.3 and conducting emergency response exercises (Section H4.5);
- the storage of containment and equipment at strategic locations along the transport route (Section H5.6.3) at possible places such as Pinjarra, Midland, Northam, Merredin and Southern Cross; and
- rapid deployment of Rhône-Poulenc emergency personnel by aircraft (Section H5.4.2).

It is expected that the Police will be able to attend an emergency situation within no more than 1 hour of notification and containment and clean-up equipment could be mobilised to any location within about 2 hours of notification.

Response time will, however, be evaluated during preparation of the plan. This will include consultation with emergency response personnel along the transport route and will be undertaken in conjunction with evaluation of spill scenarios and responses.

H5.3 ASSESSMENT AND FIRST STRIKE ACTION

H5.3.1 Introduction

The dangerous goods carried by the truck can be readily identified by the police assessing the situation by the six Emergency Information Panels and assessment can be subsequently undertaken rapidly.

In the case of extensive fire damage to the truck, the existence of Emergency Information Panels, registration of the truck and other markings could be used to readily identify the ownership of the truck and the goods being transported.

The **First Strike Action** is the immediate response action required to minimise the hazards to life, property and the environment.

The contingency responses will normally be triggered by the CCR operator at Pinjarra resulting from direct communication with the driver or with the Police. Police officers will immediately attend the site of the emergency with other personnel from the company and other authorities flown to the area by helicopter, if necessary.

H5.3.2 By the Truck Driver

The driver will be trained in First Strike Action procedures. These procedures will also be described on an Emergency Procedure Guide (EPG) - Transport Card which will be carried in the cabin of the truck.

These procedures will include:

- communications and notification;
- placement of safety signs and use of emergency flashing lights to reduce the hazard of traffic accidents; and
- site control until the On-site Controller arrives.

The procedures will be defined in the Plan.

H5.3.3 By the On-Site Controller

The Controller will initiate action in accordance with:

- the EPG, if available at the site;
- the Emergency Information Panels;
- his training; and
- specialist advice received by radio.

The actions will include:

- notification of the other emergency response organisations and Rhône-Poulenc;
- obtaining other police assistance as required;
- traffic control;
- attendance to injured;
- monitoring of information for other response organisations and specialists to assess the nature of the emergency and implement appropriate responses; and
- evacuation of people from the Control Area and control of access into the Control Area.

The required actions will be defined in the Plan.

H5.4 CONTROL AND CONTAINMENT

H5.4.1 Introduction

The control of the emergency scene and the containment of any spilt gangue residue are critical to the protection of human health and the environment. Procedures for control and containment will be presented in the Plan.

H5.4.2 Specialist Support

Specialist support will be available through Rhône-Poulenc and the Radiation Health Section of the Health Department.

As soon as Rhône-Poulenc is aware of an emergency, at least the leader of the Rhône-Poulenc emergency response team will be go to the site immediately. If the site is outside the Metropolitan area this person will travel by helicopter or a chartered fixed winged aircraft, whichever is the more expedient. Contract arrangements will be established with an air charter company to ensure a system is set up to enable rapid deployment of Rhône-Poulenc emergency response personnel.

The Rhône-Poulenc emergency response leader or the senior policeman will have the responsibility of ensuring that the public is kept at a safe distance and that the time involved for emergency response personnel is minimised and monitored.

H5.4.3 Site Control

The site will initially be cordoned-off to prevent uncontrolled access. This area may be extended to include space for:

- command post and on-site operations centre:
- containment of spilt residue;
- clean-up;

- support equipment storage/parking; and
- decontamination.

The size and configuration of the area will depend on many factors such as the nature and location of the emergency. However, guidelines will be provided in the Plan for minimum distances required for protection of human health and to facilitate effective control and clean-up.

As described in Section 6.4.4.8 of the ERMP a person would need to be about 5 metres from a transport container of waste (about 20 tonne) for a period of about 200 hours to reach the public dose limit for exposure. Consequently, the use of a control distance of 5 metres would be adequate. However, for traffic passing, even at very low speeds, a broken down truck or spilt residue the exposure would be very low because a person would need to be in contact with a bag of waste for about five hours to reach the permissible public dose limit.

H5.4.4 Containment

Containment of spilt residue could be achieved by one or more of the following methods:

- repackaging into containers provided for storage of spilt residue;
- covering with tarps to prevent generation of dust;
- slight wetting to keep the residue moist to prevent dusting; and
- earthen bunds to prevent dispersion in a creek or by rainfall runoff.

Details of these containment methods will be presented in the Plan.

H5.5 MEDICAL SERVICES

Treatment of casualties on-site and the road transport of casualties will be provided by the WA Ambulance Service.

If required, air services for casualties will be co-ordinated by the Police.

H5.6 CLEAN-UP

H5.6.1 Responsibility

Any clean-up will be the responsibility of Rhône-Poulenc and will be undertaken either by the Combat Authority under the direction of Rhône-Poulenc or by the Rhône-Poulenc clean-up team.

Any initial containment of spilt residue may be undertaken by the On-site Controller in order to minimise health hazards or environmental contamination.

H5.6.2 Equipment

Clean-up equipment such as drums, bags, hand tools, radiation detection equipment and personal protective clothing will be provided by Rhône-Poulenc. Stores of this equipment will be kept at strategic locations along the transport route under the control of nominated emergency response teams.

H5.6.3 Clean-up Procedures

Clean-up procedures will be documented in the Plan. They will, however, comprise mainly:

- containment;
- repackaging into bags or drums with the use of hand shovels; and
- packaging of contaminated soil into bags or drums with shovels.

H5.6.4 Validation of Clean-up

Any clean-up will be subject to validation testing to assess if any unacceptable contamination remains. Such testing will be done according to procedures approved by Radiation Health. Such procedures will be described in the Plan.

H5.7 STAND-DOWN AND DEBRIEFINGS

The On-site Controller in consultation with Rhône-Poulenc and the Combat Authority will co-ordinate the stand-down and debriefing of participating agencies when it is considered that all response activities have been completed and the emergency site has been rendered safe.

H5.8 INVESTIGATIONS AND REPORTS

Rhône-Poulenc will undertake an investigation of all incidents using recognised procedures such as the "International Safety Rating System (ISRS)".

All emergency incidents involving the transport of gangue residue will be reported to Rhône-Poulenc Management Safety Committee for review and endorsement of preventative measures with a copy being forwarded to the appropriate authorities.

H5.9 LONGTERM CLEAN-UP

In some scenarios it may be necessary to continue clean-up works after the site has been rendered safe. Such works would be done by Rhône-Poulenc in consultation with the Department of Environmental Protection and any other relevant agency such as Radiation Health or the Water Authority.

Any such clean-up will be subject to validation testing.

H6.0 POTENTIAL OF DISPERSION

If a spill of the gangue residue occurred in the land environment, it is in a form that could be readily retrieved and placed into suitable containers for transport and disposal.

The potential for the material to disperse into the environment by dusting or mobilisation due to runoff was also assessed. The gangue residue will be a clayey material with 40% moisture, as described previously, therefore, it would take a significant length of time for the material to dry.

In order to simulate the unlikely event of the waste being exposed for sufficient time, following an accidental spill, to allow it to dry completely (therefore represent a potential dust source) samples of similar material were either air or oven-dried. In these circumstances the waste behaved as a typical clay and negative pore pressures generated by the drying process bind the material into a hard solid which does not dust unless mechanical effort is applied.

The low level radioactivity of the waste would be of assistance in ensuring its complete retrieval following a spill as radiation detection equipment, such as a gamma counter, would readily identify the waste and any contaminated soil which would be collected and transported to the IWDF. The radioactive component of the material is dense and insoluble, therefore, in the event that heavy rain mobilises some of the spill it is unlikely that it would travel any distance. There will be minimal hazard to the clean-up team or general public by exposure to this material for the time taken for clean-up procedures.

Another scenario to be addressed is the unlikely event of a bulka bag of waste spilling into a flowing stream or river. The gangue residue has extremely low solubility, such that laboratory test work on samples of the material indicates that the total immersion of a bag of waste in fresh water would not result in an exceedance of the permissible levels of thorium contained in wastes discharged to the environment (Radiation Safety (General) Regulations, 1983). Solubility tests were conducted at the Proponent's La Rochelle Plant, using 100g of similar gangue material mixed with 1 litre of demineralised water for 16 hours. Three samples were analysed and the results are shown in Table H1.

TABLE H1
RESULTS OF SOLUBILITY TESTS

Component	Sample*			Guidelines for Quality of Drinking Water**
	1	2	3	
Ra-228 (Bq/l)	0.3	0.3	0.5	0.5
Ra-226 (Bq/l)	<0.2	<0.2	<0.2	0.5
U (mg/l)	0.08	0.04	0.03	0.25
Th (mg/l)	<0.1	<0.1	<0.1	0.1***
Pb (mg/l)	<0.5	<0.5	<0.5	0.1
SO_4 (mg/l)	230	135	100	500

Sources: * Rhône-Poulenc.
** NHMRC/ARMCANZ, 1994.
*** DOME, 1995 pers. comm.

The results in Table H1 indicated that a solution of <0.1mg/L of thorium was generated, corresponding to 3.7Bq/L which can be compared to a regulatory level of 7.4 x 10^3 Bq/L as indicated in the Radiation Safety (General) Regulations (1983). (Schedule VIII Table 2 Column 2 Natural Thorium). These values can also be compared with the guidelines for drinking water (NHMRC/ARMCANZ, 1994) as shown in Table H1.

All the above components, with the exclusion of lead, are equivalent to or are below the guidelines for drinking water quality. Further solubility tests are being undertaken to determine more accurate lead levels by the use of equipment with a lower detection limit. However, it is extremely unlikely that a sufficient quantity of material would be spilt into a drinking water source to reach the concentrations given in Table H1. In addition, in the unlikely event of waste being spilt into a flowing stream or drinking water source, the constituents would be immediately diluted to background level concentrations within a few metres from the spill. Tests will be undertaken to determine the physical dispersion characteristics of the gangue residue in water and the results will assist in preparing clean-up procedures.

H7.0 RECOVERY

The potential "Recovery" aspect of an emergency involving gangue residue is long-term clean-up as described in H5.9.

*   *   *

Appendix I

APPENDIX I

REVIEW OF GROUNDWATER MONITORING DATA

APPENDIX I

REVIEW OF

GROUNDWATER MONITORING DATA

PINJARRA SITE

for

Rhône-Poulenc Chimie Australia Pty Ltd

August 1995

DK: 215-9320/PER

Job No. 12088-057-366 Revision 0

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LIST OF FIGURES

REVIEW OF GROUNDWATER MONITORING DATA PINJARRA SITE

I1.0 BACKGROUND AND SCOPE OF SERVICES

Rhône-Poulenc Chimie Australia Pty Ltd (Rhône-Poulenc) was granted approval to develop a gallium extraction plant at the Pinjarra site in 1987. The Gallium Plant was designed and constructed between 1987 and 1989; it was operational from 1989 to 1990 and then placed on care and maintenance status. The plant design and operation includes non-radioactive waste disposal and storage in on-site clay-lined evaporation ponds.

In order to monitor the effects of potential seepage from the evaporation ponds, a comprehensive groundwater monitoring bore network was established across the site in 1987 (Figure 1). The network comprises eleven monitoring bore clusters constructed to a maximum depth of about 36m below ground level. The clusters comprise three bores at each site completed in:

(i) the upper section of the superficial formations (suffix S);
(ii) the lower section of the superficial formations (suffix I); and
(iii) the upper part of the Leederville Formation (suffix D).

Since 1989 Rhône-Poulenc has undertaken regular groundwater monitoring, comprising monthly groundwater level measurements and quarterly groundwater sampling for laboratory analysis of specified parameters.

Dames & Moore has been retained by Rhône-Poulenc to review the groundwater monitoring data and comment on the effects (if any) that the evaporation ponds have had on the groundwater chemistry and groundwater levels beneath the site.

Hydrographs (groundwater level versus time plots) and time-series plots (1987 to 1995) of selected chemical parameters have been prepared for the monitoring bores.

The groundwater level and groundwater chemistry data have been reviewed to ascertain any effects that the evaporation ponds have had on the underlying aquifers.

I2.0 INTERPRETATION OF GROUNDWATER MONITORING DATA

I2.1 GROUNDWATER LEVELS

Based on the compiled groundwater level hydrographs (Figures I2, I3 and I4), the following observations can be made:

- The groundwater levels in all monitoring bores have displayed seasonal fluctuations of between 2 and 6m; the largest fluctuations generally occur east of monitoring bore 3. There does not appear to be a change in the range of groundwater level fluctuations since the construction and operation of the evaporation ponds.

- There is a general downward trend in the annual summer groundwater levels in the monitoring bores. This is probably associated with the generally lower-than-average annual rainfall during the monitoring period.

Based on these observations, we are unable to find any effect that the presence and operation of the evaporation ponds have had on groundwater levels under the site.

I2.2 GROUNDWATER CHEMISTRY

Based on the time-series plots (Figures I5 to I13), there does not appear to be any significant changes in the chemistry of the groundwater under the site due to the presence and operation of the evaporation ponds.

I2.2.1 pH

The pH of the groundwater has remained in the range 3.8 to 7.5, and where fluctuations are observed, all of the monitoring bores show similar fluctuations. In the swampy area west and downslope of the evaporation ponds acidic groundwater conditions occur; this is probably a natural phenomena due to the geochemical interaction of organic material and near-surface groundwater.

I2.2.2 Salinity

The salinity of groundwater under the site has not fluctuated significantly since the evaporation ponds were commissioned. A gradual decline in groundwater salinity has been observed in many monitoring bores. The groundwater salinity is generally less than 3,000mg/L TDS (total dissolved solids) except at monitoring bore 10 where the groundwater salinity is between 3,000 and 5,000mg/L TDS. This monitoring bore site is about 400m south of the ponds and groundwater salinity in these bores has decreased since the monitoring network was commissioned.

I2.2.3 Sulphate

Prior to operation of the evaporation ponds the sulphate concentrations of groundwater were slightly elevated but were all generally less than 150mg/L. In general, the sulphate concentrations of groundwater are still less than 150mg/L, except for monitoring bores 10S, 5I and 8I where higher temporary concentrations have been measured.

I2.2.4 Nitrate

The nitrate concentrations of groundwater in the monitoring bores have remained less than about 10mg/L - except for bores 4S, 6S, 11S and 12S which occasionally have slightly higher unexplained values. These isolated "spikes" could possibly be due to analytical errors.

I2.2.5 Phosphorous

The phosphorous concentrations of groundwater in all monitoring bores have been less than 5mg/L since monitoring commenced.

I2.2.6 Sodium and Magnesium

The sodium and magnesium concentrations of groundwater in the monitoring bores have not fluctuated significantly since monitoring commenced.

I2.2.7 Aluminium

The aluminium concentrations of groundwater in the monitoring bores have all been very low and generally less than 0.25mg/L for most of the monitoring period. The notable exception is monitoring bore 12S, in which abnormally high concentrations (up to 25mg/L) of aluminium in the groundwater have sometimes been measured. The high aluminium values are generally coincident with the seasonal rise in groundwater levels and are probably unrelated to the groundwater chemical regime; they may be due to the presence of cement grout in the slotted interval of this monitoring bore.

I3.0 CONCLUSIONS AND RECOMMENDATIONS

I3.1 CONCLUSIONS

The groundwater levels beneath the Pinjarra site have shown seasonal fluctuations due to rainfall and evaporation. The magnitude of the changes in groundwater levels are between 2 and 6m, with the largest fluctuation east of monitoring bore 3. There has been an overall decline in the groundwater levels beneath the site. The operation of the evaporation ponds has not effected the groundwater levels beneath the site.

The concentrations of the various chemical parameters in the groundwater have not changed significantly since the evaporation ponds were commissioned. The groundwater chemistry appears to have improved slightly and some natural phenomena are observed (e.g. slightly acidic conditions beneath the swampy areas). The groundwater under the site has always had slightly elevated sulphate concentrations which appear unrelated to the evaporation ponds.

The chemistry of the groundwater beneath the site has not been effected by the presence and operation of the evaporation ponds.

I3.2 RECOMMENDATIONS

The groundwater monitoring programme should be continued; however in view of the proposed revised status at the Pinjarra facility some changes to the programme are suggested.

The groundwater levels should be monitored monthly. The quarterly groundwater sampling should continue, however the suite of analytes should be revised when the approval for the new plant is obtained. The proposed new suite should include:

- pH, total dissolved solids, nitrate and phosphate.

I4.0 REFERENCES

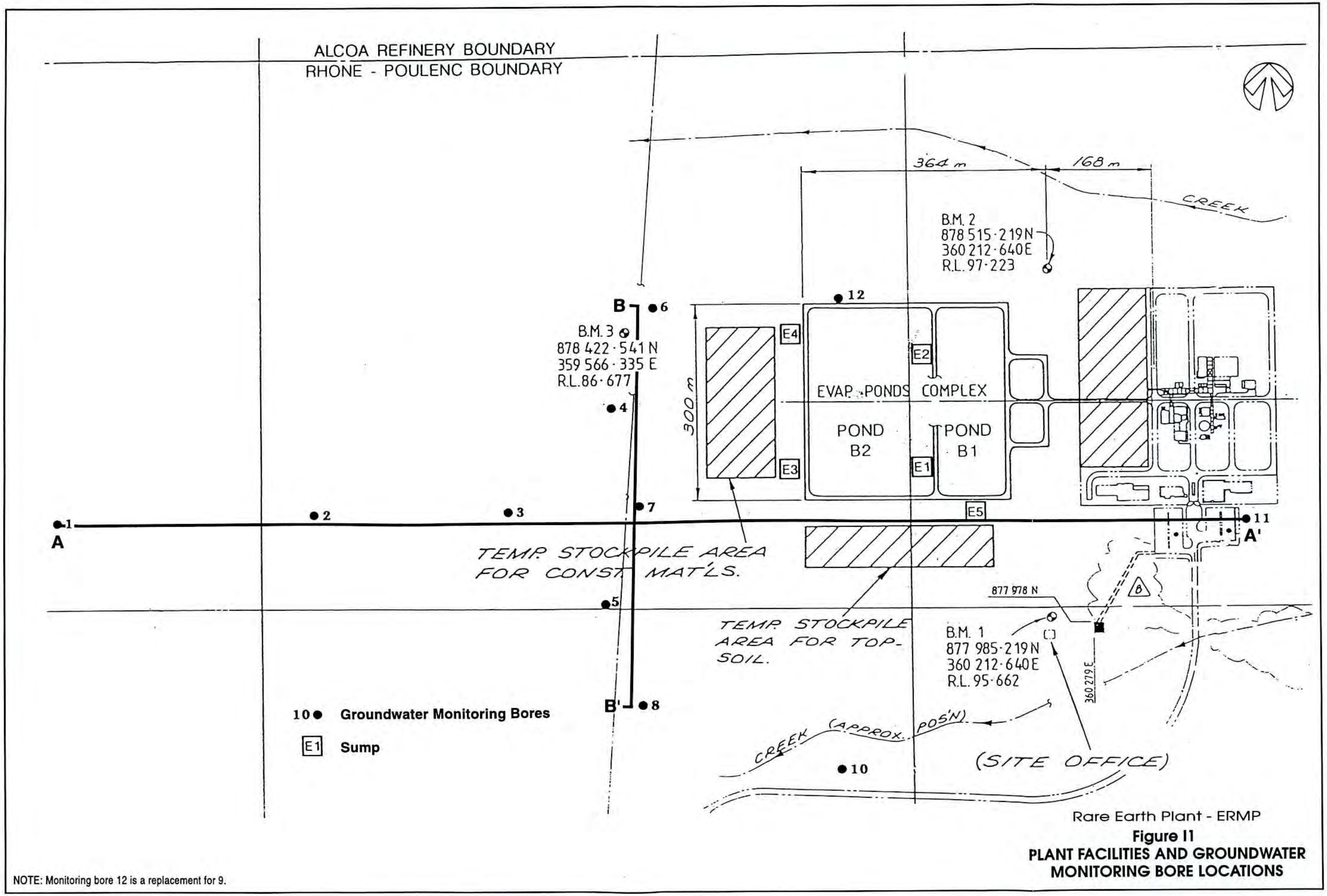
Groundwater Resource Consultants, 1987, Rare Earths Plant, South Pinjarra, WA. Hydrogeology and Hydrogeologic Transport Potential. Project Code 12088-012-071, Report 219.

Groundwater Resource Consultants-Dames & Moore, 1990, Annual Water Pollution Control Assessment. Pollution Control Licence No. 0861. Gallium Extraction Plant, Pinjarra. Project Code 12088-027, Report 403.

Rhône-Poulenc Chimie Australia Pty Ltd, Groundwater Level and Groundwater Chemistry Data, 1989 to 1995.

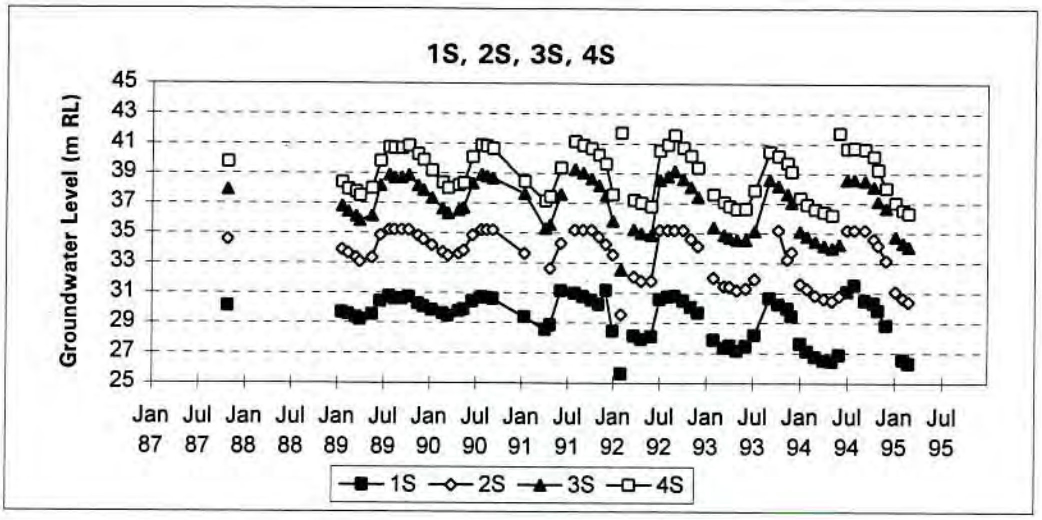
* * *

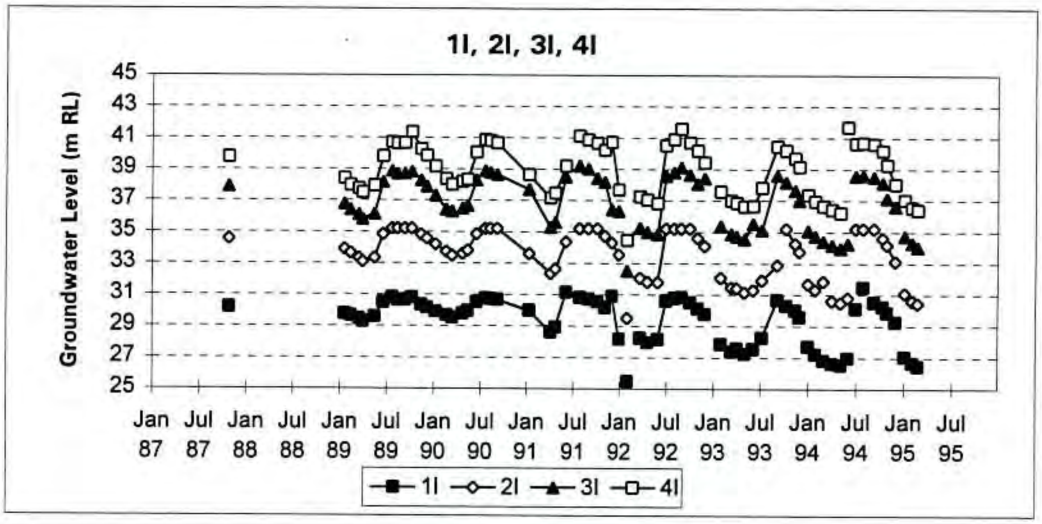
Figures

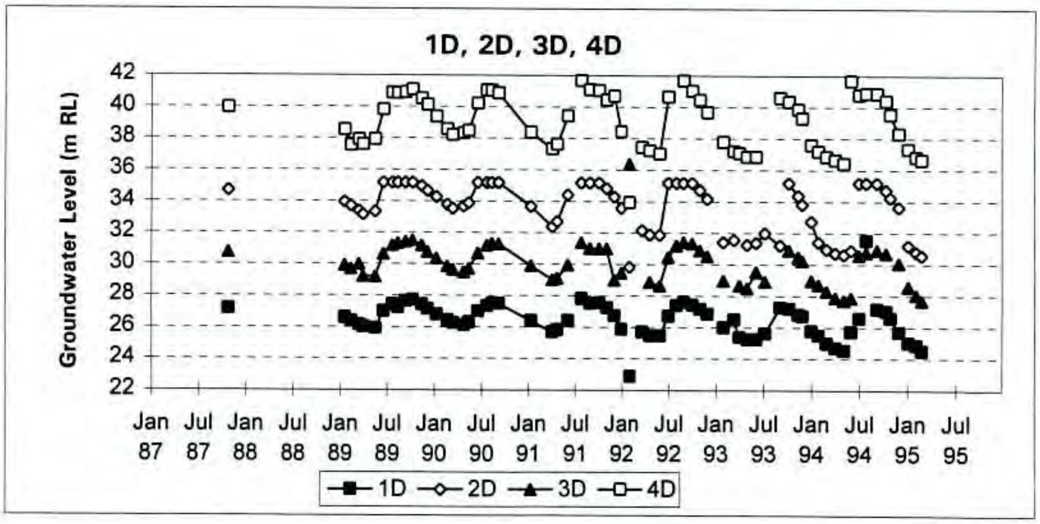


Rare Earth Plant - ERMP

Figure I1
PLANT FACILITIES AND GROUNDWATER MONITORING BORE LOCATIONS

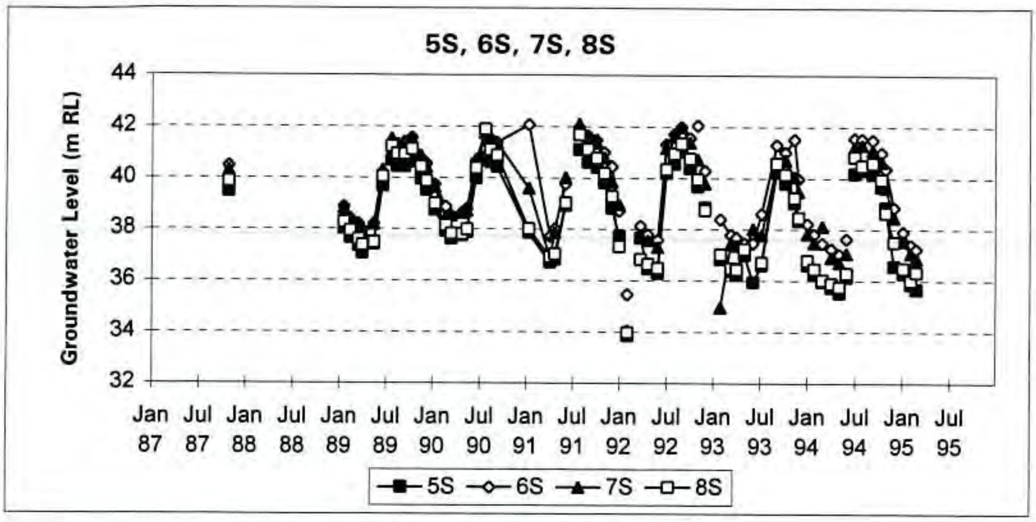


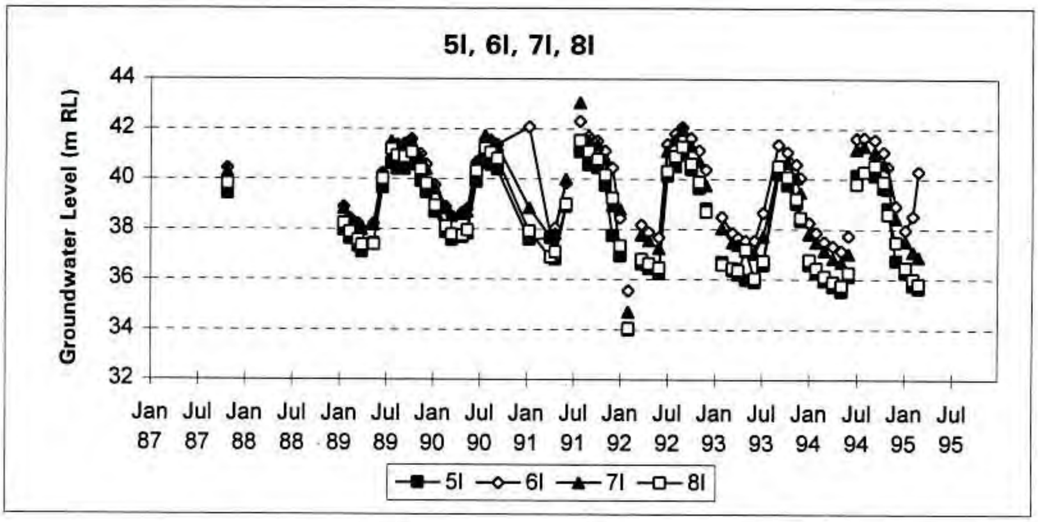


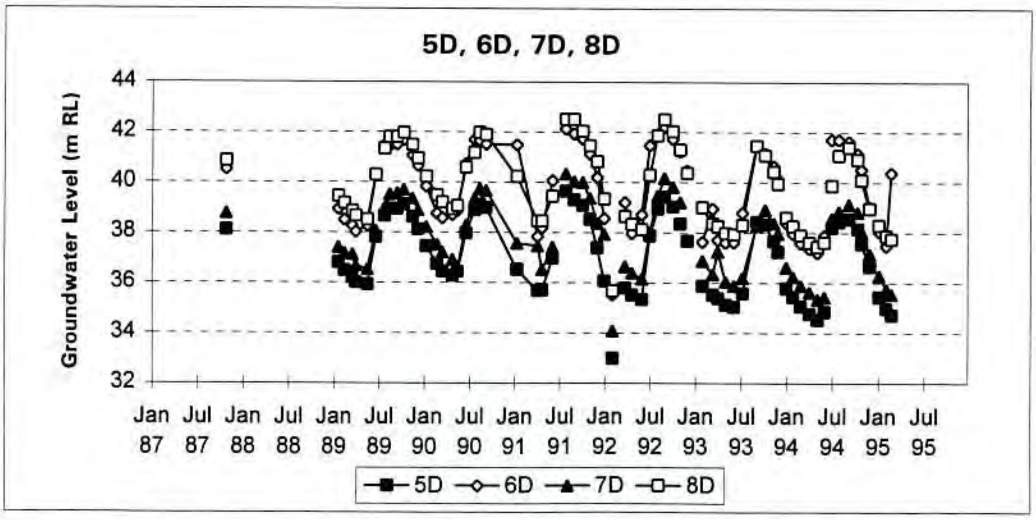


Rare Earth Plant - ERMP

Figure I2
GROUNDWATER LEVELS - 1S TO 4D

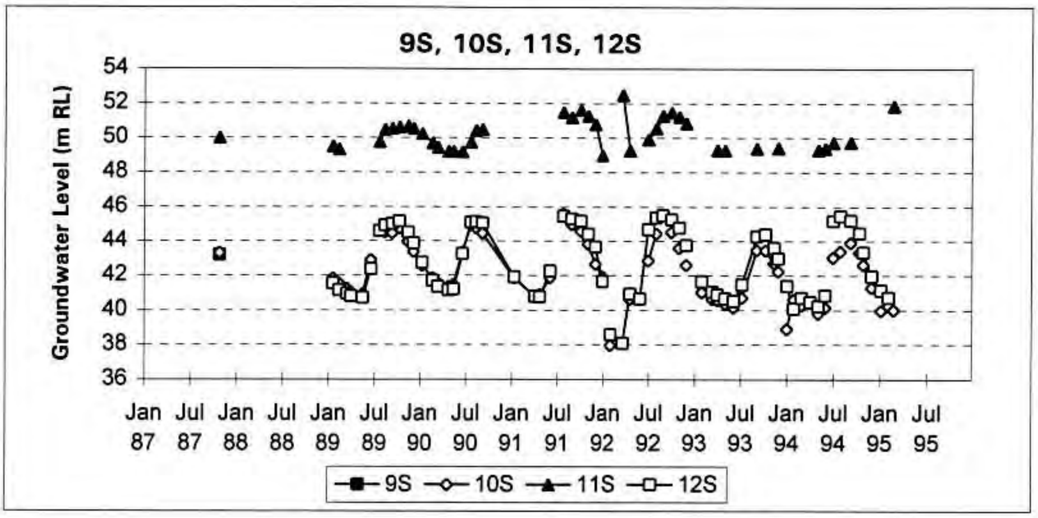


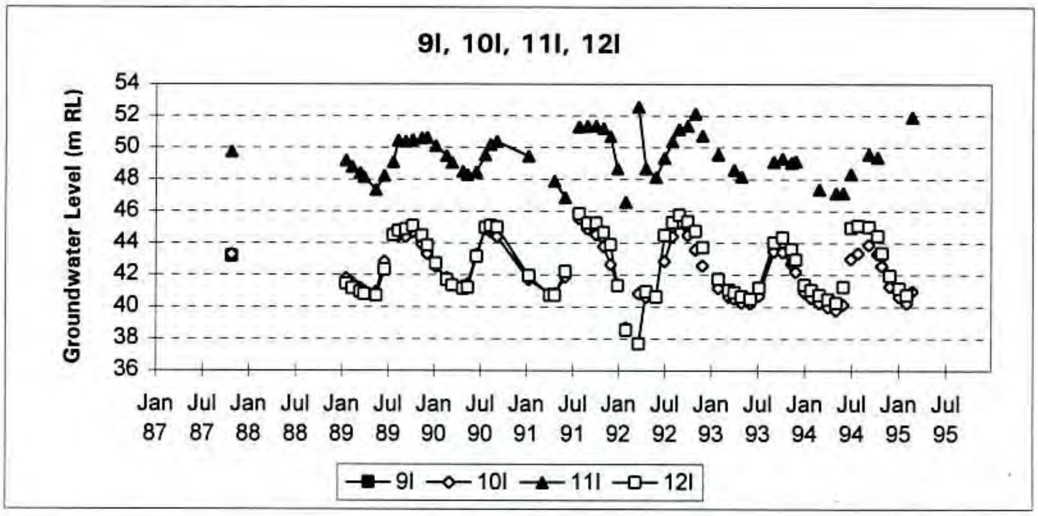


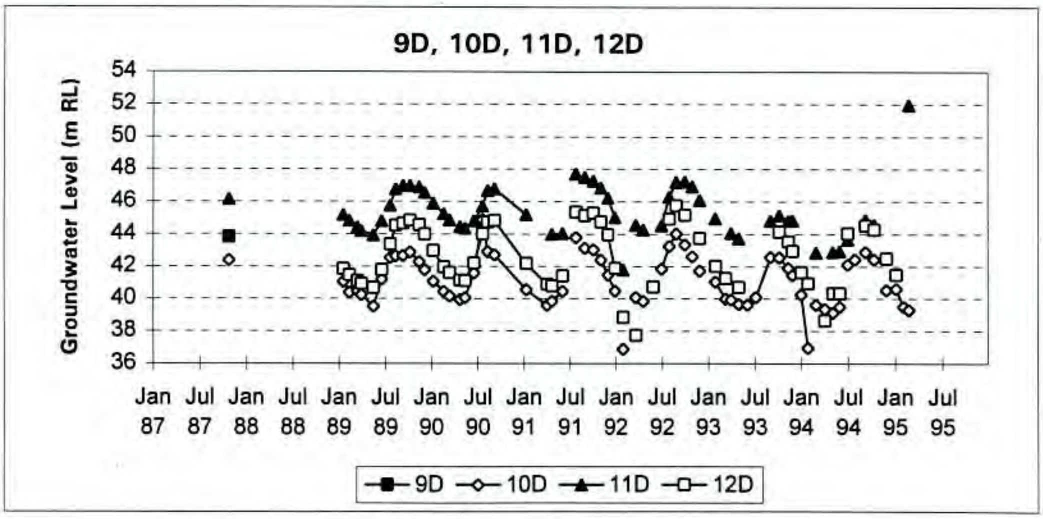


Rare Earth Plant - ERMP

Figure I3
GROUNDWATER LEVELS - 5S TO 8D

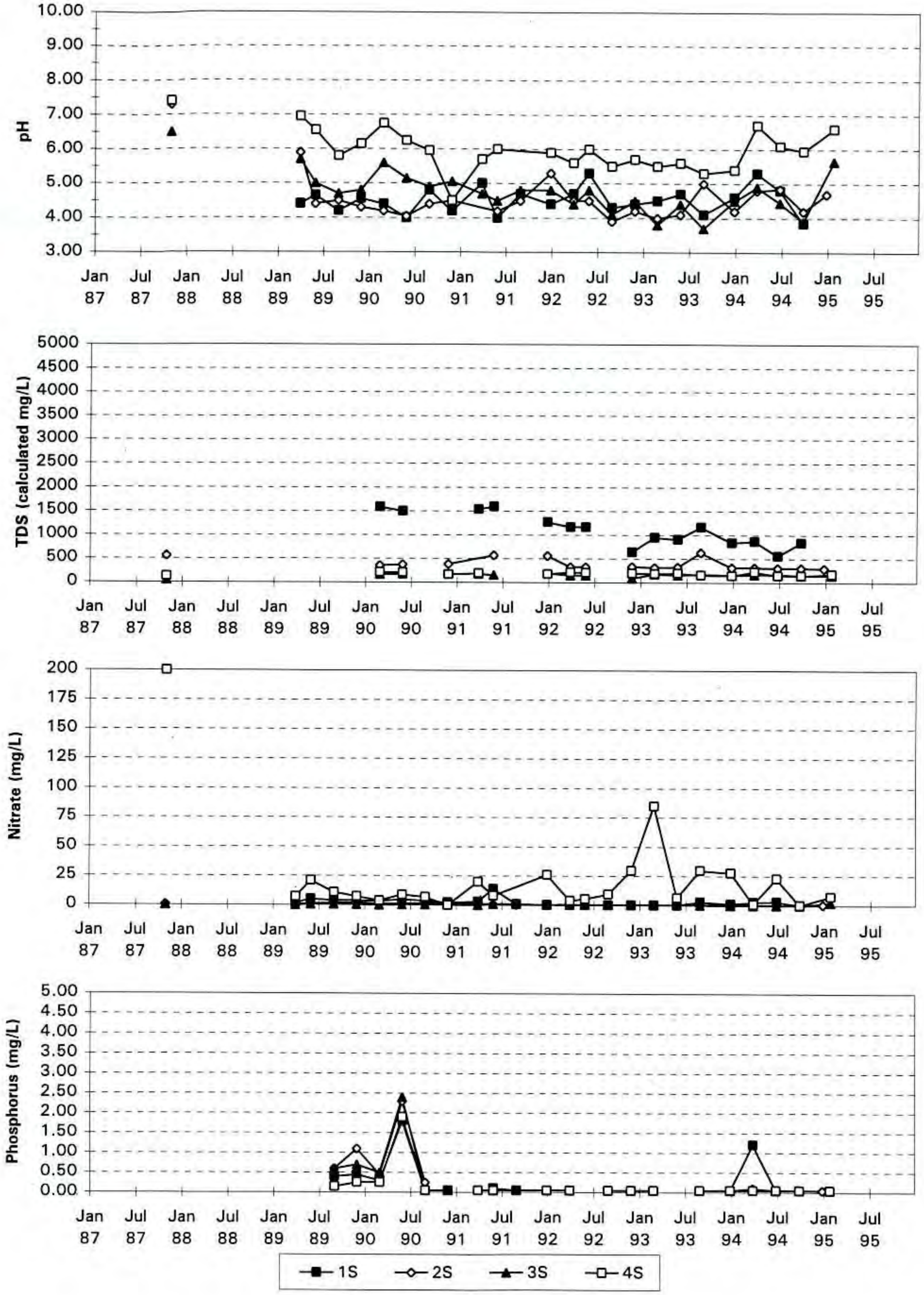






Rare Earth Plant - ERMP

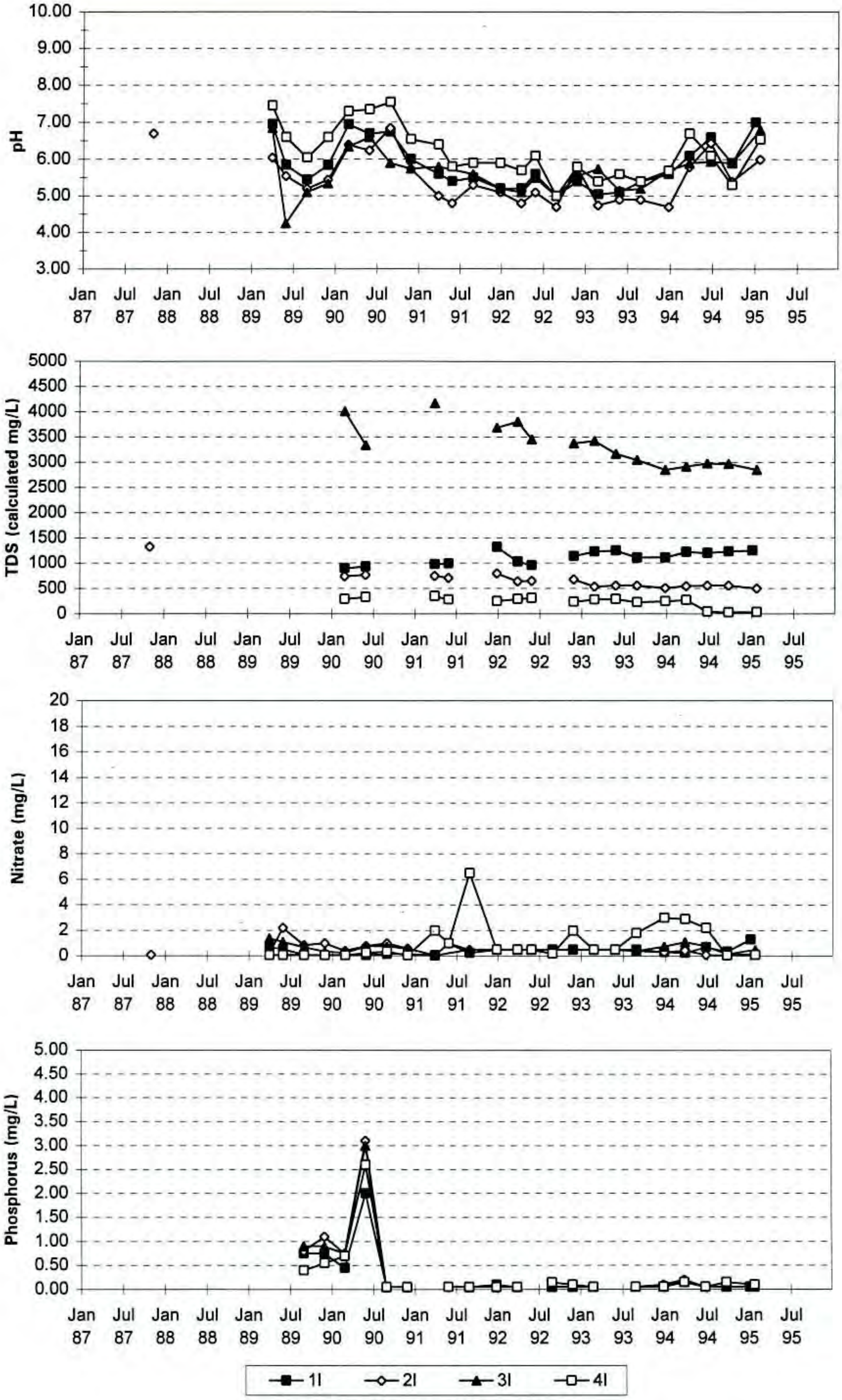
Figure I4
GROUNDWATER LEVELS - 9S TO 12D



Rare Earth Plant - ERMP

Figure I5

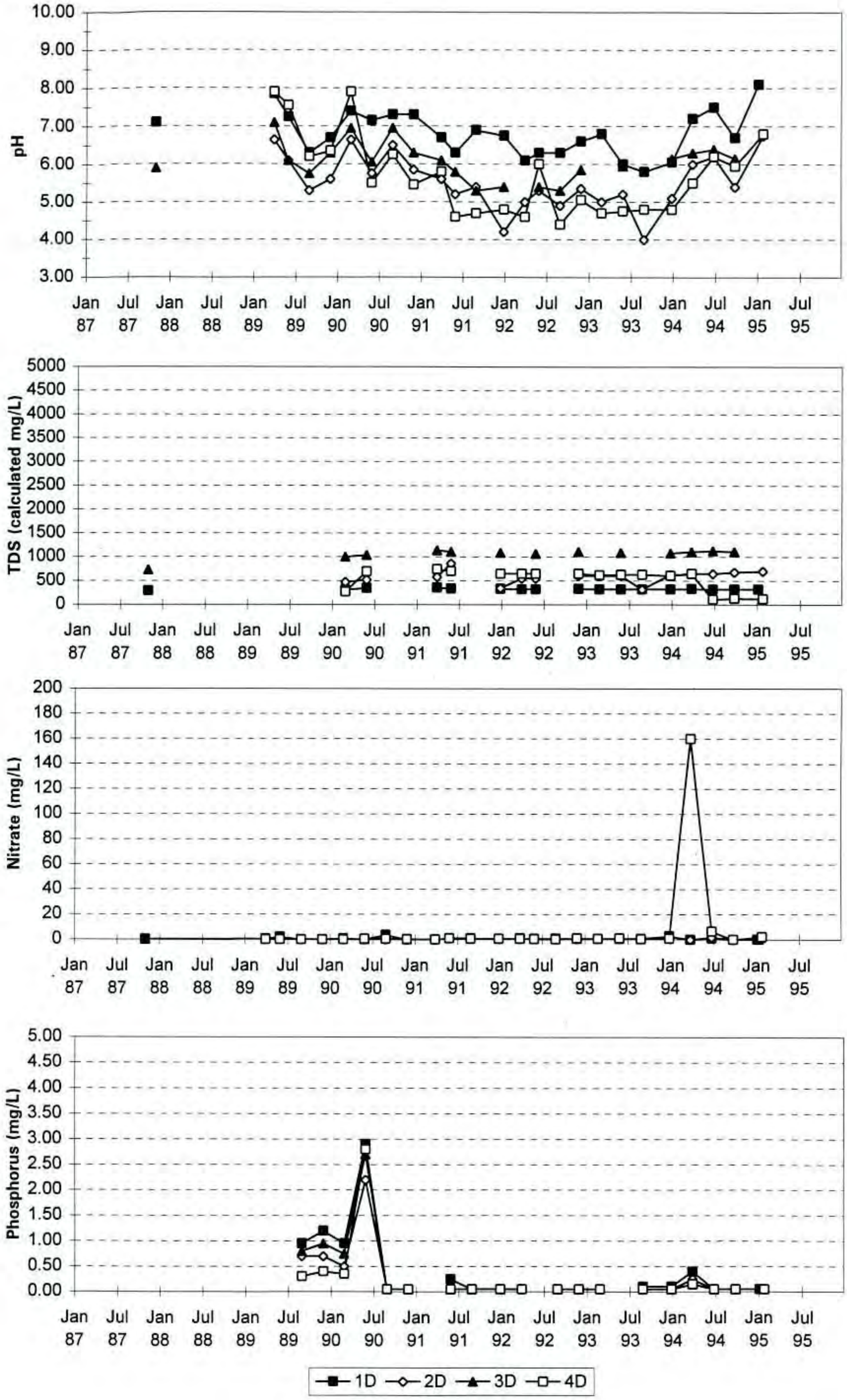
GROUNDWATER CHEMISTRY - 1S, 2S, 3S, 4S



Rare Earth Plant - ERMP

Figure 16

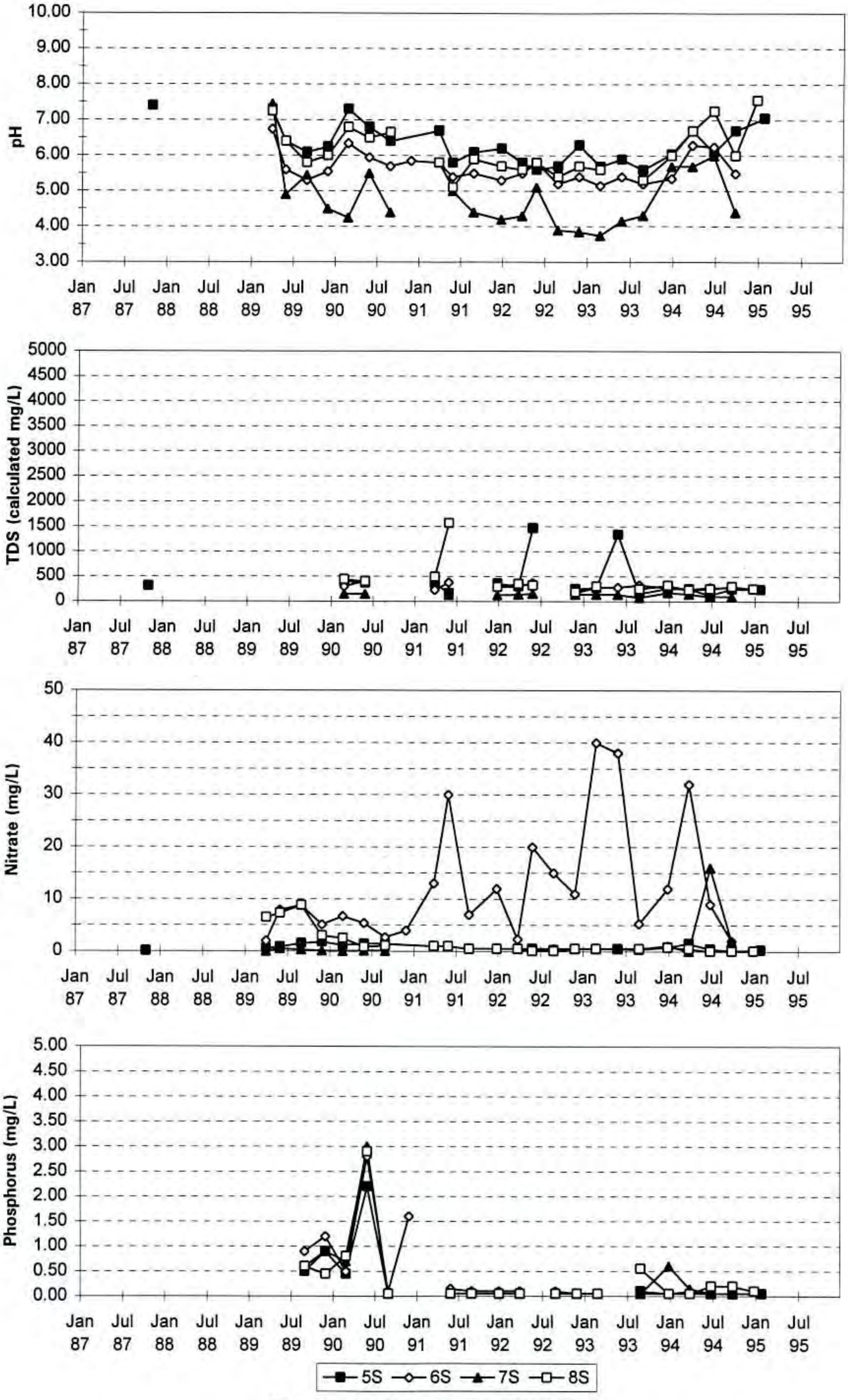
GROUNDWATER CHEMISTRY - 1I, 2I, 3I, 4I



Rare Earth Plant - ERMP

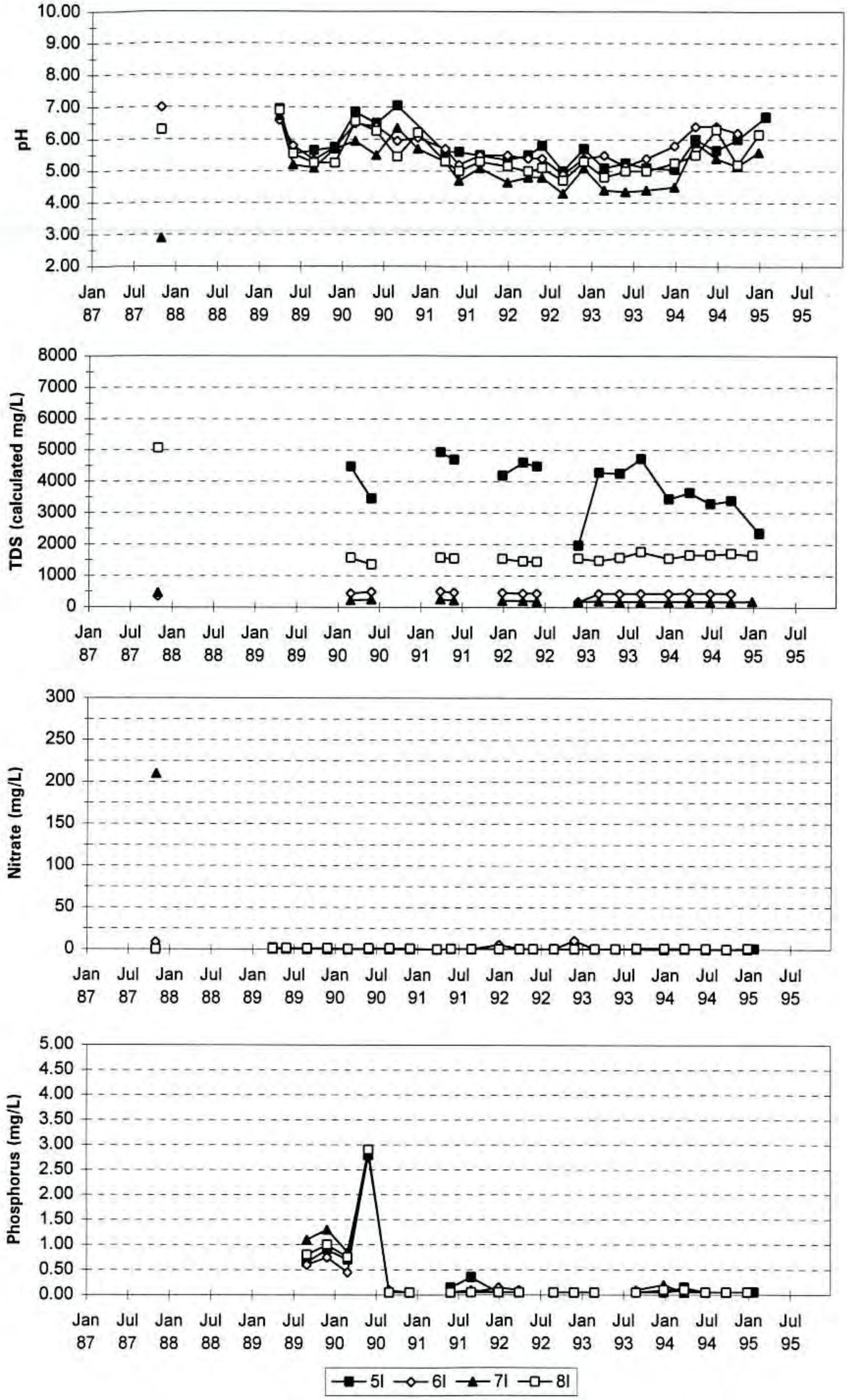
Figure I7

GROUNDWATER CHEMISTRY - 1D, 2D, 3D, 4D



Rare Earth Plant - ERMP

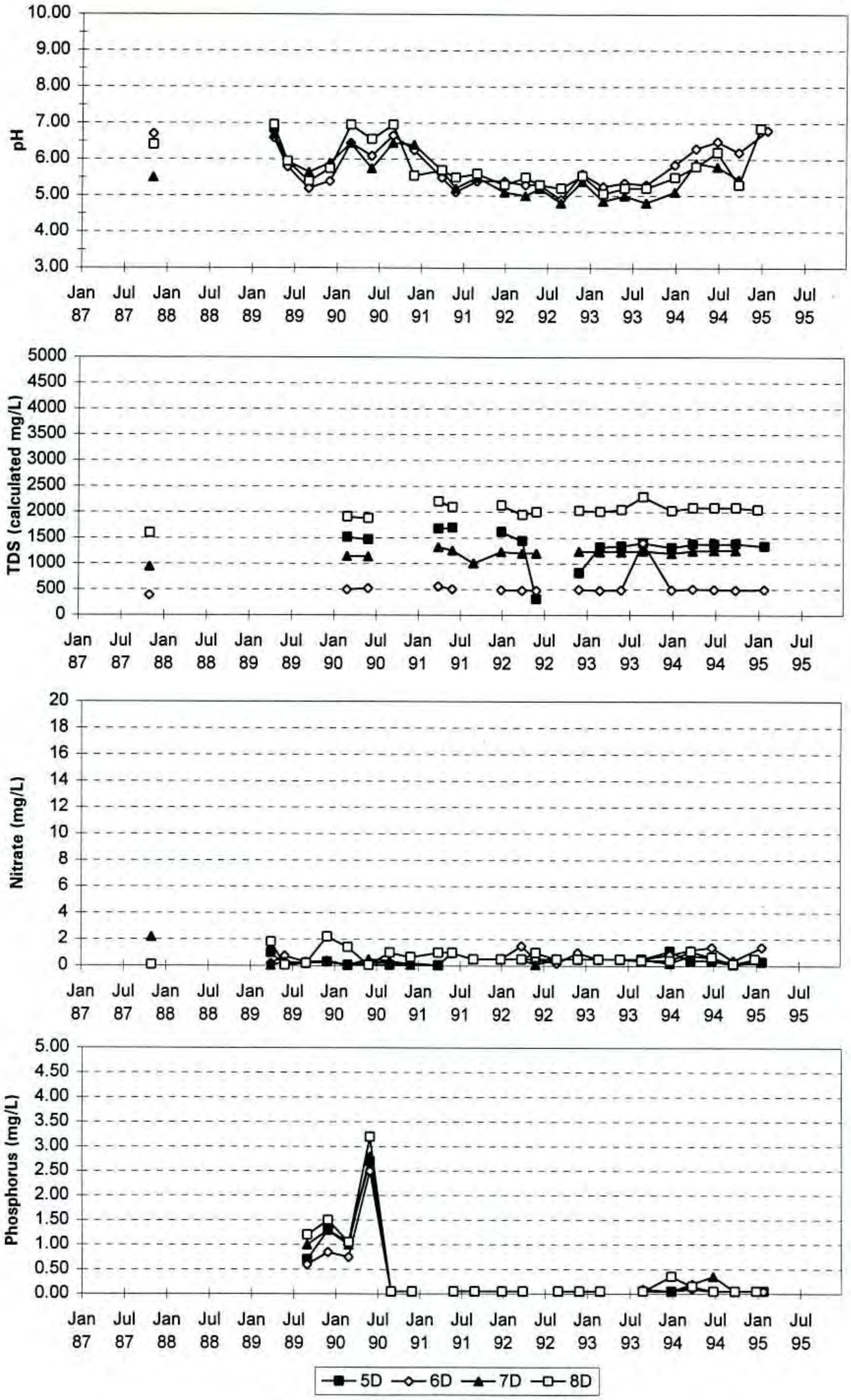
Figure I8
GROUNDWATER CHEMISTRY - 5S, 6S, 7S, 8S



Rare Earth Plant - ERMP

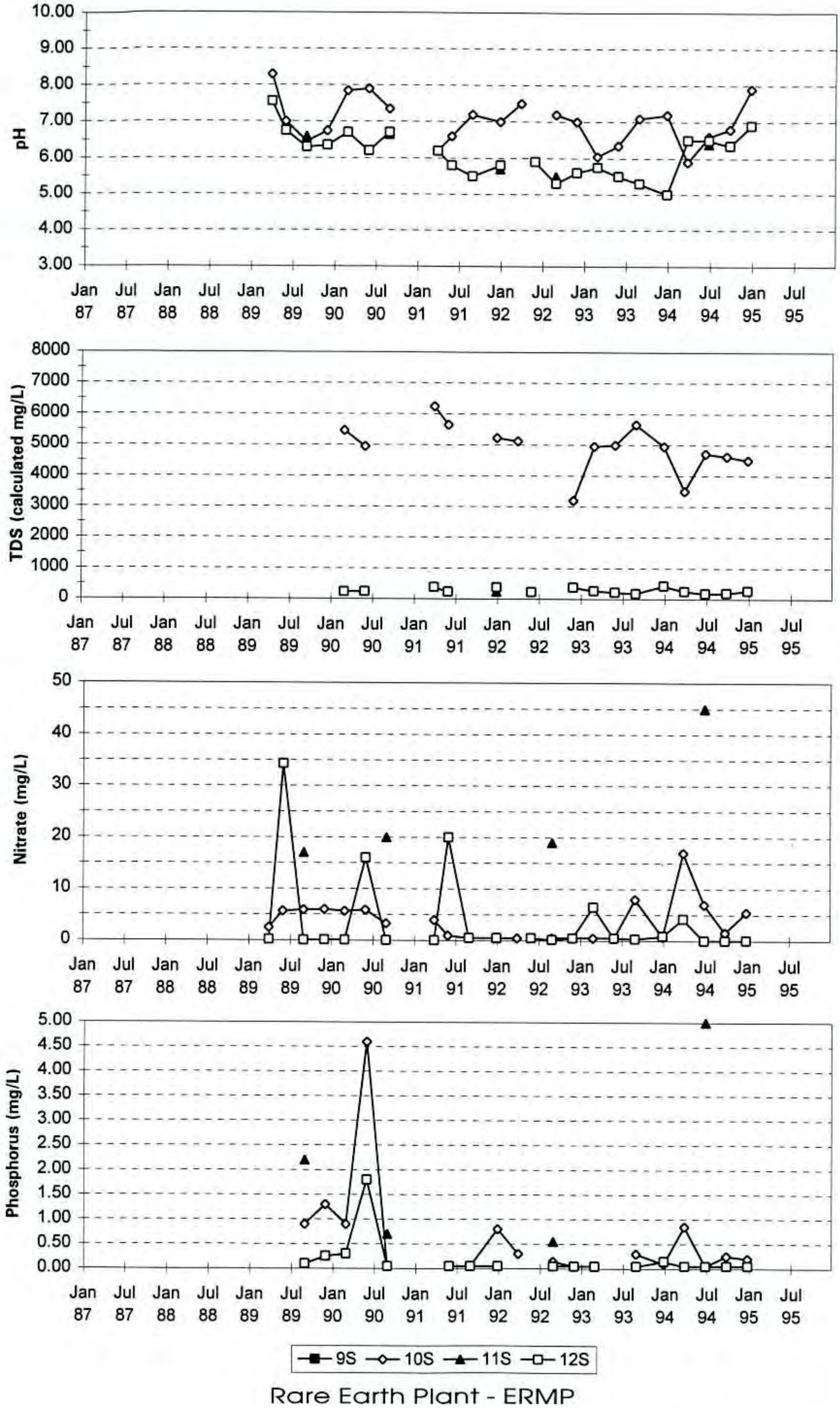
Figure 19

GROUNDWATER CHEMISTRY - 5I, 6I, 7I, 8I



Rare Earth Plant - ERMP

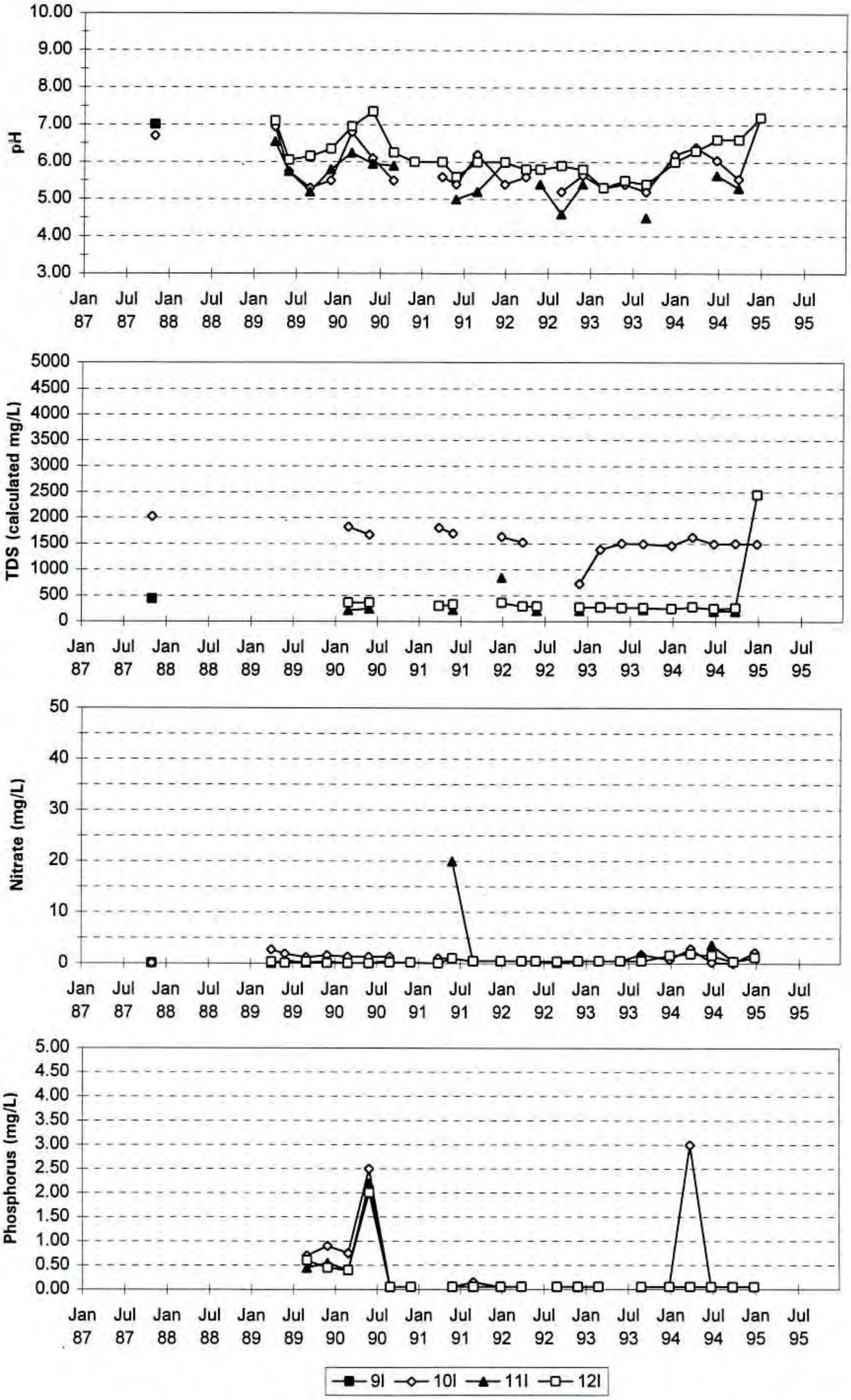
Figure I10
GROUNDWATER CHEMISTRY - 5D, 6D, 7D, 8D



Rare Earth Plant - ERMP

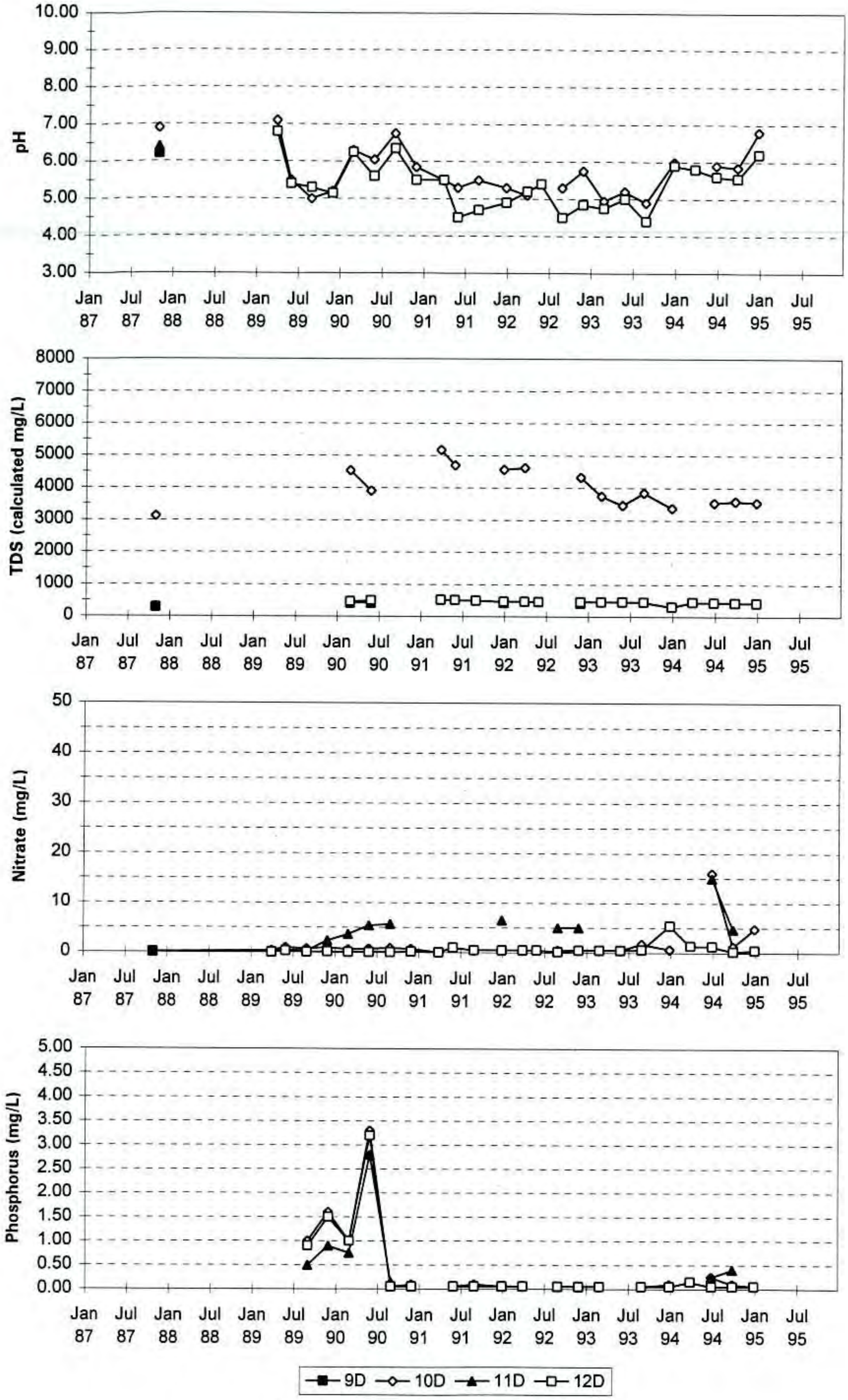
Figure I11

GROUNDWATER CHEMISTRY - 9S, 10S, 11S, 12S



Rare Earth Plant - ERMP

Figure I12
GROUNDWATER CHEMISTRY - 9I, 10I, 11I, 12I



Rare Earth Plant - ERMP

Figure I13
GROUNDWATER CHEMISTRY - 9D, 10D, 11D, 12D

Appendix J

APPENDIX J

EVAPORATION PONDS CONTINGENCY PLANNING

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APPENDIX J
EVAPORATION PONDS CONTINGENCY PLANNING

J1.0 GENERAL

The most significant materials which will be either disposed of or stored temporarily in the evaporation ponds are:

- tricalcium phosphate;
- calcium sulphate;
- sodium sulphate;
- sodium chloride; and
- water.

Tricalcium phosphate ($Ca_3 [PO_4]_2$) is an insoluble by-product from the processing of monazite to produce rare earth nitrate.

It is proposed to store the tricalcium phosphate in the evaporation ponds prior to recovery for sales to the fertiliser industry. There has been some public concern as to the storage of this insoluble by-product in the evaporation ponds due to the potential for leakage from the ponds resulting in the addition of phosphorous to the Peel-Harvey system.

The evaporation ponds that will be used for the disposal of these materials from the plant currently occupy an area of about 8ha. An additional 5ha pond is required for the combined effluents from both the Gallium and Rare Earth Plants. The ponds extend (at the deepest point) to an elevation of about -44.5m AHD. The ponds are underlain by an extensive underdrain system (comprising of 500mm sand over a minimum of 500mm compacted *in situ* clay to 98% Standard Maximum Dry Density with a permeability of 5×10^{-9}m/sec) and are sealed with a 1,000mm thick compacted clay liner.

The ponds have been designed to ensure that there is minimal leachate from the ponds and any material seeping through the clay liner will be intercepted and returned to storage. The evaporation pond system has effectively been subject to a full-scale operational trial utilising Gallium Plant effluents.

The results of groundwater monitoring before, during and after this "trial" have shown that the evaporation ponds have had little or no effect on the shallow groundwater resources of the plant site area.

Upon decommissioning, all liquids will be evaporated off and the ponds will be backfilled and covered with a contoured and compacted clay cap which will divert runoff away from the pond area.

In order to assess the "worst case" scenarios of potential leakage from the ponds two phases of the project will be considered. Firstly, the potential leakage from the ponds during operations and secondly, after decommissioning.

Public concerns of potential leakage from the ponds during the operation phase relate to the following factors:

- flooding due to overtopping;
- flooding due to erosion;
- seismic risk;
- breach of the pond wall; and
- bushfires.

In addition to the above factors there was some public concern of a phosphate source remaining in the Peel-Harvey system upon decommissioning. The tricalcium phosphate by-product will be recovered from the ponds and sold to the fertiliser industry. However, in the unlikely event that the by-product remains in the ponds the "worst case" scenario will be considered.

J1.1 FACTORS RELATING TO POTENTIAL LEAKAGE FROM THE PONDS

J1.1.1 Flooding - Overtopping

The first pond (B-1) in the evaporation pond system will operate at a constant adjustable level and will overflow into the second pond (B-2), hence overtopping of the first pond cannot occur. The second pond will be operated with a minimum freeboard of approximately 1.5 metres.

The storm ponds are designed to accommodate 100mm of rainfall from the plant site area. The operating philosophy of the storm ponds is to direct clean rainwater to the adjacent creeks and contaminated water to the evaporation ponds. Allowing for no diversion and up to 100mm of rainfall, this would increase the depth of the second evaporation pond by an additional 130mm. Combining the effects of heavy rainfall on the plant site and the pond system, together with the maximum operating level intended in the ponds, still leaves approximately 1.3 metres of freeboard.

J1.1.2 Flooding - Erosion

The potential for flooding of the land around the evaporation pond has been assessed based on a 1 in 100 years storm of 30 minutes duration having a rainfall intensity of 60mm/hr. An analysis of this flood was completed using the accepted hydraulic drainage design methods of Manning's formula and the Rational method as detailed in the Australian Rainfall and Runoff (1987), produced by the Institution of Engineers, Australia.

Water flow resulting from the above storm would only fill the two creeks running past the plant and ponds to the north and south.

In the north creek, the water surface level would be 0.5m below the creek banks and the corresponding ground level at the evaporation ponds. A similar situation exists with the south creek.

In summary, under a 1 in 100 year storm, the level of the surface water in the vicinity of the plant and evaporation ponds will be below the level of the natural surface at these facilities, and thus there is no possibility that the facilities will be flooded.

J1.1.3 Seismic Risk

Records from the Australian Geological Survey Organisation (formally the Bureau of Mineral Resources) indicate that only nine earth tremors above II on the Modified Mercalli Scale (MMII) have occurred at the Pinjarra site since 1941. MMII is classified as the level at which tremors may be felt by a few persons at rest indoors, especially on upper floors (Standards Association of Australia, 1979). The highest intensity was in 1968 (the Meckering earthquake) where an intensity of MMV was experienced in Pinjarra.

The peak ground intensity contour map (Gaull, B.A. *et al.*, 1990) indicates that Pinjarra has a risk of an intensity MMVI to MMVII for a 1:500 year return event. From the definition of Modified Mercalli intensities, it is not until tremors reach an intensity of MMIX that dam structure may be seriously damaged (Standards Association of Australia, 1979).

J1.1.4 Breach of Pond Wall

While data presented above indicate the very low probability of the evaporation pond walls being breached due to flood or earthquake events, there remains a finite possibility of a breach occurring.

In the event, the following is likely to occur.

- The free water covering the wastes, and the semi-liquid wastes themselves will flow out of the breach, and into either one (or both) of the two ephemeral watercourses that traverse the Proponent's property in an east to west direction.

- As a result of the low gradients of these watercourses, particularly towards the western end of the property, and between the property and the Murray River, the solids will largely settle out, and most if not all of the fluid would be expected to infiltrate into the sandy soils. In a worst case, if a breach occurred when streams were flowing and the natural water table approximated the ground surface, water containing calcium phosphate could conceivably reach the Murray River. In these circumstances, considerable dilution would be expected. The volume of water that would be expected to escape as a result of the breaching of a pond wall may be estimated from the area of typical pond and the minimum depth of water overlying the waste (225m x 25m x 0.5m $\simeq$ 25,000m^3).

While the probability of such a breach occurring is extremely low, the assumed worst case conditions that would maximise the potential for the waste to reach the Murray River are wet, winter conditions, and high natural flow rates (and hence a high rate of dilution) would be anticipated for the river. Conversely, when flow rates in the Murray River are at a minimum (in dry, summer conditions) the potential for any spilled waste to reach the river will be minimised. The solid or semi-solid waste that would be deposited downslope from the evaporation pond would be cleaned-up and re-deposited into a secure storage on the Proponent's property.

J1.1.5 Bushfires

The effects of a bushfire on the rehabilitated surface of an evaporation pond are apparently of some concern in the event that, as is normal practice in firefighting, earth moving equipment is utilised to clear fire breaks. It is highly unlikely that the inert cover to the pond will be penetrated, as a minimum cover thickness of one metre is currently envisaged.

J1.2 "WORST CASE" PHOSPHOROUS LOADING TO THE ENVIRONMENT

In order to address the 'worst case' scenario of phosphorus loading to the environment caused by the ponds, it has been assumed that all of the tricalcium phosphate remains in the ponds and the underdrain system is not in operation after decommissioning. These assumptions form the basis of the discussion and calculations shown below.

Two scenarios of potential phosphorous mobilisation from the decommissioned ponds have been considered:

- infiltrating rainfall; and
- saturation of waste in the ponds caused by a rise in water table.

J1.2.1 Mobilisation of Phosphorus by Infiltrating Rainfall

In order to calculate the potential leaching of phosphorus from the pond area after decommissioning, an estimate of the percentage of rainfall which reaches the water table (recharge) is required.

This recharge has been estimated for the sandier sections of the Swan Coastal Plain. In the Mirrabooka wellfield it is estimated to be 8.3% (Bestow, 1971). For the western half of the Gnangara Mound, it has been estimated as 8.5% (Allen, 1976). For the entire Gnangara Mound, Allen (1981) has estimated recharge as 11.5% and for the Jandakot Mound, Davidson (1984) has calculated it to be 12.3%. The generally accepted range for the Swan Coastal Plain is 5-15%.

Closer to the Pinjarra area, Deeney has calculated that the recharge through sections of Guildford Clay near Waroona is approximately 1.8% of annual rainfall.

The percentage of rainfall entering a compacted clay cap contoured to promote surface runoff and covered with grass vegetation must be very small and can only be estimated. Based on the results from Waroona and considering the compacted nature of the clay cap, estimated recharge through the ponds is probably less than 0.2%, and 0.1% is considered to be a realistic estimate when transpiration losses are taken into account. Table F1 below outlines estimated flows through the pond area using differing recharge rates and assuming an annual rainfall of about 900mm.

TABLE J1

ESTIMATED FLOW THROUGH POND AREA

% Rainfall	Infiltration (m)	Pond Area ($10^4 m^2$)	Annual Recharge	
			(m^3/year)	(m^3/day)
0.05	0.0005	30	135	0.37
0.1	0.0009	30	270	0.74
0.2	0.0018	30	540	1.48

Although 0.1% of rainfall infiltrating the clay cap is considered reasonable, other values of 0.2% (2 times estimated actual) and 0.05% (one half of estimated actual) are also considered. This indicates that 135-540m^3/year or 0.37-1.48m^3/day may pass through the buried tricalcium phosphate.

To translate this amount of vertical water throughflow to nutrient loading the solubility of the nutrient sources in water can be used. This, once again, may be an overestimate of potential nutrient loading because the nutrient source will generally be in the unsaturated zone.

The form of phosphorus in the decommissioned ponds is tribasic calcium phosphate, (Ca_3 $[PO_4]_2$) and dibasic phosphate ($CaHPO_4.2H_2O$). If the higher solubility of dibasic phosphate (0.02 grams per 100 grams of water) is used, the 135-540m^3 of water could contain about 27-108kg/year (135-540m^3 x 1,000L/m^3 x 0.2g/L) of salt. This is equivalent to a phosphorus load to the environment of about 5-20kg/yr. In terms of potential environmental impact, it is widely recognised (Kinhill, 1988) that phosphorus is the critical nutrient in the Peel-Harvey system. The Western Australian Government's management strategy aimed at lowering the phosphorus input to the Peel Inlet and Harvey Estuary to 85 tonnes/year. The worst case quantity of phosphorus from the ponds, 20kg/yr, amounts to 0.024% of the goal input, so it is considered insignificant when dilution and attenuation effects are taken into account.

J1.2.2 Mobilisation of Phosphorus by Rising Water Table

The lowest design elevation of the ponds is approximately 44.5m AHD (for the western edge of B2). One of the criteria of overall pond design will be to minimise the depth the ponds and underdrain system extend below the highest recorded groundwater level in the shallow piezometers. Within practical and engineering limitations, this indicates that the lowest design elevation of the ponds will generally be in the range 44-46m AHD. During the period of groundwater level monitoring (July 1987 to April 1995) the following groundwater elevation ranges were measured.

TABLE J2

RANGE OF GROUNDWATER LEVELS

Monitoring Bore Site	Portion of Ponds	Groundwater Level (m AHD)
6	Northwest corner	36 - 42
7	West central side	35 - 42
8	Southwest corner	35 - 42
9	North central side	(Not functional)
10	South central side	39 - 45

The highest groundwater levels were generally recorded in August/September and occurred over a 1-2 month period.

From the groundwater level data it appears that small areas of the eastern portion of Pond B2 could be in the saturated zone for a one to two month period each year due to a seasonal rise of the water table. This time period has been minimised by pond design within the constraints of the existing topography of the site. Calculations have shown that with a 500mm compacted clay liner below the underdrain, groundwater takes about 100 days to move through the clay. The head differential which could cause this movement will be removed within 30-60 days by a declining water table. The resulting seepage into the buried phosphorus source would be nil because in actual fact the groundwater has to move through 1.5m of compacted clay before entering the residue.

In considering the worst case scenario, however, it has been assumed that the water table rises 0.5m into the residue in Pond B2 every 10 years. This worst case scenario may never be realised if the performance of Pond B2 can be demonstrated to be satisfactory.

Assuming the following parameters:

- clay specific yield (1%);
- area of Pond B2 possibly affected (4ha); and
- maximum rise of water table into residue (0.5m).

If the total thickness of 1.5m of low permeability clay liner is disregarded, then a 0.5m water table rise into the residue represents (0.5m rise x 4 x $10^4 m^2$ x 0.01) = $200m^3$ of water which can mobilise phosphorus. Utilising the data given in Section G1.2.1, it may be calculated that, in the worst case, this volume of water can contain about 7kg of P. These values are equivalent to an annual loading of 0.7kg P/year.

This value therefore represents a possible maximum phosphorus load caused by a rising water table into Pond B2 but are considered unrealistic as the low permeability of the compacted clay liners has been ignored and the underdrain system is assumed inoperative.

J1.3 DISCUSSION

The above worst case analyses have shown that the decommissioned evaporation ponds may contain a source of phosphorus of which a small percentage may become mobilised by both infiltrating rainfall and a rising water table. However, it is unlikely that any significant phosphorus source will remain on-site in the evaporation ponds and therefore any potential mobilisation is insignificant.

In all contingency cases, the potential addition of phosphorus to the groundwater system is not considered significant within the context of the Peel-Harvey Estuary system.

This potential loading can only be properly assessed by monitoring evaporation pond performance in the early years of the project and extrapolating these results to assess future phosphorus movement out of the decommissioned ponds.

Under present engineering design, ponds B1 and B2 are considered models for monitoring infiltration and underdrain performance in both the unsaturated zone and upper phreatic surface. The results of these performances, assessed by monitoring during the early years of plant life, can be used as a guide for future pond design.

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