Proposed rare earths mining and beneficiation at Mt Weld, Laverton and secondary processing at Meenaar, near Northam

Ashton Rare Earths Ltd

Report and recommendations
of the Environmental Protection Authority

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THE PURPOSE OF THIS REPORT

This report contains the Environmental Protection Authority's environmental assessment and recommendations to the Minister for the Environment on the environmental acceptability of the proposal.

Immediately following the release of the report there is a 14-day period when anyone may appeal to the Minister against the Environmental Protection Authority's recommendations.

After the appeal period, and determination of any appeals, the Minister consults with the other relevant ministers and agencies and then issues his decision about whether the proposal may or may not proceed. The Minister also announces the legally binding environmental conditions which might apply to any approval.

APPEALS

If you disagree with any of the assessment report recommendations you may appeal in writing to the Minister for the Environment outlining the environmental reasons for your concern and enclosing the appeal fee of $10.

It is important that you clearly indicate the part of the report you disagree with and the reasons for your concern so that the grounds of your appeal can be properly considered by the Minister for the Environment.

ADDRESS

Hon Minister for the Environment
18th Floor, Allendale Square
77 St George's Terrace
PERTH WA 6000

CLOSING DATE

Your appeal (with the $10 fee) must reach the Minister's office no later than 5.00 pm on 11 September, 1992.

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Ashton Rare Earths Ltd (Ashton) proposes to mine and beneficiate a rare earths deposit at Mt Weld, 35 km south-east of Laverton, and to process the beneficiated material to produce various rare earth oxides, concentrates and compounds at Meenaar, 20 km east of Northam.

The proposal

The proposal would involve the following:

- mining the rare earths deposit at Mt Weld, located 35 km south-east of Laverton;
- beneficiation of ores at Mt Weld to form an ore concentrate;
- transport of the ore concentrate 880 km by road to a secondary processing plant in the proposed Meenaar Industrial Park, located 20 km 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.

Site selection for secondary processing plant

A sites evaluation study was undertaken by Ashton to identify the most suitable site for the establishment of the secondary processing plant on the basis of selected economic, environmental and social criteria. The proposed Meenaar Industrial Park was the site preferred by Ashton.

The EPA considers that Ashton's site selection process was extremely thorough.

Public consultation

An intensive consultation programme has been undertaken with both the State Government and the public. A public meeting was held at Grass Valley (about 2 km west of Meenaar), and a public open day held in Northam. Ashton also made regular presentations to local authorities and interested groups and individuals. No major issues of concern were raised during the public consultation. In addition, a public meeting and two meetings with the Shire Council were held at Laverton, and an opportunity to comment on the transport aspects of the project was provided to all local authorities between Mt Weld and Meenaar.

The EPA received 27 private submissions and 14 submissions from Commonwealth, State and local government authorities.

Environmental impacts and management at Mt Weld

Groundwater protection at Mt Weld

The EPA considers that the low salinity groundwater resource within the confined aquifer of the carbonatite pipe at Mt Weld is an important water resource in the region, and should be conserved and protected from pollution where possible for future users.

To ensure the impact of its project is minimised, Ashton is committed to water management and groundwater monitoring plans, incorporating methods to protect the quality of the groundwater

resources and water conservation measures. Ashton has designed the layout and construction of facilities to minimise the impact of the project on the quality of the groundwater at Mt Weld. Residue ponds for the waste from Meenaar would be located off the carbonatite pipe and therefore the potential for saline leachates to impact on the higher quality groundwater would be very low.

The EPA considers that, although Ashton's proposal could have a significant impact on the high quality groundwater resource at Mt Weld, the proposed dewatering and disposal practices can be managed to minimise this impact, and impacts on the surrounding environment. The EPA considers that, prior to dewatering of the groundwater for the rare earths project, Ashton should prepare a plan for the monitoring and management of the groundwater resource at Mt Weld, as part of the Environmental Management Programme, and in consultation with the Water Authority of Western Australia and the Department of Minerals and Energy. The plan should meet the requirements of the EPA (see Recommendation 2).

Native vegetation impacts

The EPA considers that projects should be designed to minimise the amount of clearing of native vegetation. The main impact on native vegetation from Ashton's proposal would be during the construction phase of the Mt Weld mine and facilities, when approximately 60 ha of existing vegetation (mainly mulga woodland) in the works area would be removed.

The native plant communities in the Mt Weld area have already been disturbed by goats, rabbits, sheep and some exploration activities. Ashton is committed to participating in an appropriate programme to control feral animals, in consultation with the Agricultural Protection Board and pastoral owners, prior to the commencement of rehabilitation measures.

Ashton is committed, where practicable, to use vegetation and topsoil cleared during Mt Weld site preparations to rehabilitate disturbed areas. Ashton has designed the proposed facilities and infrastructure to minimise further clearing at Mt Weld.

The EPA considers that Ashton's proposed construction and operating activities would have minimal and manageable impacts on the extent of native vegetation and floral species diversity at Mt Weld. The EPA considers that, prior to further clearing for the rare earths project, Ashton should prepare a plan for the monitoring and management of clearing of native vegetation at Mt Weld, as part of the Environmental Management Programme, in consultation with the Department of Minerals and Energy. The plan should meet the requirements of the EPA (see Recommendation 2).

Residue and wastewater management

The EPA considers that solid residues and liquid wastes generated by proponents should be managed to protect the receiving environment. Solid residues from the beneficiation plant and the Meenaar secondary processing plant would contain low levels of radiation and high concentrations of soluble salts.

The EPA considers that main potential environmental impact associated with the disposal of residues from the beneficiation plant would be the risk of contamination of the groundwater at Mt Weld. About 40,000 t/a of fine residue, contained in 500 ML/a of wastewater, would be generated from the beneficiation plant.

Ashton has provided a conceptual design for the beneficiation residue ponds in the PER, and given an undertaking that the final design and construction would comply with the guidelines issued by the Department of Minerals and Energy. If detailed investigations fail to confirm low soil permeability, then Ashton would install a clay liner. Ashton considers that salinity levels of the residue would be within measured salinities of the unconfined aquifer (5,000–8,000 ppm) and thus unlikely to have detectable impacts on the groundwater. The solid components in the residue are considered unreactive and insoluble, and are therefore unlikely to contribute to any potential pollution of the groundwater.

The EPA considers that the proposed disposal of beneficiation residues and wastewater is unlikely to significantly impact on the quality of groundwater in the confined and unconfined aquifers at Mt Weld.

Various options for the disposal of residues produced from the secondary processing plant at at Meenaar were considered by Ashton. These included disposal by burial at Mt Weld, on-site disposal at Meenaar, disposal in existing residue storage areas or disused mines, and disposal at the integrated waste disposal facility at Mt Walton, north-east of Koolyanobbing. Disposal at Mt Weld was considered by Ashton to be the most environmentally responsible and the preferred option.

The Health Department of Western Australia considers that Ashton's preferred option of returning solid residues from the secondary processing plant at Meenaar to be acceptable. The Department of Minerals and Energy supports the proposed disposal of the low activity residue at Mt Weld.

Ashton proposes to return 28,500 tonnes of wet residue from the secondary processing plant at Meenaar to Mt Weld each year, and deposit this material in a series of linked ponds. The ponds would be located off the carbonatite pipe, but within Ashton's mining lease. The EPA considers that main potential environmental impact associated with this solid waste would be the risk of contamination of the groundwater in the confined aquifer at Mt Weld from salts and radionuclides contained in the residue.

Ashton is committed to the preparation of a management plan for the disposal at Mt Weld of residues from the Meenaar secondary processing plant, prior to the commissioning of the project .

The EPA considers, on the basis of information from Ashton regarding the likely composition of the Meenaar residue, and on the condition that these residue ponds are not located over the carbonatite pipe and are adequately lined to reduce seepage, that disposal of secondary processing residues at Mt Weld would not significantly impact on the quality of groundwater in the confined aquifer. The EPA considers that Ashton should monitor the possible movement of radionuclides as part of a radiation management plan (see Recommendation 2).

The EPA considers that Ashton's proposed residue disposal and wastewater management at Mt Weld would have minimal and manageable impacts on the receiving environment at Mt Weld. The EPA considers that, prior to further clearing for the rare earths project, Ashton should prepare a plan for residue disposal and wastewater management at Mt Weld, as part of the Environmental Management Programme, and in consultation with the Water Authority of Western Australia, the Health Department of Western Australia, and the Department of Minerals and Energy of Western Australia. The plan should meet the requirements of the EPA (see Recommendation 2).

Rehabilitation and decommissioning

Ashton's primary objectives of rehabilitation would be to stabilise the surface of all exposed surfaces and to re-establish self-sustaining vegetation native to the area. It is envisaged that Mt Weld will return to grazing land and that other mining may be carried out in the carbonatite pipe. Ashton is committed to progressive rehabilitation at Mt Weld in accordance with EPA and Department of Minerals and Energy's guidelines.

The EPA considers that Ashton should undertake further research in the early stages of the project's life, such as re-vegetation trials and overburden characterisation, to ensure successful rehabilitation of the area.

Ashton proposes, prior to the commencement of operational mining and commissioning of the beneficiation plant, to provide a detailed decommissioning plan to the Department of Minerals and Energy and the EPA for approval. The decommissioning strategy would comply with the guidelines of the Commonwealth of Australia's Code of Practice on the Management of Radioactive Wastes from the Mining and Milling of Radioactive Ores 1982.

The EPA considers that Ashton's proposal for rehabilitation and decommissioning of the mine pit, plant facilities, associated infrastructure, residue and overburden storage areas, and other disturbed area at Mt Weld is acceptable in principle. The EPA considers that, prior to further clearing for the rare earths project, Ashton should prepare a plan for the details of rehabilitation and decommissioning at Mt Weld, as part of the Environmental Management Programme, in consultation with the Department of Minerals and Energy. The plan should meet the requirements of the EPA (see Recommendation 2).

Noise, dust, atmospheric emissions and visual impacts

Due to the remoteness of the site, the number of people around the site who are likely to be impacted by the operation is quite small. For most of the time this would be restricted to employees who would live and work on the site, and those people associated with the Mt Weld pastoral lease and residence.

Construction activities at Mt Weld would be carried out in accordance with statutory requirements relating to noise, and would incorporate appropriate management techniques to ensure that occupational and ambient noise levels were within acceptable limits set by the Department of Occupational Health, Safety and Welfare and the EPA .

Noise emissions from the mine and beneficiation plant operations would be low. Most noise would originate from the use of heavy earthmoving machinery, the crushing processors and the diesel generator. Ashton is committed to implementing dust suppression measures, including application of water from tankers at Mt Weld to minimise dust generation during site preparation and construction activities .

The project area is subject to local dust storms due to the degraded condition of the mulga woodlands. Ongoing rehabilitation of exposed soil surfaces would reduce ambient dust levels. Beneficiation is a wet process, and therefore the potential for dust generation would be low. Gaseous atmospheric emissions would be limited to exhaust gases from the mobile machinery and the diesel generator.

Overburden dumps would be up to 10 metres high and would be visible from outside the lease area. Due to the distance of the Mt Weld mine site from populated areas and the presence of similar features in the region, the visual impact on the local landscape of these dumps would be minimal.

The mine site and beneficiation plant at Mt Weld will be prescribed premises under Part V of the Environmental Protection Act and accordingly Ashton will be required to obtain a Works Approval prior to construction and a Licence prior to operation of the premises. Industry performance standards relating to air and water pollution will be set by the EPA. The EPA considers that noise, dust, atmospheric emissions and visual impacts resulting from Ashton's proposed construction and operating activities would have minimal and manageable impacts on the environment at Mt Weld.

Impacts on local community

Most of the construction work force for the proposal would be recruited from outside the region and be accommodated in on-site or other mining construction camps nearby. The EPA has been advised that there would be little impact, positive or negative, on the local communities from the construction phase of the project.

The EPA has been advised that there is sufficient community infrastructure, accommodation and local services to support the introduction of up to 30 families to the town. There would be significant benefits to the local economy and social well being of Laverton with new families moving into the town. The location of the work force in Laverton is supported by the Shire of Laverton.

Environmental impacts and management at Meenaar

Waste management and protection of water resources

Ashton has described the occurrence of groundwater at the site of the secondary processing plant at Meenaar as minor and localised aquifers in soils with low permeabilities, and with high levels of salinity, nitrate and sulphate. The Water Authority of Western Australia has confirmed that the groundwater resources in the Meenaar region are generally saline, and there are no major users of groundwater in the area.

The main components of the wastewater would be soluble salts of sodium, calcium and ammonia (and nitrates at Stage II); trace quantities of radionuclides would be present, the levels of which are expected to be similar to those in Perth drinking water. Organic solvents used in rare earths processing would be recovered and reused as far as possible.

The proponent is committed to a total containment policy for waste water and surface runoff from the plant area. Stormwater would be directed (via a system of open channels) to a centralised drainage sump separate from the evaporation ponds. A number of measures would be implemented to ensure that the effect of seismic events on the ponds would be minimised and that seismic generated waves do not overlap the sides of the embankments. The design and construction of the ponds would be supervised by a competent geotechnical engineer.

Ashton is committed to implementing a groundwater monitoring programme. The results of this monitoring would be reported at least annually to the Water Authority and the EPA. Regular monitoring of wastewater components, including radionuclides, entering the Meenaar evaporation ponds would be developed under the Environmental Management Programme. Due to the low permeabilities of the soils, any potential leachates would be detected through the network of monitoring bores and would be returned to the evaporation ponds through recovery bores.

Ashton has given a commitment to specifically address the issue of decommissioning and rehabilitation of the evaporation ponds. The EPA considers that implementation of Ashton's rehabilitation and decommissioning by Ashton would be consistent with a "walk-away" outcome for to the evaporation ponds.

Solid residues produced during secondary processing operations would be returned to Mt Weld for disposal. Some components of the solid waste from the processing would contain a high level of phosphates, largely as low solubility calcium phosphate. Ashton considers that reuse of these components as commercial fertiliser may be possible if there was a sustained demand for the material, and there was a reliable, economic method of ensuring that the level of radionuclides in these streams were within acceptable levels. Ashton has given a commitment to continue to investigate the feasibility of selling the calcium phosphate material or otherwise making it available to others.

The EPA considers that the impacts of the secondary processing plant on ground and surface waters would be minimal and the proposed solid and liquid waste disposal and management procedures would be acceptable. Prior to the commencement of construction of the the secondary processing plant, Ashton should prepare a plan for the monitoring and management of ground and surface waters in the immediate vicinity of the plant site, and to address solid and liquid waste disposal, as part of the Environmental Management Programme, in consultation with the Water Authority of Western Australia and the Health Department. The plan should meet the requirements of the EPA (see Recommendation 2).

Noise

Construction activities at Meenaar would result in periodic and short-term increases in existing background noise levels. Ashton has given a commitment that construction and operational activities at the secondary processing plant would be carried out in accordance with statutory requirements relating to noise, and would incorporate appropriate management techniques to

ensure that occupational and ambient noise levels were within acceptable limits set by the EPA and the Department of Occupational Health, Safety and Welfare.

Ashton expects that ambient noise levels would not exceed the limits likely to be set by the EPA because of the imposition of noise specifications for all items of equipment, the adoption of a range of appropriate noise-suppression measures, and the existence of other background noise sources. Ashton will implement a noise monitoring programme.

The EPA considers that noise emissions from the secondary processing plant should conform with its standard requirements. Although it is likely that noise emissions from the secondary plant would comply with these limits at most residences for most of the time, the EPA considers that the noise limits may be exceeded by Ashton under certain meteorological conditions. To ensure compliance with EPA's noise limits, Ashton would be required to carry out noise modelling, prior to the issue of a Works Approval. Any necessary noise attenuation of equipment could then be carried out before operations start.

The EPA considers that, subject to Ashton abiding by its commitments and meeting the conditions specified by the EPA, noise emissions from from the construction and operation of the proposed secondary processing plant site are likely to have minimal impact on nearby residents, and would be acceptable.

Atmospheric emissions

The process of calcination, using LPG to burn off residual reagents and other organic matter, together with the use of heaters, would produce some atmospheric emissions. Emissions to be vented to the atmosphere include carbon dioxide, sulphur dioxide, oxides of nitrogen, water vapour and particulates. A total of 80 ML/a of water as steam would also be vented to the atmosphere from the boilers. Ashton are committed to establishing a programme upon commissioning to monitor emissions of sulphur dioxide.

The ambient air quality would be measured at the boundary of the plant premises. Although it is likely that atmospheric emissions from the secondary plant would comply with air quality standards set by the EPA most of the time, the EPA considers that these standards could be exceeded by Ashton under certain meteorological conditions, particularly at times when the plant is not operating normally. To ensure compliance with EPA's atmospheric emission standards, Ashton would be required to carry out out air pollution modelling, prior to the issue of a Works Approval. Further information on specifications for pollution control equipment would also be required at this stage.

Ashton are committed to implementing dust suppression measures, including application of water from tankers, at Meenaar to minimise dust generation during site preparation and construction activities. Dust control measures would be implemented to comply with Department of Minerals and Energy's regulations.

The EPA considers that atmospheric emissions from the secondary processing plant should be controlled under Works Approval and Licensing provisions of Part V of the Environmental Protection Act. Subject to Ashton abiding by its commitments and meeting the specified emission standards, the EPA considers that atmospheric emissions from the construction and operation of the proposed secondary processing plant site are likely to have minimal impact on nearby residents and land uses, and would be environmentally acceptable.

Visual impact

The secondary processing plant at Meenaar is likely to be partially visible from the nearest neighbour's residence, as only Great Eastern Highway and the established vegetated area separate the homestead and the site. The most prominent component of the plant would be the emissions stack, which would be about 28 metres above ground level. A glow-haze associated with the lights required for night-time operation would be visible to users of Great Eastern Highway and possibly some residents.

The EPA considers that Ashton's proposed secondary processing plant site would have minimal visual impact and would be acceptable, if landscaping and lighting control were carried out as described in the PER. The EPA recommends that, prior to the start of construction activities at Meenaar, Ashton should prepare a plan detailing visual impact and landscaping measures, as part of the Environmental Management Programme, in consultation with the Shire of Northam. The plan should meet the requirements of the EPA (see Recommendation 2).

Preliminary risk analysis

A preliminary risk analysis of the secondary processing plant has been undertaken on behalf of Ashton. The analysis provides a preliminary assessment of the hazards associated with the storage of 150 tonnes of liquified petroleum gas.

Ashton has made a number of commitments to plant safety and risk minimisation at Meenaar. The emergency management plan to be developed by Ashton will specify measures to be taken in the event of significant incidents involving hazardous chemicals or LPG stored on site.

A review of the preliminary risk assessment by the Explosives and Dangerous Goods Division of the Department of Minerals and Energy has indicated that the risk contours are within the limits of uncertainty. The review showed that the storage of 150 tonnes of LPG (and the 100 tonnes of anhydrous ammonia which are no longer required) at Meenaar would meet the risk criteria established in EPA's Bulletin 611, provided all requirements of the Dangerous Goods Regulations 1992 are met.

The EPA considers, on the basis of the preliminary risk assessment, the commitments by Ashton, and the advice of the Department of Minerals and Energy, that the individual risk levels developed for the secondary processing plant would be acceptable.

Seismicity

Ashton propose that a number of measures would be taken to ensure that the secondary processing plant could withstand credible seismic events. These would include the construction of critical structures, such as the barium precipitation building and chemical storage areas, upon heavy raft foundations. Additional bracing would also be provided. The secondary processing plant would be constructed to withstand earthquakes, according to the relevant Australian Standards. The LPG storage vessel would be designed and constructed such that it met the requirements of the earthquake codes.

Ashton indicate that the evaporation ponds would be designed to minimise the risk of damage resulting from seismic activity. The pond embankments would be designed with an impervious core and cut-off to prevent seepage of water through the soil. The height of the embankments would be designed to account for 'wave run-up' due to both wind waves and waves generated from seismic shaking.

Ashton will develop an emergency action plan prior to commissioning, to cover the unlikely event of damage to the evaporation ponds following seismic activity. Inspections of the evaporation ponds would be made on a weekly basis.

The Geological Survey of WA has reviewed Ashton's proposal and considers that suitable undertakings have been made by Ashton concerning the necessary investigation and design activities to complete the designs to construction stage.

Ashton's proposal to address potential seismic impacts as outlined in the PER is considered comprehensive and is environmentally acceptable. The EPA considers that, prior to the commissioning of the secondary processing plant, Ashton should prepare an emergency management plan, as part of the Environmental Management Programme, which should address risk issues associated with storage of dangerous goods and seismic contingency plans at the Meenaar site, in consultation with the Department of Minerals and Energy. The plan should meet the requirements of the EPA (see Recommendation 2).

Impacts on local community

Ashton propose that the operational work force would be recruited locally where possible. The EPA has been advised that Ashton's plans for local recruitment are a vital element of the community's support for the proposal.

Some of the operational work force, particularly skilled workers, are expected to move to the region. The region has ample capacity in community infrastructure, housing and land availability to support an increase in population.

Ashton has made a commitment to undertake a social monitoring programme in conjunction with the management programme proposed for the Meenaar Industrial Park.

Transport

Ashton propose to transport ore concentrate, residues and chemicals by road. Daily impacts of ore concentrate and residue transport between Meenaar and Mt Weld would be limited to approximately two trucks passing each way, representing less than 1% of the recorded traffic. Road transport of dangerous goods from the Metropolitan area to Meenaar would comply with the Dangerous Goods Regulations 1992. Ashton has given a commitment to address the monitoring and management of transport issues in the Environmental Management Programme, to be developed in consultation with, and to the satisfaction of, the EPA.

The EPA considers that Ashton's transport proposals are environmentally acceptable. Prior to the commissioning of the secondary processing plant, Ashton should detail their transport proposal in a transport management plan, as part of the Environmental Management Programme, in consultation with the Department of Minerals and Energy. The plan should meet the requirements of the EPA (see Recommendation 2).

Radiation impacts

Ashton would incorporate the ALARA principle (which requires that exposures to radiation be kept as low as reasonably achievable), for all components of the project. Ashton has committed to comply with all formal regulatory radiation protection requirements, and would meet the Commonwealth requirements for radiation control outlined in the Code of Practice on Radiation Protection in the Mining and Milling of Radioactive Ores 1987 and the Code of Practice on the Management of Radioactive Wastes from the Mining and Milling of Radioactive Ores 1982. Similarly, the Western Australian requirements for radiation control outlined in the Radiation Safety (General) Regulations 1983 would be met.

Prior to commissioning facilities at Mt Weld and Meenaar, Ashton is required to prepare and submit a Radiation Management Plan that would address the management and monitoring of occupational and environmental radiation issues to the satisfaction of the Department of Minerals and Energy and of the Radiological Council, with advice from the EPA.

Ore beneficiation and processing contain mainly wet stages. Ashton expect that air quality within these operations would be controlled such that the concentration of airborne ore and beneficiated ore would not exceed 0.1 mg/m^3.

Precipitation and filtration treatments of neutralised wastewater from the Meenaar plant are expected to remove effectively 100% of the thorium and 99.8% of the uranium as solids in the main residue for return to Mt Weld. The minimal amounts of radionuclides entering ponds with wastewater would not accumulate to higher concentrations, as approximately 7,000 t/a of solids would be deposited with them on evaporation.

Radium in the liquor stream passing to the rare earth solvent extraction process would be removed by precipitation. Should this process be shown to remove unacceptably high levels of rare earths, Ashton has indicated that a different, equally efficient method of radium removal would be undertaken. The radionuclides in solid waste resulting from neutralisation of

wastewater and precipitation of radium would be returned to Mt Weld in the general residue stream. The lead component (Pb-210) in the rare earth liquor would also be effectively removed by precipitation. This process would also occur in the impurity removal stage in the isolated section of the processing plant. The residue would then be blended into the major waste stream. As Pb-210 is part of the uranium chain that occurs at very low concentrations, amounts of lead residue would be small.

The deposition of radioactive waste from the project would be governed by the Code of Practice on the Management of Radioactive Wastes from the Mining and Milling of Radioactive Ores 1982. The two waste streams which may come into the scope of the Code would be the residue from the beneficiation plant at Mt Weld and the residue from the secondary processing plant at Meenaar.

The Australian Ionising Radiation Advisory Council and the Australian Radiation Laboratory have indicated in their submissions to the EPA that it is unlikely that the project would present a serious occupational or public radiation exposure problem.

The Health Department considers that, as the thorium/uranium content of the ore is only about 1/50 that of beach sands monazite, the radiological impact of the project would be minimal. The Health Department considers it important that there be on-going verification that the radionuclide content of the ore and concentrate remains low throughout the operation, to ensure that radiation exposure is not significantly greater than that predicted in the PER.

The Department of Minerals and Energy also indicated that radiation is not expected to be a significant hazard in the project, however some level of radiological surveillance would be required, and has indicated that the concentrate and residues would not be defined as radioactive substances for the purposes of transport. The Department of Minerals and Energy considers that the residues returned to Mt Weld would have less radioactivity than the original deposit. The Department concluded that the facility, including associated waste management systems, could be designed, constructed and operated in such a manner that radiological impacts to the community would be well below national and international limits, and that commitments by Ashton would be sufficient to ensure this would be the case.

The EPA considers that effective removal of radionuclides from the wastewater is a key component to the environmental acceptability of the plant. Ashton will be required to provide further details on the alternative radium removal process should this be necessary, prior to commissioning of the secondary processing plant. Efficient removal of radionuclides in the plant liquor stream will need to be demonstrated by Ashton before a Licence to operate the plant will be granted by EPA. Details of radiological significance will be submitted by Ashton to the Department of Minerals and Energy and the Radiological Council for assessment.

The EPA considers that the environmental impacts of radiation associated with the proposal are manageable and therefore acceptable. The EPA considers that, prior to the commissioning of the beneficiation and secondary processing plants, Ashton should prepare a radiation management plan, as part of the Environmental Management Programme, in consultation with the Department of Minerals and Energy and the Department of Health. The plan should meet the requirements of the EPA (see Recommendation 2).

The EPA has identified a number of environmental impacts associated with the proposal by Ashton. Based on its assessment of the proposal and additional information provided by the proponent in response to questions raised as a result of the assessment process, the EPA makes the following conclusions and recommendations:

Recommendation 1

The Environmental Protection Authority has concluded that the proposal by Ashton Rare Earths Ltd is acceptable and all impacts are manageable, either by the environmental management commitments given by the proponent, or by the Environmental Protection Authority's recommendations in this report.

In reaching this conclusion, the Environmental Protection Authority 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.**

Accordingly, the Environmental Protection Authority recommends that the proposal could proceed, subject to the proponent's commitments to environmental management (Appendix 1) and the Environmental Protection Authority's recommendations in this report.

The EPA believes that any approval for the proposal based on this assessment should be limited to five years. Accordingly, if the proposal has not been substantially commenced within five years of the date of this report, then such approval should lapse. After that time, further consideration of the proposal should occur only following a new referral to the EPA.

The EPA notes that during the detailed implementation of proposals, it is often necessary to make minor and non-substantial changes to the designs and specification which have been examined as part of the EPA's assessment. The EPA considers that subsequent statutory approvals for this proposal could make provision for such changes, where it can be shown that the changes are not likely to have a significant effect on the environment.

Recommendation 2

The Environmental Protection Authority recommends that the proponent should prepare and implement an Environmental Management Programme to meet the requirements of the Minister for the Environment, describing plans for, but not necessarily be limited to:

- **conservation of native flora and fauna at Mt Weld;**
- **rehabilitation of disturbed sites, overburden dumps and residue ponds at Mt Weld;**
- **contingency plans for major seismic events at Meenaar;**
- **radiation management;**
- **solid and liquid waste management at Mt Weld and at Meenaar;**
- **visual impacts and landscaping at Mt Weld and Meenaar; and**
- **periodic reporting of monitoring results and consequential changes to environmental management.**

The timing of the preparation and review of the implementation of these plans should meet the requirements of the Environmental Protection Authority.

The Environmental Protection Authority concludes that the emission and monitoring of noise, atmospheric contaminants, and solid and liquid waste disposal associated with the construction and operations of the beneficiation plant and mine site at Mt Weld and secondary processing plant at Meenaar, should be controlled through conditions imposed by Works Approvals and subsequently, Licences, under the Environmental Protection Act.

The EPA points out that the proponent's compliance with Environmental Conditions and the conditions of Works Approvals and Licences will be periodically audited. Pollution control limits and other conditions will be periodically reviewed and may be modified by the EPA in the light of operating experience.

1. Introduction

Ashton Rare Earths Ltd (Ashton) proposes to mine and beneficiate a rare earths deposit at Mt Weld, 35 km south-east of Laverton, and to process the beneficiated material to produce various rare earth oxides, concentrates and compounds at Meenaar, 20 km east of Northam.

The proposal was referred to the Environmental Protection Authority (EPA) in May, 1991 and the level of assessment was set at Public Environmental Review (PER). The site for the secondary processing plant was subject to an extensive period of analysis and consultation by Ashton before Meenaar was selected as the preferred site. Ashton consulted widely with government agencies and the public during the preparation of the PER, including a public meeting at Grass Valley and a public open day at Northam. The PER was released for an eight week review period on 4 May 1992, with submissions closing on 29 June 1992. Forty one submissions were received by the EPA.

The Authority has assessed the potential environmental impacts of the proposal, both as described in the Public Environmental Review and from Ashton's responses to issues raised during the public submission period.

Environmental issues, such 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, have been considered in the EPA's assessment. Many of these issues have been addressed by the proponent with a comprehensive set of commitments (Appendix 1).

2. The Proposal

2.1 Mining and beneficiation at Mt Weld

The proposed Mt Weld mine site would be located within mining leases M38/58 and M38/59, some 35 km south-east of Laverton. The conceptual layout of the proposed facilities at Mt Weld is presented in Figure 1. The beneficiation complex would include offices, a laboratory, a workshop, a reagent and consumables store, and a load-out facility for the final concentrate.

Following the removal of overburden to a depth of 20 to 30 metres, the rare earths deposit would be mined at a rate of 50,000 tonnes per annum (t/a) over a single 4 to 10 week campaign each year, using conventional open-cut mining methods. Pre-mine dewatering would require the pumping of 13,000–14,000 ML of water over a 12–18 month period. Most of this water would be stored in a disused pit at the nearby Granny Smith Gold Mine.

The beneficiation plant would operate for 300 days per annum and would produce 10,000 t/a (12,000 t/a wet weight) of concentrated ore. The proposed beneficiation process is a modified phosphate flotation process involving feed preparation of the ore followed by desliming, flotation and filtration. Chemicals to be used in the process would be sodium sulphide (300t/a), depressants and collector reagents (245t/a), sodium silicate (40t/a) and sodium carbonate (10t/a). The low level radioactive, non-hazardous concentrate would be stored as a paste (85% solids), then transported to the secondary processing plant at Meenaar.

Slurry residues would be produced at the desliming, filtration and flotation stages. The residues would be pumped to a residue pond where supernatant water would be reclaimed and recycled to the beneficiation plant. The residues would be discharged with a solids content of approximately 8%, at a rate of 70 m^3/h. Washdown water would be collected and combined with the beneficiation residues.

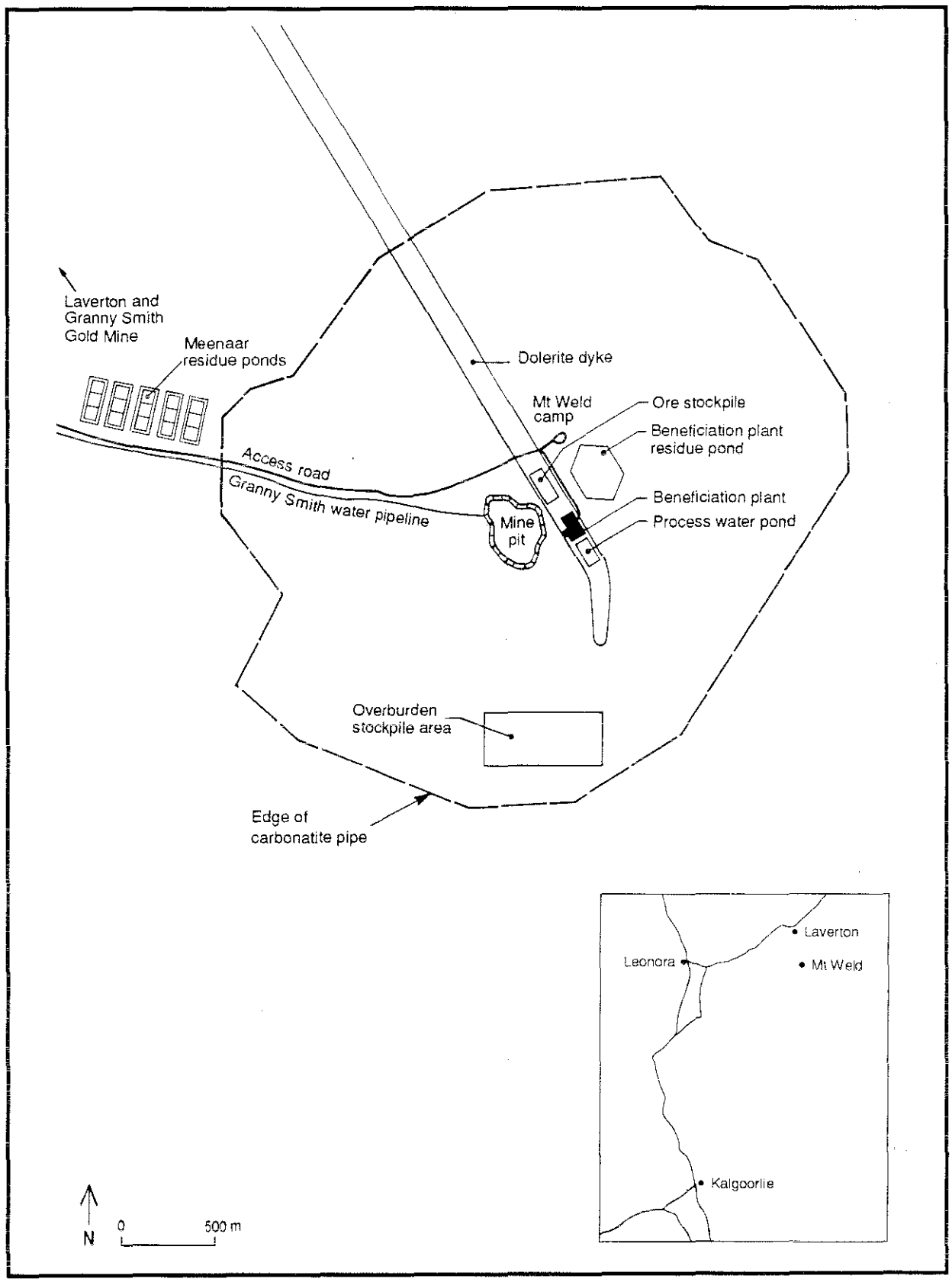

Figure 1: Location and conceptual layout of proposed facilities at Mt Weld (Source: Ashton's PER).

The major inputs for the ore beneficiation would be:

- 50,000–60,000 t/a of ore (containing about 5,000 t/a of water)
- 600 t/a of chemicals
- 500 ML/a of process water.

The major outputs would be:

- 10,000 t/a of rare earth concentrate (12,000 t/a wet weight)
- 500 ML/a of wastewater
- 40,000 t/a of beneficiation fine residues (contained in the wastewater).

2.2 Secondary processing of rare earths at Meenaar

The secondary processing plant would be located on the east side of the proposed Meenaar Industrial Park, which is located about 20km east of Northam (Figure 2 (a)). Construction of plant facilities, access and evaporation ponds would be on cleared, ex-agricultural land.

The secondary processing plant would operate on a 24-hour basis for 365 days each year (assuming no down-time). The processing of concentrate at the Meenaar secondary processing plant would involve a range of chemical processes, including acid, caustic and organic solvent dissolution stages, and precipitation and calcination stages. Conceptual layout of facilities for the proposed secondary processing plant is shown in Figure 3.

Downstream processing of the rare earths would involve three incremental stages. Stage I would produce cerium oxide plus light and medium rare earth concentrates, with the later stages producing light rare earth compounds (Stage II, 1996) and medium rare earth compounds (Stage III, 1998).

The description of the proposal in the PER is based on the maximum levels of inputs and outputs for the secondary processing plant (Stage III), which would be as follows:

Inputs:

- 10,000 t/a of rare earth ore concentrate (12,000 t/a wet weight) from Mt Weld;
- 52,620 t/a of process chemicals from Kwinana (refer to Table 2);
- 388 ML/a of process water from the Goldfields and Agricultural Water Supply Scheme pipeline;
- 400 TJ/a of energy from gas (equivalent to 8,000 t/a of liquefied petroleum gas) from Kwinana;
- 1 MW (with an annual draw of 8 million kWh) of electricity from an extension to the existing State Energy Commission of Western Australia grid.

Outputs:

- 5,000 t/a of rare earth products, to be sent to the Port of Fremantle for export;
- 305 ML/a of wastewater and about 20 ML of water from process chemicals, to be stored in on-site evaporation ponds;
- 20,000 t/a of rare earth and phosphate residues (28,500 t/a wet weight), to be returned to Mt Weld for disposal;
- 7,000 t/a of suspended and dissolved solids in wastewater, to be stored in on-site evaporation ponds;
- 80 ML/a of water as steam, to be vented to the atmosphere.

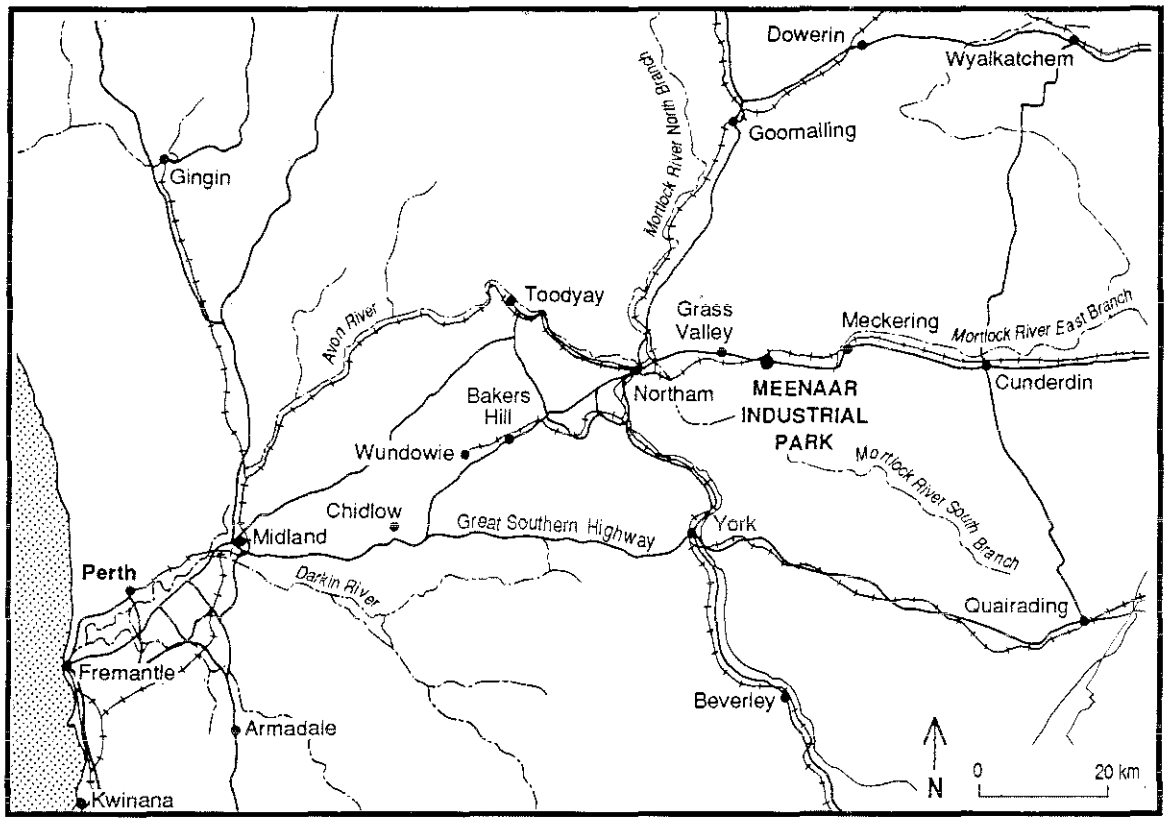

Figure 2 (a) Regional setting of proposed Meenaar Industrial Park (Source: Ashton's PER).

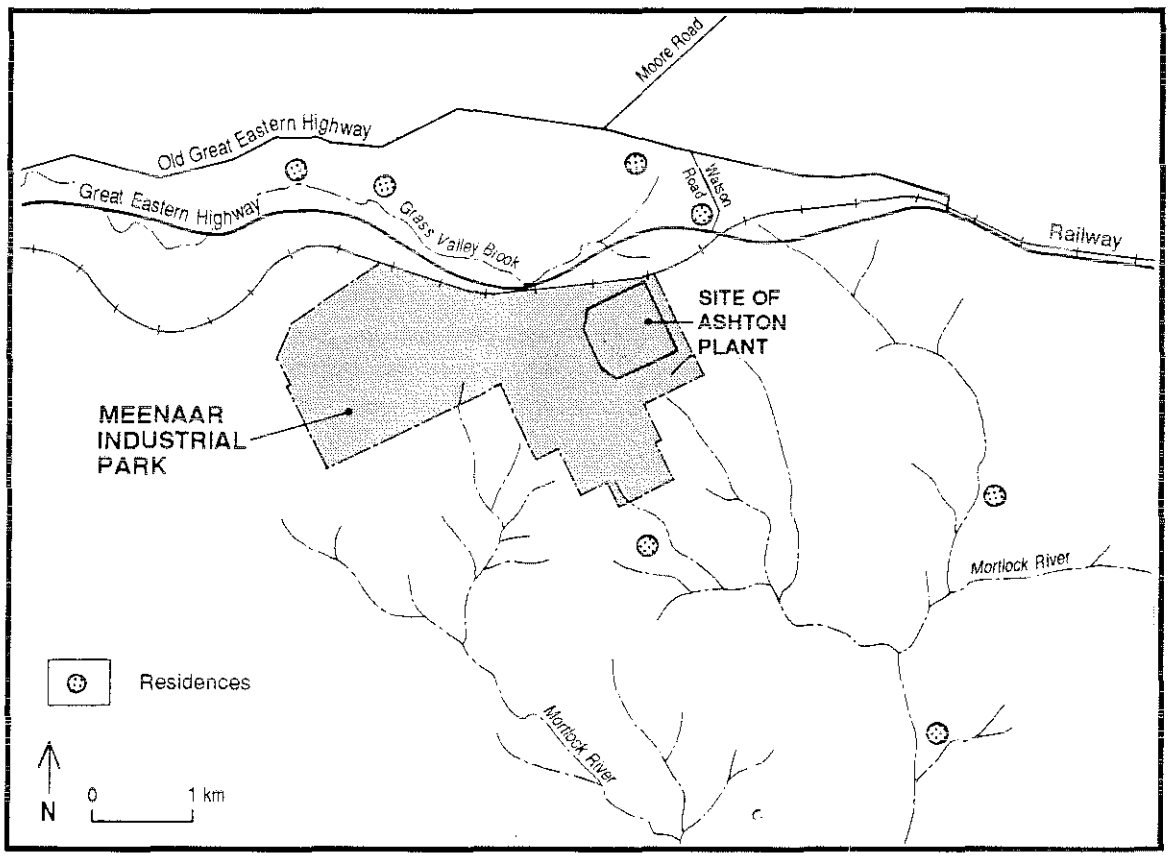

Figure 2 (b) Proximity of proposed secondary processing plant site to residences at Meenaar (Source: Ashton's PER).

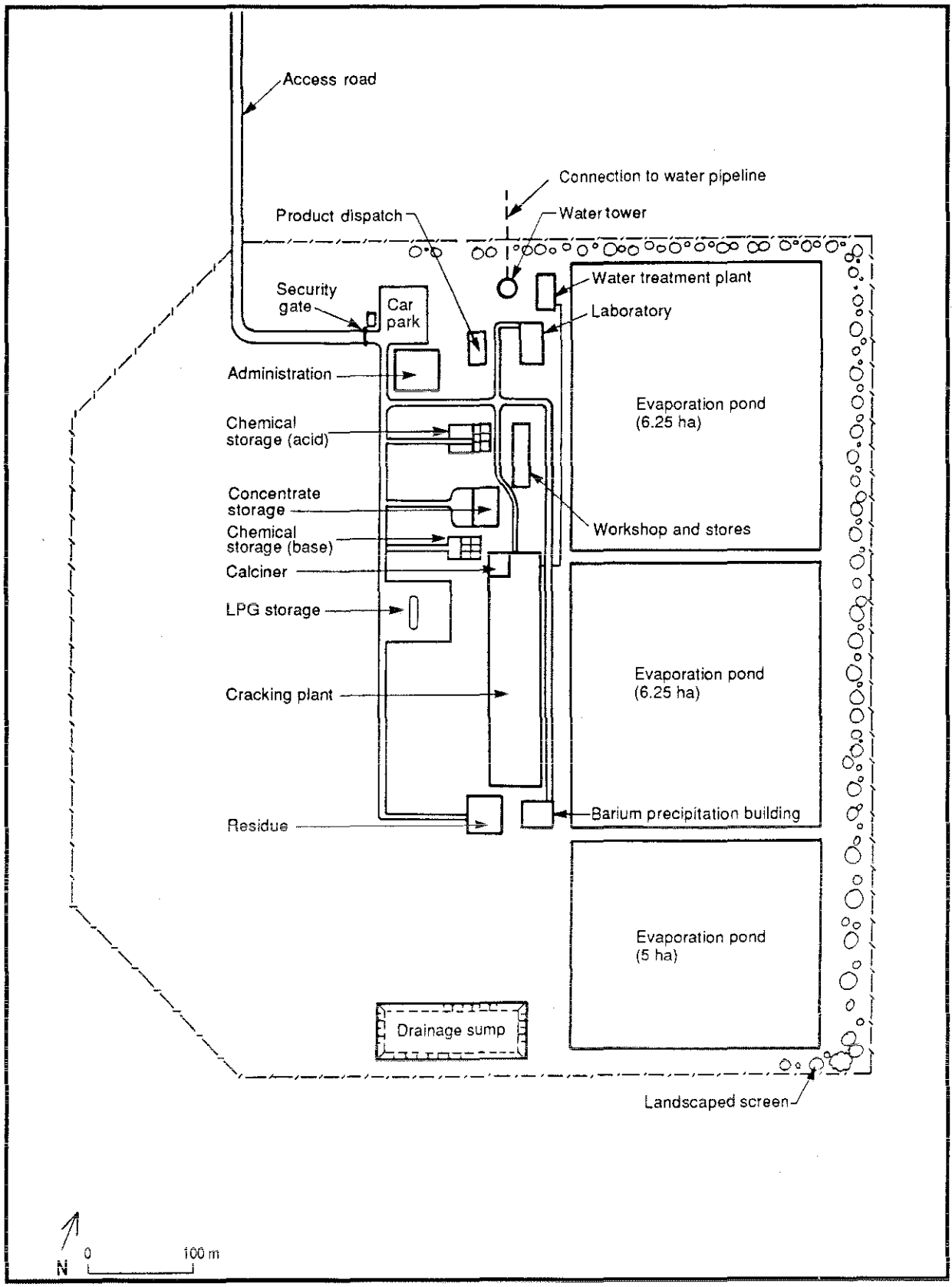

Figure 3: Conceptual layout of proposed secondary processing facilities at Meenaar (Source: Ashton's PER).

Neutralised wastewater from the plant would be directed to evaporation ponds which would be constructed with an impermeable, synthetic liner between clay–sand layers The main components of the wastewater would be sodium and chloride ions, ammonia, nitrates and calcium sulphate, and are predicted to have negligible levels of radioactivity.

Solid residues from the plant at Meenaar would be blended to a low level radioactive, non-hazardous form and returned to Mt Weld for disposal in a series of 5 m deep linked ponds. Upon decommissioning each pond, the residue would be covered with a 2.5 m layer of soil, rock and topsoil, and rehabilitated.

The rare earth products, which would be non-radioactive, would be packaged in various forms and transported by road to Fremantle for export.

The project would involve a capital investment of an estimated $75 million, and would provide direct employment opportunities for 200 people during construction and 75 people during operations at Mt Weld and Meenaar.

Table 1. Proposed process chemical requirements and storage at Meenaar#

Chemical	Annual requirements (t)			Storage
	Stage I	Stage II	Stage III	(Stage III)
Sodium hydroxide (65%)	5,100	5,100	5,100	470
Hydrochloric acid (35%)	10,000	10,000	10,000	1,500
Calcium oxide (80%)	5,100	7,000	9,000	2,000
Sulphuric acid (industrial)	12,000	12,000	12,000	1,200
Nitric acid (58%)	–	4,000	5,000	500
Ammonium bi-carbonate*	8,000*	10,000*	10,000*	240
Barium chloride	20	20	20	2
Others (solvents, kerosene, flocculants, etc.)	1,000	1,500	1,500	100
Total	41,220*	49,620*	52,620*	6,012**

Note: Percentages in brackets refer to concentrations.

* *If oxalic acid were used as a precipitating agent instead of ammonium bi-carbonate/carbonate, the total tonnage of chemicals would be 3,000 t/a less than that indicated.*

** *It oxalic acid were used as a precipitating agent instead of ammonium bi-carbonate/carbonate, the total tonnage to be stored would be about 220 t less than indicated (i.e. 5,792 t).*

from Ashton's PER

3. Site selection for secondary processing plant

As part of Ashton's feasibility study of the project, a detailed evaluation of alternative sites for the secondary processing plant was prepared and copies provided to government agencies, including the EPA, in August 1991. The sites evaluation study was undertaken with no established preference toward any particular location.

The aim of the study was to identify the most suitable site on which to establish the secondary processing plant on the basis of selected economic, environmental and social criteria. Semi-quantitative and qualitative assessments were made on fifteen locations, including Collie, East Rockingham, Esperance, Geraldton, Kalgoorlie, Karratha, Kemerton, Koolyanobbing, Kwinana, Moore River, Mt Weld, Muchea, Northam, Picton and Pinjarra.

A preliminary evaluation concluded that six of the sites—Collie, East Rockingham, Kalgoorlie, Kemerton, Geraldton and Northam—warranted further evaluation.

Northam was found to be the most economic location for the construction and operation of the secondary processing plant, as well as the site likely to have the least environmental or social impact. Various sites in the Northam region were reviewed by Ashton. Of these sites, the proposed Meenaar Industrial Park was selected on the basis that it complied with plans for regional industrial development proposed by the Department of State Development and the Industrial Lands Development Authority.

The EPA considers that Ashton's site selection process is the most thorough and objective it has seen for this type of facility.

4. Public consultation and submissions

Ashton has conducted an extensive consultation programme with both the relevant government agencies and the public. A public meeting was held at Grass Valley (about 2 km west of Meenaar) on 11 February 1992, which was attended by about 40 people. A public open day was held in Northam on 19 February 1992, which was attended by over 100 people, as well as Ashton management, and officers of the Department of State Development (joint proponents with the Industrial Land Development Authority for the Meenaar Industrial Park), the Social Impact Unit and the EPA. Ashton has made presentations to local authorities and interested groups and individuals. Ashton attended a public meeting and two meetings with the Laverton Shire Council, and provided to all local authorities between Mt Weld and Meenaar an opportunity to comment to Ashton on the transport aspects of the project.

Upon release of the PER in May, 1992, interested members of the public were provided either copies or summaries of the PER, and relevant government agencies, local libraries and nearest residents to the site were given a copy of the PER document. The EPA received 27 private submissions and 14 submissions from Commonwealth, State and local government authorities (Appendix 3).

Environmental issues raised in submissions regarding the proposed operations at Mt Weld relate to conservation and protection of the quality of the groundwater resource, residue and wastewater management, and rehabilitation of the residue ponds, mine pit and overburden dump. Concerns were raised about potential impacts of noise, dust and atmospheric emissions associated with the secondary processing plant on nearby residents and sensitive land uses at Meenaar. The integrity of the plant, dangerous goods storage and evaporation ponds in the event of a major seismic event were questioned in submissions. Concern was raised about the potential for downstream radiation, nutrient and salt effects on surface and groundwater resources. A large proportion of submissions related to the noise, safety, vibration and nuisance impacts of transporting beneficiated ore and residue between Mt Weld and Meenaar by road. The alternative of rail transport for this material, and for the transport of dangerous goods from Fremantle to Meenaar was consistently raised in submissions. There were a number of submissions on radiation issues by the public and State and Commonwealth agencies, including

the Mines Department of WA, the Health Department of WA, the Australian Ionising Radiation Advisory Council and the Australian Radiation Laboratory.

The proponent's public consultation programme has been sound and comprehensive. The EPA commends Ashton for its efforts in identifying the major issues of concern, communicating with affected parties the impacts of its proposal, and for making significant efforts to resolve these issues.

5. Existing environment

5.1 Mt Weld

The rare earths deposit at Mt Weld was formed as a result of weathering of a carbonatite pipe and residual concentration within a regolith. The topography of the mine site is flat. The area has no clear drainage lines; sheet-wash drainage occurs towards Lake Carey to the west-south-west.

Groundwater at Mt Weld occurs in two distict horizons. The upper unconfined aquifer occurs between 7 and 17 m below ground level and is high in salinity (5,000 to 8,000 mg/L total dissolved salts). The lower aquifer is confined within the carbonatite and contains about 50 Mt of water. The PER quotes the salinity range of the groundwater in the confined aquifer as 1,500–8,500 mg/L total dissolved solids, although recent information from Ashton indicates that the quality of water currently drawn from the aquifer is in the range 1600 to 3600 mg/L.

The flora and vegetation of Mt Weld are typical of the region and are dominated by a mulga woodland with some localized mallee and spinifex communities. No rare or geographically restricted plant species are known to occur. The area suffers from overgrazing, primarily by introduced species, but also by kangaroos. The only rare fauna likely to occur are four widely distributed bird species that are migrants or uncommon seasonal visitors.

The nearest population centre to Mt Weld is Laverton, which has a population of 1,500. The Shire of Laverton has a high proportion of its workforce employed in the mining industry.

Ethnographic surveys commissioned by the proponent determined, after consultation with Aboriginal people during the survey, that the proposed rare earths mine at Mt Weld would not affect any areas of Aboriginal cultural significance. Some surface archeological material was noted within the surrounding area.

5.2 Meenaar

The location of the secondary processing plant at Meenaar is within the proposed Meenaar Industrial Park. The site is zoned rural and the current land use is agricultural.

The proposed plant site contains no remnant vegetation, and most of the surrounding land has been cleared for agricultural purposes. Proponents for the Meenaar Industrial Park have nominated an 80 ha area of uncleared bushland to the south of Ashton's plant site to be retained and managed as part of an "internal" buffer zone for the estate. There are a number of nature reserves in the Meenaar region, covering 225 ha. The nearest reserve is Throssells Nature Reserve, about 2.5 km to the north.

The nearest population centre to Meenaar is Grass Valley (population 70–100), 2 km to the west (Figure 2(b)). The residence nearest to the plant site is about 500 m to the north. Other residences are located 1 km east, 1.8 km south and 3.3 km south-east. Northam, located 20 km west of Meenaar, is the administrative and commercial centre of the region.

The surface soils at the plant site are generally clay–sands overlying sandy clays, and have developed from in situ weathering of the underlying bedrock. The soils exhibit low field permeabilities, ranging from 1.16x10-7 cm/s in the near surface, to 2.4x10-5 cm/s on average at depth. Phosphorus retention capacities are low to moderate in comparison to Perth sands.

The site as depicted in the PER straddles two catchments: the Mortlock River catchment to the south-east and the Grass Valley Brook catchment to the north-west. Depth to groundwater varies between 4.4m and 20m. Groundwater is saline (7,400 to 16,000 mg/L total soluble salts), and high nitrate (21 mg/L) and sulphate (650 mg/L) levels were detected in the one sample submitted for analysis by Ashton's groundwater consultants.

Meenaar is situated 12 km west of the Meckering fault line, in a region which has been subject to seismic events of varying magnitudes. The 1968 Meckering earthquake had a Richter magnitude of 6.8, and resulted in major damage to buildings and infrastructure in the region. The most recent significant siesmic event occurred in January 1990 with a magnitude of 5.5, indicating that the present phase of seismic activity is continuing. The site is within seismic Zone 2, as classified under the *SAA Earthquake Code* (AS 2121—1979), although Gaull and Michael-Leiba (1987) ascribe a Zone 1 category to the area including Meenaar for the purposes of their classification. The Bureau of Mineral Resources estimate the Maximum Credible Earthquake for the region to be of Richter magnitude 7.3.

6. Environmental impacts and management

6.1 Mining and beneficiation at Mt Weld

6.1.1 Groundwater protection

The EPA considers that the low salinity groundwater resource within the confined aquifer of the carbonatite pipe at Mt Weld is an important water resource in the region, and should be conserved and protected from pollution where possible for future users.

To ensure the impact of its project is minimised, Ashton has indicated that a water management plan will be prepared, incorporating methods to protect the quality of the groundwater resources and water conservation measures.

Ashton's groundwater consultants determined that the more saline shallow aquifer would be expected to contribute about one third of the total quantity of groundwater extracted. On the basis of ongoing studies of hydrogeology at Mt Weld, Ashton presently estimates that total dewatering may be reduced to 9,000–10,000 ML (compared with 13,000 to 14,000 ML in the PER). Further testing would be undertaken as part of the final feasibility studies, to confirm these results.

Specific measures by Ashton to conserve water and minimise the amount of dewatering of the confined aquifer include the following:

- water from pre-mine dewatering would be stored in a disused mine pit at the nearby Granny Smith gold mine;
- Granny Smith mine would modify its current bore field to ensure drawdown occurs in Ashton's mine pit region rather than elsewhere in the carbonatite pipe;
- the production bore field for the Mt Weld Project would also be located to assist with dewatering; and
- water from mine dewatering would be directed to the residue pond for treatment and recycling or direct to the process water pond if it were of suitable quality. Excess groundwater would not be discharged to natural surface drainage features.

A number of other options to minimise the amount of dewatering were investigated by Ashton, including the use of a grout curtain. None of these options would significantly reduce the required amount of dewatering over the proposed method.

The EPA queried the alternative use of a higher density residue slurry, which could have greater potential to reduce water usage, accelerate drying and reduce the risk and rate of seepage in the

ponds, compared to the proposed low density slurry. Ashton responded that feasibility studies had been undertaken to investigate the use of slurries of various density. The low density slurry residual disposal system is considered to be the most economic for its process, and that this method incorporates recycling of process water.

Various alternatives for storage of the low salinity groundwater were investigated by Ashton. The high quality of this water relative to surrounding saline groundwater, and the low natural recharge rates, makes artificial recharge of the aquifer east of the impervious dolerite dyke undesirable and impractical at this stage. The discharge of this water to Lake Carey was investigated but rejected by Ashton due to the potential adverse environmental impacts of establishing the pipeline, the alteration of the natural ecosystem resulting from the supply of water, and the waste of the resource. Hydrogeological studies undertaken for Ashton confirmed that pits at Granny Smith are the only practical surface reservoirs available to receive dewatering. Storage of water in the Goanna Pit at Granny Smith mine site would conserve much of the dewatering for future use; however, if losses were substantial, they are predicted by Ashton to occur without adverse impacts.

Ashton has designed the layout and construction of facilities to minimise the impact of the project on the quality of the groundwater at Mt Weld. Wherever feasible, the project facilities and infrastructure would be located over the dolerite dyke to avoid direct impacts on groundwater. Ashton considers that leachate from waste disposal facilities would be limited and would have a low potential for adverse impact on groundwater. Residue ponds for the waste from Meenaar would be located off the carbonatite pipe and therefore the potential for saline leachates to impact on the higher quality groundwater would be very low.

Ashton is committed to the preparation of a water management plan, which would detail appropriate measures to manage the groundwater resources in the carbonatite pipe area. The plan would be prepared prior to the commencement of mining operations, in consultation with the EPA and the Water Authority of WA (Commitment 21).

Ashton is committed to the preparation of a groundwater monitoring programme in consultation with the Water Authority (Commitment 23). Ashton would maintain the bore log monitoring which is currently undertaken in the Mt Weld Water Supply Bore Field. The existing borefield monitoring programme would be extended to any new bores. The level and salinity of water stored in the Goanna Pit would also be monitored. The pipeline would be either visually inspected at least every twelve hours or an approved telemetric system would be installed. Ashton would develop a programme of regular water level and quality monitoring to detect fluctuations in groundwater in consultation with the Water Authority and the EPA.

Ashton would undertake regular monitoring of wastewater for the purpose of beneficiation process control. Relevant information would be incorporated into the groundwater control monitoring programme to ensure water conservation measures were adequate.

In response to more information on the proposed groundwater monitoring programme, Ashton has indicated that the precise location of the residue ponds at Mt Weld has yet to be finalised. Further geotechnical studies would be required to determine suitable residue pond locations away from commercial ore bodies. Ashton would provide detailed information of the proposed groundwater monitoring in the Environmental Management Programme (EMP) and Works Approval application, once the location of the residue ponds is finalised.

The EPA considers that, although Ashton's proposal could have a significant impact on the high quality groundwater resource at Mt Weld, the proposed dewatering and disposal practices can be managed to minimise this impact, and impacts on the surrounding environment. The EPA considers that, prior to dewatering of the groundwater for the rare earths project, Ashton should prepare a plan for the monitoring and management of the groundwater resource at Mt Weld, as part of the Environmental Management Programme (EMP), and in consultation with the Water Authority of Western Australia and the Department of Minerals and Energy. The plan should meet the requirements of the EPA (see Recommendation 2).

6.1.2 Native vegetation impacts

The EPA considers that projects should be designed to minimise the amount of clearing of native vegetation.

The main impact on native vegetation from Ashton's proposal would be during the construction phase of the Mt Weld mine and facilities. Approximately 60 ha of existing vegetation (mainly mulga woodland) in the works area would be removed.

The native plant communities in the Mt Weld area have already been disturbed by goats, rabbits, sheep and some exploration activities. Ashton is committed to participating in an appropriate programme to control feral animals, in consultation with the Agricultural Protection Board and pastoral owners, prior to the commencement of rehabilitation measures. Ashton has engaged botanists to undertake another flora and vegetation survey in the spring of 1992, when species diversity should be at its greatest, following the significant rainfall experienced in early 1992. Ashton expects that the survey would not only confirm the results of the previous survey, but also that the number of species recorded in the Mt Weld area would increase.

Ashton is committed, where practicable, to use vegetation and topsoil cleared during Mt Weld site preparations to rehabilitate disturbed areas (Commitment 9). Ashton has designed the proposed facilities and infrastructure to minimise further clearing at Mt Weld. To prevent unnecessary damage to vegetation, vehicle access would be restricted to selected tracks and roads. Wherever feasible, in order to limit the area required for clearing, overburden material recovered during pre-mine stripping would be used in the construction of other facilities, such as the residue ponds.

Ashton considers that it is unlikely that dewatering would adversely affect the vegetation in undisturbed areas, as the groundwater is contained in an aquifer below the impervious laterite caprock. Bunding of drains around the project area, required to divert the sheet-wash flow and prevent flooding of the project area, could cause some temporary drainage shadow effects to the west-south-west. The bunds and diversion channels around the project area would be constructed such that clean surface runoff rejoined the natural drainage system immediately downslope of the protected facilities.

The EPA considers that Ashton's proposed construction and operating activities would have minimal and manageable impacts on the extent of native vegetation and floral species diversity at Mt Weld. The EPA recommends that, prior to further clearing for the rare earths project, Ashton should prepare a plan for the monitoring and management of clearing of native vegetation at Mt Weld, as part of the Environmental Management Programme (EMP), and in consultation with the Department of Conservation and Land Management, and the Department of Minerals and Energy. The plan should meet the requirements of the EPA (see Recommendation 2).

6.1.3 Residue and wastewater management

The EPA considers that solid residues and liquid wastes generated by proponents should be managed to protect the receiving environment.

The proposal by Ashton would generate the following residues and liquids, which would require management and disposal at Mt Weld:

Solid residue and entrained liquids from the beneficiation plant:

About 40,000 t/a of fine residue, contained in 500 ML/a of wastewater, would be generated from the beneficiation plant. Ashton estimates that 30% of the beneficiation plant wastewater would be recycled to the plant, 30% would remain as interstitial liquor in the residue or as other unrecoverable liquor, 30% would be lost to evaporation, and the remaining 10% (some 50 ML/a) would leak to groundwater through the base of the ponds. After the first year of operation, leakage rates are estimated to be less than 10 ML/a.

The EPA considers that main potential environmental impact associated with the disposal of residues from the beneficiation plant would be the risk of contamination of the groundwater at Mt Weld.

Ashton has provided a conceptual design for the beneficiation residue ponds in the PER, and given an undertaking that the final design and construction would comply with the guidelines issued by the Department of Minerals and Energy. Each pond would have a capacity to store 5 to 7 years of beneficiation residue. Preliminary investigations have determined that the permeability of the duricrust is 10^{-6}–10^{-5} cm/s. If detailed investigations fail to confirm this, then Ashton would install a clay liner, using lake clay similar to the residue ponds for the Meenaar waste.

Ashton expects that the water in the beneficiated residue ponds would have a pH of 8 to 8.5. The principal dissolved component of the wastewater is likely to be sodium bicarbonate at concentrations around 3,000 ppm. Added to the 'background' salinity of process water, this would yield an eventual salinity of 5,000–7,000 ppm for leachate. Ashton considers that such levels are within measured salinities of the unconfined aquifer (5,000–8,000 ppm) and thus unlikely to have detectable impacts on the groundwater.

The solid components in the residue would comprise those minerals remaining after extraction of the bulk of the rare earths, namely goethite (60%), rare earth minerals (11%), ilmenite (6%), and clay and quartz (6%). These minerals are considered unreactive and insoluble, and are therefore unlikely to contribute to any potential pollution of the groundwater. The high goethite content in the beneficiation residue would aid the sealing of the ponds by 'clogging' the pores of the liner.

The EPA considers that the proposed disposal of beneficiation residues and wastewater is unlikely to significantly impact on the quality of groundwater in the confined and unconfined aquifers at Mt Weld.

Solid residues from secondary processing plant at Meenaar

Various options for the disposal of residues produced at Meenaar were considered by Ashton. These included disposal by burial at Mt Weld, on-site disposal at Meenaar, disposal in existing residue storage areas or disused mines, and disposal at the integrated waste disposal facility at Mt Walton, north-east of Koolyanobbing. Disposal at Mt Weld was considered by Ashton to be the most environmentally responsible and the preferred option.

The Health Department of Western Australia considers that Ashton's preferred option of returning solid residues from the secondary processing plant at Meenaar to be acceptable. The Department of Minerals and Energy supports the proposed disposal of the low activity residue at Mt Weld.

Ashton proposes to return 28,500 tonnes of wet residue from the secondary processing plant at Meenaar to Mt Weld each year, and deposit this material in a series of linked ponds. The ponds would be located off the carbonatite pipe, but within Ashton's mining lease.

Each pond would hold about 2 years' production of residue, and would be clustered in groups of three. The ponds would be excavated to an average depth of 5 m and be lined with a compacted clay base 0.3 m thick. The maximum average depth of residue to be placed in ponds would be 2.5 m, allowing up to 2.2 m for 'freeboard' and eventual cover to ground level. The residue slurry would be at a pulp density of approximately 50%, and it would spread laterally to a low repose angle. This would also reduce the surface area for drying and would assist in preventing the generation of dust. Continuous addition of residue slurry to the top of the pond should maintain a wet surface layer.

Ashton is committed to the preparation of a management plan for the disposal at Mt Weld of residues from the Meenaar secondary processing plant, prior to the commissioning of the project (Commitment 22).

The EPA considers that main potential environmental impact associated with solid waste from the secondary processing plant would be the risk of contamination of the groundwater in the confined aquifer at Mt Weld from salts contained in the residue.

Ashton maintains that the residue returned to Mt Weld would contain radionuclides at levels below those occurring in the ore, and groundwater in the area already has levels of radioactivity above those prescribed for drinking water. Ashton predicts that radionuclides would be at very low levels and low solubility in the Meenaar residues, that their migration from the residue bodies would be minimal, and therefore the radionuclides would not impact significantly on the quality of the groundwater. Ashton expects that other components of the residues, such as soluble salts, are unlikely to have any negative impacts on the saline groundwater. Similarly, the low solubility phosphates in this residue are also natural components of the area and are therefore unlikely to affect groundwater quality.

The EPA considers, on the basis of information from Ashton regarding the likely composition of the Meenaar residue, and on the condition that these residue ponds are not located over the carbonatite pipe and are adequately lined to reduce seepage, that disposal of secondary processing residues at Mt Weld would not significantly impact on the quality of groundwater in the confined aquifer there. The EPA will require Ashton to monitor the possible movement of radionuclides as part of a radiation management plan (see Recommendation 2 and Section 6.4.3).

Mine overburden

Ashton proposes, where possible, to use mine overburden material for construction purposes and the remainder would be stockpiled. The various types of overburden material would be stockpiled separately. The overburden stockpiles would cover approximately 17 ha and be 10 m in height. These stockpiles would be rehabilitated to prevent dust generation. The largest volume of solid waste generated at Mt Weld would be the mine pre-strip. However, pending the results of geotechnical testing, most of this material would be used in the construction of bund walls and other earthen structures.

Ashton does not propose to use the waste dumps as backfill in the open pit due to:

- the real potential for future mining in the pit area;
- the low impact that the rehabilitated waste dump would have on the local landscape; and
- the high cost of backfilling which would adversely affect the viability of the project.

Miscellaneous wastes

Ashton proposes that miscellaneous wastes, such as sanitary waste from the messing facilities and reagent containers that cannot be returned to the suppliers, would be disposed of on site in a sanitary landfill. All non-toxic and inert wastes from the beneficiation plant and camp would be buried in a sanitary landfill disposal site located near the Meenaar residue storage area, off the carbonatite region as approved by the Shire of Laverton. The disposal of food scraps and other combustibles by burial in the sanitary landfill site would prevent odours, flies and animal scavenging. A separate landfill would be used to dispose of containers used for reagents and other spent hydrocarbons. This landfill would be fenced to contain any wind-blown materials and to exclude fauna.

Ashton is committed to the removal of solid refuse and material wastes from construction sites and disposed of in accordance with the requirements of the Shire of Laverton (Commitment 8).

The Health Department of Western Australia has indicated that establishment of a sanitary landfill at the mine site would not be affected by the requirements of the Health Act, however the Health Department is willing to provide further advice on its operation.

Sewage

Geotechnical investigations by Ashton have shown that nature of the impervious duricrust layer and presence of the underlying groundwater make the use of septic tanks unsuitable for the

project. Ashton proposes that sewage would be treated in a package treatment plant, with the treated wastewater directed to the residue pond to reduce the risk of surface waterlogging or contamination of groundwater.

The EPA considers that Ashton's proposed residue disposal and wastewater management at Mt Weld would have minimal and manageable impacts on the receiving environment at Mt Weld. The EPA considers that, prior to further clearing for the rare earths project, Ashton should prepare a plan for residue disposal and wastewater management at Mt Weld, as part of the Environmental Management Programme (EMP), and in consultation with the Water Authority of Western Australia, the Health Department of Western Australia, and the Department of Minerals and Energy of Western Australia. The plan should meet the requirements of the EPA (see Recommendation 2).

6.1.4 Rehabilitation and decommissioning

Ashton's primary objectives of rehabilitation would be to stabilise the surface of all exposed surfaces and to re-establish self-sustaining vegetation native to the area. It is envisaged that Mt Weld will return to grazing land and that other mining may be carried out in the carbonatite pipe.

Ashton is committed to progressive rehabilitation at Mt Weld in accordance with EPA and Department of Minerals and Energy's guidelines (Commitment 18). Topsoil containing the seed beds would be stockpiled for future use. To preserve the regenerative capacity of this material, topsoil stockpiles would be limited to 2 m in height and used as soon as practicable. Wherever possible, topsoil would be directly applied to areas requiring revegetation, rather than stockpiled. Friable soil material below the topsoil level would also be stockpiled separately, as this has considerable use as a soil forming stratum and as a buffer between the root zone and clay cap of the residue areas. Unused gridlines, tracks and other open areas would be rehabilitated as soon as practicable. Material in excess of that required for construction would be stockpiled for later use in future pond construction. Rehabilitation of overburden dumps would commence at the end of the earthworks construction stage. Initial rehabilitation would include the application of 100 mm of topsoil and seeding. Wherever possible, fences would be used to keep grazing animals, particularly goats, from areas being rehabilitated.

Components of the storage area receiving the Meenaar residues would be progressively rehabilitated. Once residue deposition had ceased and the ponds dried out, they would be covered with soil to avoid dust formation. Residue storage areas would be covered initially with a layer of mine overburden waste with a high clay content, followed by layers of subsoil and seeding if required. Depth of cover would exceed 2 m in line with recommendations covering the shallow burial of low-level radioactive waste.

The EPA considers that Ashton should undertake further research in the early stages of the project's life, such as re-vegetation trials and overburden characterisation, to ensure successful rehabilitation of the area.

Ashton proposes, prior to the commencement of operational mining and commissioning of the beneficiation plant, to provide a detailed decommissionong plan to the Department of Minerals and Energy and the EPA for approval. The decommissioning strategy would comply with the guidelines of the Commonwealth of Australia's Code of Practice on the Management of Radioactive Wastes from the Mining and Milling of Radioactive Ores 1982 (Commitment 19).

Decommissioning would involve the dismantling and removal of all building structures, equipment and pipelines that were not required by the State to be retained. Some inert building material and contaminated soil (such as may arise from fuel spills) would be buried within the residue storage areas. The mine pit would be decommissioned in accordance with requirements of the Department of Minerals and Energy. All compacted areas, such as roads and the camp areas, would be deep-ripped and recontoured in order to restore normal drainage. Topsoil would be applied over all cleared areas to facilitate natural rehabilitation.

The EPA considers that Ashton's proposal for rehabilitation and decommissioning of the mine pit, plant facilities, associated infrastructure, residue and overburden storage areas, and other

disturbed area at Mt Weld is acceptable in principle. The EPA considers that, prior to further clearing for the rare earths project, Ashton should prepare a plan for the details of rehabilitation and decommissioning at Mt Weld, as part of the Environmental Management Programme (EMP), and in consultation with the Department of Minerals and Energy. The plan should meet the requirements of the EPA (see Recommendation 2).

6.1.5 Noise, dust, atmospheric emissions and visual impacts

Due to the remoteness of the site, the number of people around the site who are likely to be impacted by the operation is quite small. For most of the time this would be restricted to employees who would live and work on the site, and those people associated with the Mt Weld pastoral lease and residence.

Construction activities at Mt Weld would be carried out in accordance with statutory requirements relating to noise, and would incorporate appropriate management techniques to ensure that occupational and ambient noise levels were within acceptable limits set by the Department of Occupational Health, Safety and Welfare and the EPA (Commitment 11).

Due to the soft nature of the ore and overburden, blasting requirements for the mine would be limited. Noise emissions from the mine and beneficiation plant operations would be low. Most noise would originate from the use of heavy earthmoving machinery, the crushing processors and the diesel generator. Noise levels generated during the project would comply with the requirements of the EPA and the Department of Occupational Health Safety and Welfare.

Ashton is committed to implementing dust suppression measures, including application of water from tankers at Mt Weld to minimise dust generation during site preparation and construction activities (Commitment 10). The proposed method of mining incorporates short mining periods and limited blasting requirements: this, together with the high moisture content of the ore, limits the potential for dust generation. During the mining period, all haul roads would be regularly dampened by water spray trucks to minimise dust.

The project area is subject to local dust storms due to the degraded condition of the mulga woodlands. Ongoing rehabilitation of exposed soil surfaces would reduce ambient dust levels. Where rehabilitation was impractical, such as the ore stockpile, the source would be stabilised by regular application of water. The layout of the ore stockpile would be designed to reduce the potential for dust generation.

Beneficiation is a wet process, and therefore the potential for dust generation would be low. Exhaust dust collectors would be installed on all crushers and mills. Vibrating feeders, screens and conveyors would be enclosed and water sprays would be installed as required to limit occupational dust levels to the Department of Occupational Health, Safety and Welfare standards.

As beneficiation does not involve combustion and is a wet process, gaseous atmospheric emissions would be limited to exhaust gases from the mobile machinery and the diesel generator.

Rehabilitation of overburden dumps would commence at the end of the earthworks construction stage. The dumps, which would be up to 10 metres high, would form part of the local landscape and would be visible from outside the lease area. Due to the distance of the Mt Weld mine site from populated areas and the presence of similar features in the region, the visual impact on the local landscape of these dumps would be minimal.

The minesite and beneficiation plant at Mt Weld will be prescribed premises under Part V of the Environmental Protection Act and accordingly Ashton will be required to obtain a Works Approval prior to construction and a Licence prior to operation of the premises. Industry performance standards relating to air and water pollution will be set by the EPA.

The EPA considers that noise, dust, atmospheric emissions and visual impacts resulting from Ashton's proposed construction and operating activities would have minimal and manageable impacts on the environment at Mt Weld.

6.1.6 Impacts on local community

Most of the construction workforce for the proposal would be recruited from outside the region and be accommodated in on-site or other mining construction camps nearby. The EPA has been advised that there would be little impact, positive or negative, on the local communities from the construction phase of the project.

Ashton expects that the operational workforce would be located in Laverton. Historically, Laverton has coped with rises and falls in the local population, and has recently experienced population losses due to the downturn in activities in the area .

The EPA has been advised that there is sufficient community infrastructure, accommodation and local services to support the introduction of up to 30 families to the town. There would be significant benefits to the local economy and social well being of Laverton with new families moving into the town. The location of the workforce in Laverton is supported by the Shire of Laverton.

Should Ashton wish to alter its current plans for locating the workforce in Laverton, it should seek advice from the Social Impact Unit of the social implications of alternative plans.

6.2 Secondary processing of rare earths at Meenaar

6.2.1 Waste management and protection of water resources

The EPA considers that ground and surface waters are vital resources that need protection in perpetuity, and that pollution, nutrient enrichment and degradation should be avoided. Discharge of contaminants to the environment should be controlled so that their environmental impacts are acceptable. Leakage of salts and possible radionuclides from the evaporation ponds, and leakage and spillage of plant process liquors and stored chemicals (refer to Table 1), are the most likely sources of contamination of water resources from the secondary processing plant at Meenaar.

The EPA considers that waste streams can often be reduced by recycling and re-use, giving a dual benefit, and that these aspects of proposals should be investigated and encouraged. Of the waste streams produced during the processing of the rare earths at Meenaar, solid phosphate residues and soluble nitrates have the greatest potential for beneficial use, particularly as fertilisers.

Wastewater and ground and surface water impacts

Ashton has described the occurrence of groundwater at the site of the secondary processing plant at Meenaar as minor and localised aquifers in soils with low permeabilities, and with high levels of salinity, nitrate and sulphate. The Water Authority of Western Australia has confirmed that the groundwater resources in the Meenaar region are generally saline, and there are no major users of groundwater in the area.

In Stage III, the main components of the wastewater to be directed to the on-site evaporation ponds following neutralisation and precipitation of the above waste streams would be as follows:

- 1,900 t/a of sodium ions
- 3,400 t/a of chloride
- 1,800 t/a of ammonia (800 t/a if oxalic acid used)
- 600 t/a of calcium sulphate
- 2,750 t/a of nitrates.

Process water would contain only trace quantities of radionuclides, the levels of which are expected to average less than 0.1 Bq/L - ie similar levels to those in Perth drinking water. In

addition to process wastewater, small volumes of non-process water, such as plant washdown water, would also be sent to the evaporation ponds. Organic solvents (mainly kerosene) used in rare earths processing would be recovered and reused as far as possible. Solvents would be recovered by interceptors (similar to grease traps) and any losses would pass with the wastewater to the evaporation ponds.

Ashton has given a commitment to undertake studies during the design phase of Stages II and III to identify an economic means of removing the nitrate (which enters the process in Stage II as nitric acid) from the wastewater before it entered the evaporation ponds (Commitment 31). If this happens, it would reduce the risk of nutrient contamination of water resources from the evaporation ponds.

Ashton is committed to a total containment policy for waste water and surface runoff from the plant area (Commitment 30).

Stormwater would be directed (via a system of open channels) to a centralised drainage sump separate from the evaporation ponds. Stormwater runoff would be contained entirely within the plant site.

Ashton would take a number of precautions to prevent leakage and to minimise the spread of any leachate plume from the evaporation ponds. In particular, the pond design would incorporate:

- a heavily compacted 200 mm clay–sand, stone-free bed;
- a synthetic liner;
- a lightly compacted 300 mm layer of clay–sand over the liner;
- possibly an expansive clay, such as attapulgite, between the liner and the clay–sand bed;
- monitoring/recovery bores to detect and return any leachates to the evaporation ponds; and
- 2.5 m high heavily compacted clay–sand embankments.

Ashton would implement a number of measures to ensure that the effect of seismic events on the ponds would be minimised and that seismic generated waves do not overlap the sides of the embankments. These include a commitment by Ashton to prepare plans and associated documentation for the design of the Meenaar facility and evaporation ponds to withstand predicted seismic events prior to construction, in consultation with the EPA and the Water Authority (Commitment 32). In response to submissions, Ashton has confirmed that the design and construction of the ponds would be supervised by a competent geotechnical engineer.

Ashton is committed to implementing a groundwater monitoring programme. The results of this monitoring would be issued annually to the Water Authority and the EPA (Commitment 33). In its response to submissions, Ashton has indicated that regular monitoring of wastewater entering the Meenaar evaporation ponds would be developed under the EMP. Parameters to be monitored would include radionuclides. Due to the low permeabilities of the soils, any potential leachates would be detected through the network of monitoring bores and would be returned to the evaporation ponds through recovery bores. The fragmented nature of the groundwater detected suggests that an intrusion of leachate would not disperse rapidly and would be recoverable.

Ashton considers that the risk of leaching of wastewater through the synthetic liner, or loss through breaching of embankments as a result of seismic activity, is low, and any such loss would be minimal due to the nature of the surrounding soil types. Thus the potential for groundwater contamination would also be low. Any temporary loss of containment from evaporation ponds, such as might occur with a 1-in-100 year seismic event, is unlikely to have catastrophic impacts on the local or regional environment. While water quality may temporarily become worse locally, due to the addition of nutrients or salts, such a change would be transitory and not represent a major export of salt or nutrients to the Avon catchment. The establishment of the plant at Meenaar would result in the cessation of agricultural practices over

the area; this could have a positive effect on water quality due to the reduction in soluble fertiliser use.

Ashton expects the suspended and dissolved solids resulting from wastewater in the evaporation ponds would settle and eventually form a layer at the bottom of the evaporation ponds. The trace levels of radionuclides in the wastewater would be in the form of precipitated hydroxides. Due to the mixing of the radionuclides with the much greater bulk of non-radioactive solids precipitated each year, the radioactivity would remain within acceptable levels. The suspended and dissolved solids contained in wastewater from the secondary processing plant would not be returned to Mt Weld, but would be contained in the evaporation ponds at Meenaar. Ashton is continuing to investigate means of reducing the volume of solids in the wastewater stream.

Ashton has given a commitment to specifically address the issue of decommissioning and rehabilitation of the evaporation ponds (Commitment 3).

Ashton's objectives for decommissioning and rehabilitation, which would also apply to the evaporation ponds, would be to:

- minimise any short-term or long-term health risks;
- restore the site to a condition suitable for industrial use or other uses, as may be appropriate at the time of decommissioning; and
- ensure that no ongoing additional liability for the project is incurred by the State Government.

The EPA considers that implementation of these objectives by Ashton would be consistent with a "walk-away" solution to the evaporation ponds.

Given the commitments and undertakings by Ashton in regard to the design, construction and operation of the evaporation ponds, and to the management and monitoring of wastewater in general, the EPA considers that the impacts of the secondary processing plant on ground and surface waters would be minimal and therefore acceptable. The EPA recommends that, prior to the commencement of construction of the the secondary processing plant, Ashton should prepare a plan for the monitoring and management of ground and surface waters in the immediate vicinity of the plant site, as part of the EMP, and in consultation with the Water Authority of Western Australia. The plan should meet the requirements of the EPA (see Recommendation 2).

Residue and solid waste management

Solid residues produced during secondary processing operations would be returned to Mt Weld for disposal. The transport of residue between Meenaar and Mt Weld is discussed in Section 6.3.1 and the environmental impacts of residue disposal at Mt Weld are discussed in Section 6.1.3 of this report.

Some components of the solid waste from the processing would contain a high level of phosphates, largely as low solubility calcium phosphate. Ashton considers that reuse of these components as commercial fertiliser may be possible if there was a sustained demand for the material, and there was a reliable, economic method of ensuring that the level of radionuclides in these streams were within acceptable levels. Ashton has given a commitment to continue to investigate the feasibility of selling the calcium phosphate material produced from regeneration of caustic soda or otherwise making it available to others (for possible use as fertiliser feedstock) - Commitment 34.

Solid wastes such as office material would be removed from the site by contractors and recycled (if practical) or disposed of in an approved landfill site. Any disused packaging containers would be washed prior to off-site disposal by landfill. Any off-site disposal by landfill would be undertaken in accordance with the requirements of the relevant local authority. Solid sludge from the domestic septic tank would be regularly removed by local contractors. Sewage disposal would also be undertaken in accordance with the requirements of the local

authority. The Health Department of WA has indicated that these proposed disposal practices would be acceptable.

The EPA considers that the impacts of proposed solid waste disposal and management from the secondary processing plant at Meenaar would be minimal and therefore acceptable. The EPA considers that, prior to the commissioning of the the secondary processing plant, Ashton should prepare a solid waste management plan, as part of the EMP, and in consultation with the Health Department of Western Australia. The plan should meet the requirements of the EPA (see Recommendation 2).

6.2.2 Noise, atmospheric emissions and visual impacts

The EPA considers that emissions of noise, dust and atmospheric emissions from developments should be controlled so that the environment, including the amenity of nearby residents, is sufficiently protected. The discharge of atmospheric contaminants is considered a legitimate activity, provided other beneficial uses are not compromised. Assessments of environmental impacts should include consideration of emissions under abnormal operations conditions, when conditions are likely to be worse than under normal operating conditions.

Noise

Ashton expects that construction activities at Meenaar would result in periodic and short-term increases in existing background noise levels. The primary noise source during construction would be from site preparation involving earthworks, on-site assembly of major plant components and heavy vehicle movements. However Ashton has given a commitment that these activities would be carried out in accordance with statutory requirements relating to noise, and would incorporate appropriate management techniques to ensure that occupational and ambient noise levels were within acceptable limits set by the EPA and the Department of Occupational Health, Safety and Welfare (Commitment 11).

Ashton has indicated that all tender documents to be issued for the supply and installation of items of equipment for the secondary processing plant would include strict noise specifications. The maximum allowable noise emission from any item of equipment would be restricted to 85 dB(A) at a distance of 1 m.

The potential noise sources at the secondary processing plant would be:

- wet grinding mills;
- boilers;
- pumps, fans, air-conditioning;
- mobile equipment (truck movements);
- workshop machines; and
- conveyors.

Ashton has indicated that all equipment with the potential to generate noise would have effective sound proofing. The wet grinding mills would be rubber lined and housed inside an enclosed building. Similarly, the boilers would be fully enclosed. All mobile equipment would have appropriate exhaust mufflers fitted. Conveyors would have protective coverings and rubber linings.

Ashton considers that the periodic increase in noise levels due to construction activities is unlikely to cause major disturbances to the nearest residents because of existing background noises (e.g. from freight and passenger train movements and vehicles on Great Eastern Highway), the type of construction activities to be undertaken, the hours and duration of construction, and the measures to be adopted by Ashton to minimise noise. Noise emissions during construction are unlikely to be audible at Grass Valley.

Ashton are committed to incorporating effective sound-proofing measures on all potential noise-generating equipment, such that, during the operation of the plant at full capacity, noise at the

nearest residence would not exceed those limits set by the EPA (Commitment 35). Ashton has indicated that noise levels during operation of the secondary processing plant would not exceed the requirements of the *Occupational Health, Safety and Welfare Act 1984* for the protection of the workforce. Ashton expects that ambient noise levels would not exceed the limits likely to be set by the EPA because of the imposition of noise specifications for all items of equipment, the adoption of a range of appropriate noise-suppression measures, and the existence of other background noise sources, such as passenger and freight train movements (80 trains per week), vehicular traffic on Great Eastern Highway (in the order of 1,565 vehicles per day), and farming activities at certain times of the agricultural season.

Ashton will implement a noise monitoring programme, and details of its proposed programme are given in Appendix 4.

The EPA considers that noise emissions from the secondary processing plant should conform with the standard requirements. Ashton will need to ensure that the noise emissions from the proposal do not cause or contribute to noise levels in excess of:

- 40 dB(A) between 10.00 pm and 7.00 am;
- 45 dB(A) between 7.00 pm and 10.00 pm on any day, and between 7.00 am and 7.00 pm on Saturday, Sunday and any gazetted public holiday; and
- 50 dB(A) between 7.00 am and 7.00 pm Monday to Friday inclusive, but excluding gazetted public holidays;

as measured at the nearest affected noise-sensitive premises.

Where the combined level of the noise emissions from this proposal and the normal ambient noise exceeds the levels specified above, this condition will be considered to be contravened only when the noise emissions from the proposal are determined to be dominant and significantly influencing the measured noise levels. Ashton will be required to ensure that noise emissions from the proposal do not include tonal or impulsive components or other characteristics which make the noise more annoying than it would be in their absence. Ashton will be required to conduct noise surveys and assessments in consultation with the EPA.

Although it is likely that noise emissions from the secondary plant would comply with these noise limits at most residences for most of the time, the EPA considers that the noise limits may be exceeded by Ashton under certain meteorological conditions, particularly at the nearest residence which is about 500 metres from the proposed plant boundary. Furthermore, in the absence of changes to planning requirements to the area around the Meenaar Industrial Park, new residences could be established close to Ashton's plant.

To ensure compliance with EPA's noise limits, Ashton would be required to carry out out noise modelling, prior to the issue of a Works Approval. Any necessary noise attenuation of equipment could then be carried out before operations start. The EPA considers that a system for measuring appropriate meteorological conditions should be established and operating at Meenaar as soon as possible (as part of the Meenaar Industrial Park proposal), to ensure that adequate data are acquired for the purposes of modelling. This would enable Ashton to carry out noise modelling prior to operations commencing.

The secondary processing plant at Meenaar will be a prescribed premises under Part V of the Environmental Protection Act and accordingly Ashton will be required to obtain a Works Approval prior to construction and a Licence prior to operation of the premises.

The EPA considers that, subject to Ashton abiding by its commitments and meeting the conditions specified by the EPA, noise emissions from from the construction and operation of the proposed secondary processing plant site are likely to have minimal impact on nearby residents, and would be acceptable.

Atmospheric emissions

The process of calcination, using LPG to burn off residual reagents and other organic matter, together with the use of heaters, would produce some atmospheric emissions. Emissions to be vented to the atmosphere include carbon dioxide, sulphur dioxide, oxides of nitrogen, water

vapour and particulates. Ashton anticipate that most of the particulates would consist of small particles of ore, and would have negligible concentrations of radionuclides. The air emissions from the heaters and the calciner which are predicted by Ashton are summarised in Table 2

Table 2. Predicted atmospheric emissions (from PER)

Source	Atmospheric emission rate (kg/h)		
	Oxides of nitrogen	Sulphur dioxide	Particulate matter
Heaters	0.95	0.018	negligible
Calciner	2.0	0.04	0.5

Ashton would install wet scrubbers to treat air discharges from the calciner and heaters. A total of 80 ML/a of water as steam would also be vented to the atmosphere from the boilers.

Ashton are committed to establishing a programme upon commissioning to monitor the concentration and mass emission rate of sulphur dioxide, concentration of oxides of nitrogen, volume flow rate, temperature, and boiler fuel feed rate (Commitment 29).

The potential for dust generation during construction exists where site preparation involving earthworks using heavy machinery is required. Construction during winter would minimise the potential for dust generation. Ashton are committed to implementing dust suppression measures, including application of water from tankers, at Meenaar to minimise dust generation during site preparation and construction activities (Commitment 10). Commitment 20 by Ashton states that dust control measures would be implemented to comply with Department of Minerals and Energy's regulations.

The EPA considers that atmospheric emissions from the secondary processing plant should be controlled under Works Approval and Licensing provisions of Part V of the Environmental Protection Act. The air quality would be measured at the boundary of the plant premises. Air quality standards set by the EPA, which are designed for the protection of public health and welfare, are presented in Table 4.

Table 3. Air quality standards to be set by the EPA

Substance	Averaging period	Ground level concentration ($\mu g/m^3$)
Oxides of nitrogen (expressed as nitrogen dioxide)	1 hour	320
Sulphur dioxide	1 hour	350
Particulate matter (dust)	Annual	90

Although it is likely that atmospheric emissions from the secondary plant would comply with these limits most of the time, the EPA considers that the limits could be exceeded by Ashton under certain meteorological condition, particularly at times when the plant is not operating normally. As indicated above in the discussion on noise, in the absence of planning restrictions on housing for the area around the Meenaar Industrial Park, new residences could be established close to Ashton's plant, which would restrict the available airshed in which atmospheric emissions could adequately disperse.

To ensure compliance with EPA's atmospheric emission limits, Ashton would be required to carry out out air pollution modelling, prior to the issue of a Works Approval. Further information on specifications for pollution control equipment would also be required at this stage. Ashton will be required to provide an analysis of the plant product, to assist in the determination of the potential for types of pollution from the calciner stack. Stack monitoring of particulates and their composition, including heavy metals and radionuclides, would be required. As indicated previously, should Ashton's proposal proceed, it is suggested that a meteorological station is established and operating at Meenaar as soon as possible, to ensure that adequate data are acquired for the purposes of atmospheric pollution modelling.

The EPA considers that, subject to Ashton abiding by its commitments and meeting the requirements specified by the EPA, atmospheric emissions from the construction and operation of the proposed secondary processing plant site are likely to have minimal impact on nearby residents, and would be environmentally acceptable.

Visual impact

The secondary processing plant at Meenaar is likely to be partially visible from the nearest neighbour's residence (500 m to the north), as only Great Eastern Highway and the established vegetated area separate the homestead and the site. The most prominent component of the plant would be the emissions stack, which would be about 28 metres above ground level. A glow-haze associated with the lights required for night-time operation would be visible to users of Great Eastern Highway and possibly some residents.

A 30 m area between Great Eastern Highway and the railway contains trees and shrubs that visually screen the plant site. A rehabilitation and landscaping programme is expected to be undertaken within the Meenaar Industrial Park by the Industrial Lands Development Authority (now part of Landcorp) to establish native trees and shrubs, providing further screening of the plant. However, this visual screen would take some time to become established.

The location of the secondary processing plant in a broad valley also reduces the visibility of the plant from Great Eastern Highway; however, it is not expected that it would be entirely obscured. Although the conceptual plan for the Meenaar Industrial Park includes a vegetated area to the east of the plant site, the secondary processing plant may be visible from the elevated section of Great Eastern Highway to the east of Meenaar. Partial views of the plant may also be obtained from other sections of Great Eastern Highway not screened by road cuttings or embankments.

To minimise potential impacts on road safety and neighbourhood amenity, Ashton would direct all external lighting inward towards the premises and shield it from the direction of residences.

Ashton would landscape the secondary processing plant to visually screen the site from the Great Eastern Highway. The landscaping would include the establishment of a vegetative screen within the internal buffer area using local native trees and shrubs in strategic areas. A 2 m landscaped earth mound, taking into account natural drainage patterns, may also be established along the northern perimeter to screen the plant. Similarly, the bunds of the evaporation ponds would provide a screen along the eastern boundary.

The EPA considers that Ashton's proposed secondary processing plant site would have minimal visual impact and would be acceptable, if landscaping and lighting control were carried out as described in the PER. The EPA recommends that, prior to the start of construction activities at Meenaar, Ashton should prepare a plan detailing visual impact and landscaping measures, as part of the EMP, in consultation with the Shire of Northam. The plan should meet the requirements of the EPA (see Recommendation 2).

6.2.3 Risks and hazards

The EPA considers that people should not be exposed to unacceptable levels of risks and hazards from a development. The risk criteria developed by the EPA (EPA Bulletin 611) which are pertinent to this assessment are:

- A risk to individuals in a residential area of one in a million per year is considered so low as to be acceptable to the EPA.
- Risk levels from industrial facilities should not exceed a target of fifty in a million per year at the site boundary for each individual industry.
- A risk level for non-industrial activity located in buffer zones between industrial facilities and residential zones of ten in a million per year or lower, is so small as to be acceptable to the EPA.

The EPA considers that an assessment of risk to the community from a hazardous industrial development should be undertaken as part of the environmental impact assessment. Projects should be planned, designed and controlled so that risks and hazards are minimised and made acceptable. Contingency plans for accidental industrial spillages should be prepared. Facilities and emergency procedures for dealing with accidents should be planned to manage events which could still occur.

Preliminary risk analysis

A preliminary risk assessment of the secondary processing plant has been undertaken on behalf of Ashton. The analysis provides a preliminary assessment of the major hazards associated with the operations of the secondary processing plant that would have the potential to affect public safety beyond the plant site.

The main potential hazards identified were those associated with the storage of 150 tonnes of liquified petroleum gas, or LPG (mainly as propane). The assessment included the storage of 100 tonnes of anhydrous ammonia at Meenaar, which Ashton now propose not to use. Therefore the risk contours developed for the plant, which are shown in Figure 4, can be considered to over-estimate the extent of the risk. The ten in one million a year risk contour is contained within the boundary of the plant site, and the one in one million a year risk contour is contained almost entirely within that boundary. The individual risk level of fifty in one million a year was plotted, but appeared only as a single point over the LPG storage vessel.

The principal hazard associated with the LPG storage vessels is that of fire from an external source that threatens to overheat the vessel and cause flammable vapours to be released. Ashton has made a number of commitments to plant safety and risk minimisation at Meenaar. These include:

Commitment 25	The storage and handling of hazardous materials would be undertaken in accordance with relevant statutes and codes, and Ashton would institute an ongoing worker safety training programme.
Commitment 26	An emergency management plan would be developed by Ashton prior to commissioning, in consultation with the Department of Mines. The plan would include measures to be taken in the event of seismic activity.
Commitment 27	The LPG storage vessel would be designed and operated in accordance with *LP Gas: Storage and Handling* (AS 1596—1989), and would incorporate safety measures such as a fixed water spray (deluge) system as described in that standard.

Heat and fire protection of the LPG storage vessel would be provided through the establishment of a sufficient separation distance from potential heat sources as approved by the Department of Mines. The fixed water spray (deluge) system would be operated in the event of an external fire or heat source near the vessel. This spray system would be operated periodically (weekly) to ensure it was in operating order. Water would be applied to the vessel at a rate of not less than 10 L/min. per square metre of the total surface area of the vessel. Furthermore, the automatic spray system would include provisions for manual initiation and shut-off, and the means of manual initiation would be accessible under all fire conditions. The automatic system would be designed to come into operation in response to a 'fire-detected' signal, but would not be operated by the vapour pressure of the LPG storage vessel. The system would be designed to ensure that runoff water applied to cool the vessel, or from testing the system, did not endanger the foundations of the storage vessel.

The emergency management plan to be developed by Ashton will specify measures to be taken in the event of significant incidents involving hazardous chemicals or LPG stored on site.

The risk contours are based upon the conceptual design and do not incorporate risk mitigation measures such as the proposed fixed water spray (deluge) system for the LPG storage system.

A review of the preliminary risk assessment by the Explosives and Dangerous Goods Division of the Department of Minerals and Energy has indicated that the risk contours are within the limits of uncertainty. Furthermore, the review showed that the storage of 150 tonnes of LPG (and the 100 tonnes of anhydrous ammonia which are no longer required) at Meenaar would meet the EPA criteria established in Bulletin 611, provided all requirements of the Dangerous Goods Regulations 1992 are met.

Seismicity

The 1968 Meckering earthquake had a Richter magnitude of 6.8 and the return period for an earthquake of this magnitude is approximately 110 years. Ashton indicate that the effects of an earthquake with an annual recurrence interval of 500 years and a corresponding Richter magnitude of 7.2 are likely to be as follows:

- horizontal ground movement with a maximum velocity of 160 mm/s;
- horizontal ground movement with a maximum acceleration of 1.6 m/s, oscillating at a high frequency due to the generally shallow nature of the soils in the region;
- poorly graded, saturated and loose fine sands may tend to lose their shear strength and bearing capacity from liquefaction during an earthquake, possibly causing minor landslides;
- embankments may deflect longitudinally in a wave-like fashion, possibly resulting in the shearing of soil wedges from sloping faces; and
- waves may form in dams and ponds, possibly resulting in waves overtopping embankment walls.

Ashton propose that a number of measures would be taken to ensure that the secondary processing plant could withstand seismic events of the magnitudes considered credible. These would include the construction of critical structures, such as the barium precipitation building and chemical storage areas, upon heavy raft foundations to provide support. Additional bracing would also be provided. In terms of other building structures, appropriate sections of *SAA Earthquake Code* (AS 2121—1979) and AS 1170.4 (draft of the revised earthquake code) would be adopted for the design and construction of the secondary processing plant.

It is anticipated that the LPG storage vessel would be supported by a fixed-end column and a sliding-end column to allow for expansion and contraction of the vessel. The vessel would be supported above ground on reinforced concrete foundations. The vessel would be designed and constructed such that it met the requirements of *LP Gas: Storage and Handling* (AS 1596—1989) and the above earthquake codes.

Ashton indicate that the evaporation ponds would be designed to minimise the risk of damage resulting from seismic activity, and to meet performance criteria aimed at achieving low risk in relation to overtopping of embankments from seismically induced wave action; embankment failure, floor cracking, and cut faces slumping and causing excessive waves during a seismic event; leakage of wastewater; high life expectancy; and capacity for embankments to remain stable if subjected to accelerations and/or velocities arising from the estimated 50-year recurrence intervals presented in Gaull and Michael-Leiba (1987).

To design the evaporation ponds for a seismic event, Ashton would undertake the following work:

- assessment of the on-site soil conditions to determine their compaction properties and dispersivity;
- identification of appropriate locations and materials for the construction of the evaporation ponds;

- establishment of design criteria for the embankment construction, including specifications on compaction control for the earth embankments during construction;
- finalisation of the preliminary geometric arrangement of the ponds, taking into account the optimum shape of the ponds and the likely orientation of any seismically induced faults;
- completion of a stability analysis to model a soil profile, simulate the effects of seismic acceleration on the stability of the structure, and assess the factor of safety against failure of cut faces or embankments; and
- selection of a suitable synthetic liner with favourable properties relating to permeability, puncture resistance, shear strength and long-term resistance to the effects of ultraviolet light.

Ashton indicate that the pond embankments would be designed with an impervious core and cut-off to prevent seepage of water through the soil. The selected side slopes would be designed to provide adequate slope stability and to minimise the effects of erosion due to surface runoff. The ultraviolet resistant liner would protect the embankment from the erosive effects of wave action and prevent water from penetrating the embankments. The height of the embankments would be designed to account for 'wave run-up' due to both wind waves and waves generated from seismic shaking.

Ashton will develop an emergency action plan prior to commissioning, to cover the unlikely event of damage to the evaporation ponds following seismic activity. Inspections of the evaporation ponds would be made on a weekly basis.

Management by Ashton of seismic impacts on the secondary processing operation at Meenaar are addressed in Commitments 25, 26, 27 and 32.

The Geological Survey of WA has reviewed Ashton's proposal and considers that suitable undertakings have been made by Ashton concerning the necessary investigation and design activities to complete the designs to construction stage.

The EPA considers, on the basis of the preliminary risk assessment, the commitments by Ashton, and the advice of the Department of Minerals and Energy, that the individual risk levels developed for the secondary processing plant would be acceptable. Ashton's proposal to address potential seismic impacts as outlined in the PER is considered comprehensive and is environmentally acceptable . The EPA considers that, prior to the commissioning of the the secondary processing plant, Ashton should prepare an emergency management plan, as part of the EMP, which should address risk issues associated with storage of dangerous goods and seismic contingency plans at the Meenaar site, in consultation with the Department Minerals and Energy. The plan should meet the requirements of the EPA (see Recommendation 2).

6.2.4 Impacts on local community

Ashton predicts that 75% of the construction workforce would come from the local region. Any imported construction workforce would use temporary accommodation in Northam. There is sufficient vacant space in temporary accommodation to make the accommodation strategy viable. The EPA has been advised that ongoing monitoring of accommodation use would be required to ensure unforeseen difficulties are identified and issues addressed.

Ashton propose that the operational workforce would be recruited locally where possible. The EPA has been advised that Ashton's plans for local recruitment are a vital element of the community's support for the proposal. Local recruitment would address issues of unemployment and the downturn in the area's rural economy.

Ashton has undertaken to consult with the Northam TAFE Centre to ensure adequate workforce training programmes are available. This would increase the capacity of the local community to provide the labour force for the proposal.

Some of the operational workforce, particularly skilled workers, are expected to move to the region. The region has ample capacity in community infrastructure, housing and land availability to support an increase in population.

Ashton has made a commitment to undertake a social monitoring programme in conjunction with the management programme proposed for the Meenaar Industrial Park (Commitment 28).

In response to submissions, Ashton has indicated that local contractors would be given the opportunity to tender for contract to service various requirements of the secondary processing plant. Use of local contractors would further enhance the local benefits of the proposal.

6.3 Transport

6.3.1 Transport of beneficiated ore to Meenaar and residues to Mt Weld

Consideration of options

At present there are no direct rail services to the Mt Weld or Meenaar sites; therefore, the modes of transport considered by Ashton were road only and a road–rail combination.

Comparison by Ashton of road and road–rail transport options for concentrate and residues took into account the following issues:

- risk of spillage resulting from accidents;
- flexibility and security of operation; and
- operating and capital cost.

Spillage risk took account of both the probability of accidents causing spillage during transport, and the potential environmental and health consequences of such spillages.

The comparison of accident risks involves a comparison of a long road section with two short road sections, a long rail section, two shunting operations and two road–rail transfers. No adequate statistics are available that directly address the probability of accidents causing loss of containment from transporters similar to those to be used by Ashton on the relevant routes. Ashton acknowledge that, in general, transport by rail is considered to present a lower risk of accident per kilometre travelled than transport by road. However, the company considered that a comparison based on kilometres travelled alone ignores the risk inherent in the shunting and lifting operations that form part of the road–rail option. While spillages occurring in these latter operations would be largely contained in rail yards, they should be included in a risk assessment.

Neither concentrate nor residue would be classified as dangerous goods under relevant regulations, and Ashton do not believe that spillages and the likely consequences would be sufficiently serious to warrant a precise comparison of accident risk for the two options.

Ashton considered that the road only option provides the greatest operational control and flexibility.

The road–rail option would involve additional capital and operating costs in that three independent transport operations (namely, Mt Weld–Leonora, Leonora–Grass Valley, Grass Valley–Meenaar) must be maintained with their distinct equipment needs.

For the above reasons, Ashton concluded that a road only transport operation direct from Mt Weld to Meenaar is the preferred option. The route approved for B-doubles follows the main roads from Laverton to Leonora to Kalgoorlie and then via Great Eastern Highway to Meenaar.

In response to the many submissions concerned about the impacts of road transport, Ashton has pointed out that significant changes to the cost competitiveness of the road-rail option relative to the road-only option would permit the company to revise the preferred transport option.

Impacts of vehicle movements

12,000 t/a of wet beneficiated ore concentrate from Mt Weld would be transported to Meenaar by road using 40 t capacity B-doubles—trucks comprising a prime-mover pulling two trailers. 28,500 t/a of wet residue would be transported from the secondary processing plant for disposal at Mt Weld. Ashton estimate that there would be about four traffic movements per day associated with the transport of ore and residues. Miscellaneous transport would be at one to two truck movements per week.

Both materials would be moved in specifically designed ISO-type tanktainers, each holding 20t, (less than 10 m^3). Concentrate transport to Meenaar would require 600 tanktainer movements per annum. As the ratio of concentrate to residue would be 2:5, most tanktainers travelling from Mt Weld to Meenaar would be empty. All 750 tanktainers would be full for the return journey from Meenaar to Mt Weld.

The journey of approximately 880 km between Mt Weld and the Meenaar secondary processing plant would take about 12 hours, including a 1 hour allowance for meal stops and vehicle checks.

The proposed transport route is as follows:

- Mt Weld to Laverton via the Leonora–Mt Weld road;
- Laverton to Leonora on Laverton Road;
- Leonora to Kalgoorlie via Menzies and Broad Arrow along the Leonora–Kalgoorlie road;
- along the Eastern bypass, Burt Street and Gatacre Street through Kalgoorlie to Great Eastern Highway;
- Kalgoorlie to Meenaar via Coolgardie, Southern Cross, Bodallin, Burracoppin, Merredin, Kellerberrin, Tammin, Cunderdin and Meckering along Great Eastern Highway.

The traffic on the Laverton–Leonora road has increased by over 11% per annum for the past ten years, in line with the general increase in mining activity in the region. Ashton considers that the proposed future 2% increase in traffic associated with its operation at Mt Weld is within normal operating parameters.

The additional heavy truck traffic associated with the transport of ore residues and other items associated with the project is estimated to add approximately 6.3% to the annual average daily heavy vehicle traffic rates on the Leonora–Laverton road. There would be an increase of some 10–50 movements in the daily light traffic between Laverton and Mt Weld as the workforce commuted. The Mt Weld mine access road would be upgraded and maintained by Ashton to the standard required by the Shire of Laverton. State Government road regulations would apply.

Many submissions to EPA raised concerns about noise, vibration, safety and nuisance impacts on the communities along the transport route for the additional heavy transport passing through built up areas between Meenaar and Mt Weld. In its response, Ashton has pointed out that the estimated increases in traffic are limited to approximately two trucks passing each way along these roads each day, generally representing less than 1% of the recorded annual average daily traffic along the proposed routes. However, Ashton are examining ways of reducing this traffic load further by decreasing the volume of residue (calcium phosphate) requiring transport from Meenaar to Mt Weld. Ashton considers that project related traffic is unlikely to significantly decrease road user safety and communities near the transport routes are unlikely to be significantly inconvenienced by the small increases in traffic associated with the project.

The EPA considers that road-only option chosen by Ashton for the transport of concentrate and residue between Meenaar and Mt Weld would have some environmental impact, particularly on communities along the route. However these impacts are not significant and a requirement for road-rail transport by the company is not warranted, given that the materials are not classified as dangerous goods.

Public exposure to radiation from transport

Ashton has made estimates of the doses from gamma radiation that workers and the public would be exposed to during the transport of concentrate, and the transport and storage of residues. Doses due to inhalation were not considered as the materials would be either wet or in sealed vessels.

The principal sources taken into consideration when estimating doses were tanktainers of ore and residues, ore and residue storage tanks, and the residue ponds at Mt Weld.

Ashton considers that the project's transport operations present minimal risk of radiation exposure for the public. There are very few circumstances conceivable in which members of the public would be sufficiently close to concentrate or residues for long enough that they would absorb doses discernible from background levels.

Most realistic scenarios of the public encountering concentrate or residue trucks suggest an annual exposure to sufficiently few trucks (less than fifty) for such brief times (less than a few minutes) at relevant distances (less than 5 m) that the annual exposure would be less than one-thousandth of the recommended annual dose limit for a member of the public.

Ashton does not propose any radiation monitoring of the public along the transport route, as the company has estimated that doses to the general public would be indistinguishable from background doses.

The levels of radiation associated with trucks would be monitored as part of Ashton's normal occupational radiation monitoring programme.

The EPA was concerned at how Ashton would ensure that the concentrate and residue carried in the trucks does not exceed the radiation limit of 7×10^4 Bq/kg required by the Explosives and Dangerous Goods Act and associated regulations, or alternatively identify those that do exceed this level, thus requiring special labelling and handling. Ashton has responded that the estimate of the radioactivity level of the concentrate to be carried to Meenaar is based on the mean level of radionuclide concentrations within the ore samples assayed by Ashton. This estimate (5.4×10^4 Bq/kg) is 20% below the limit specified by regulations as designating a radioactive substance for the purposes of transport (7.0×10^4 Bq/kg). Variation of radionuclide concentration in the ore samples is sufficient only in a small percentage of cases to produce concentrate which exceeds the limit. However, ore being processed will be mined from a variety of sites within the pit, and concentrate from a number of days production will be constantly blended within a large holding tank before shipment. Thus the radioactivity of concentrate is likely to be close to mean levels. Regular measurement of the activity of concentrate will be undertaken by Ashton to ensure that levels are below statutory limits. Should a high activity occur within the holding tank, activity would be reduced through further blending before transporting the material.

B-doubles would be designed to have a low centre of gravity to reduce the risk of rollover. The tanks would be constructed of boiler quality steel to withstand pressures greater than 170 kPa. All nozzles and openings would be designed to eliminate the possibility of leakage from bottom outlets or damage of bottom pipework. The loading and discharge points would be strengthened and shielded to provide rollover protection.

Ashton has indicated that detailed records of each journey would be kept to ensure compliance with speed limits. Travel during bad weather or flood conditions would be avoided. Adequate emergency residue storage for up to 8 days' production would be provided at Meenaar. The drivers of the road vehicles would be provided with cab-mounted radios to allow regular contact with plant personnel at Mt Weld and Meenaar. This equipment could also be used in the event of an accident.

Emergency response and cleanup procedures

If a tanktainer were to rupture, the amount of contents lost and its immediate behaviour would be governed by its consistency. Concentrate (15% moisture) and residue (30% moisture) would be in the form of a dense paste and, under most rupture scenarios, a large proportion of

the contents would remain within the tanktainer. Ashton has considered the worst case scenarios, involving the consequences of total loss of the contents.

Spilt materials would mostly remain adjacent to the tanktainer and little fluid would enter the underlying soil or, in a built-up area, run off into drains. Under dry conditions, effectively no fluid would leave the paste at this low moisture content. During periods of rain, the paste may be spread by surface water.

Thorium oxide and uranium oxide, the radioactive constituents of the natural ore, are effectively insoluble at a neutral pH and would be transported as particulates in any surface water or rain runoff. Under saline conditions, radium in the concentrate or residues may be quite soluble. Amounts of radium in the concentrate and residues are estimated by Ashton to be very low under most circumstances.

Exposure of the public or emergency crews to radioactivity could occur through gamma radiation or through the inhalation of dust containing radionuclides. Ashton has estimated gamma radiation exposure from a thin layer 20 m in diameter for a person standing 1 m away over 48 hours would amount to about one-thirtieth for concentrate or one-seventieth for residues of the annual limit recommended for public exposure respectively.

Inhalation of long-lived radionuclides in dust could present a greater risk of exposure should clean-up measures be delayed such that the concentrate or residues began to dry or spread. Ashton expects that emergency procedures would be able to avoid this outcome under most scenarios.

Ashton has given a commitment that transport and handling procedures will comply with the requirements of the Commonwealth of Australia's Code of Practice for the Transport of Dangerous Goods by Road and Rail 1987 and the Commonwealth of Australia's Code of Practice for the Safe Transport of Radioactive Substances 1990, together with the Western Australian Dangerous Goods Regulations 1992 and the Radiation Safety (Transport of Radioactive Substances) Regulations 1991 (Commitment 38). The Commonwealth and State dangerous goods codes and regulations require correct labelling, placarding and documentation when consigning dangerous goods. In the event of an accident, this information would help to ensure an appropriate response.

Ashton has given a commitment that emergency procedure guides and emergency contacts would be documented and available in vehicle cabs, and all drivers would be instructed in the actions, as specified under the Western Australian Hazardous Materials Emergency Management Scheme, to be taken in the event of an accident (Commitment 39). The Western Australian Hazardous Materials Emergency Management Scheme involves:

- the control authority (usually the police) responsible for management of the entire incident;
- the combat authority (the fire brigade) responsible for the physical combat of the fire, leak or spill of dangerous goods; and
- support organisations responsible for the provision of resources and specialist advice as needed; for example, the Health Department, the Department of Minerals and Energy and the EPA.

Ashton has indicated that emergency procedures to prevent pollution from transport accidents would be prescribed fully prior to commencement of transport. These procedures would specify that initially:

- the area surrounding the spill be cordoned off—a distance of 25 m from the edge of the spilt material would be sufficient to reduce the rate of public exposure to a negligible level; and
- the spill be sealed with foam spray to avoid drying and dust formation. Trucks would carry 12 L cans of portable foam capable of covering any spilt paste in danger of drying; if these spray extinguishers were destroyed, water, when available, could be sprinkled on to the spill until the fire brigade arrived.

The initial response team should arrive within several hours of the accident, within which time public exposure would be minimal and the material would be unlikely to have dried sufficiently to produce significant quantities of dust. Within 12 hours of notification, the Ashton clean-up team would arrive. Industrial wet–dry vacuum cleaners would be used to transfer paste and the surface layer of soil to another tanktainer. A radiation check of remaining soil would be undertaken to ensure that no radioactive material was left behind. Nutrient and salt pollutants would be removed by this operation with the exception of those dissolved in the small amounts of water that might have left the site.

If the paste were to enter an enclosed waterbody, specialised recovery teams would be used to pump out the undissolved residues, which would contain the majority of the low solubility phosphate and radionuclide components. Paste entering running water would be largely lost, but in such a situation significant acute or chronic effects are unlikely, due to dilution.

In the event of a road accident, time taken to mobilise a response team would be minimised by provision of radio schedules for each truck, clearly marked contact numbers on the vehicle, and training and equipping of rapid response teams (comprising Mt Weld and Meenaar employees).

Ashton has indicated that drivers would be trained in emergency procedures, including the use of foam and clean-up operations. All emergency equipment would be maintained by Ashton to ensure a safe operation.

Ashton has given a commitment to address the monitoring and management of transport issues in the EMP, to be developed in consultation with, and to the satisfaction of, the EPA (Commitment 2).

In response to submissions about the danger that heavy and dangerous goods traffic associated with Ashton's proposal poses to other road users and communities along the route, the company has responded that compliance with the requirements of regulatory authorities and licence/permits issued for vehicles and to drivers would ensure that the established safety standards would be met. These safety standards have been developed to ensure that the risk of accidents is minimised. One of the conditions of contract for transport operators engaged by Ashton would be that these safety standards are met.

Conclusion

The EPA considers that the impacts of transport of concentrate and residues between Mt Weld and Meenaar would be minimal and therefore acceptable. The EPA considers that, prior to the commissioning of the secondary processing plant, Ashton should prepare a transport management plan and a radiation management plan, as part of the EMP in consultation with the Department of Minerals and Energy and the Health Department. The plan should meet the requirements of the EPA (see Recommendation 2).

6.3.2 Transport of dangerous goods and other feedstock chemicals

Consideration of options

The options available to Ashton for the transport of chemicals and dangerous goods from Kwinana or Fremantle to Meenaar are either directly by road; or by road to the Kewdale rail depot, where facilities exist for loading International Standards Organization (ISO) containers on to rail wagons, and then by rail to Grass Valley and by road to Meenaar. The latter option would require an unloading facility for ISO containers to be constructed at Grass Valley.

The routes available for transporting bulk chemicals from Kwinana to Meenaar are limited to those approved by the Main Roads Department (MRD). Ashton's preferred route to Meenaar is via Northam along Great Eastern Highway.

Environmental impacts of transport of chemicals and dangerous goods to Meenaar

Chemicals to be used at the Mt Weld beneficiation plant and the Meenaar secondary processing plant (Table 1) would be transported by road. All chemicals would be sourced in the Kwinana region where possible; oxalic acid and some minor constituents such as solvents may need to be imported via Fremantle.

A total of 600 t of chemicals would be transported to Mt Weld each year; while the Meenaar secondary processing plant would require 38,220 t/a in Stage I, increasing to 49,620 t/a in Stage III. If ammonium bicarbonate were used instead of oxalic acid, tonnages would increase by 3,000 t/a to 52,620 t/a .

Transport of all chemicals between Kwinana and Meenaar would follow roads approved for B-doubles and pass along Cockburn Road, Stock Road, Leach Highway, Tonkin Highway, Roe Highway and Great Eastern Highway. The route from Fremantle would originate in North Quay and cross Stirling Bridge to join Leach Highway; from there, it would follow the B-double route. State and Commonwealth regulations and codes for the transport of dangerous goods would be followed where applicable.

Based on the composition of feedstock chemicals for the Meenaar secondary processing plant, approximately 70% of transported stocks would be classified as dangerous goods and would therefore be carried by B-doubles. Assuming an average 40 t load, this would require approximately 1,000 trips per annum. All chemicals classified as dangerous under the Dangerous Goods Regulations 1992 would be transported in accordance with those regulations.

The 30% of chemicals not classified as dangerous goods would be transported under the MRD's general road traffic regulations and guidelines. These chemicals would be transported by a mix of articulated vehicles such as B-doubles and ordinary rigid trucks. Assuming an average 30 t load, this would require 500 trips per annum.

Ashton has indicated that emergency procedures required to combat chemical spills resulting from accidents occurring during transport would be covered under the Western Australian Hazardous Materials Emergency Management Scheme.

The Explosives and Dangerous Goods Division of the Department of Minerals and Energy has indicated that it would work with Ashton to ensure that its emergency management plan complies with the Dangerous Goods Regulations 1992.

Conclusion

Following its review of the PER, the Explosives and Dangerous Goods Division of the Department of Minerals and Energy has indicated that Ashton's conclusion and preferred options are acceptable.

The EPA considers that the impacts of transport of dangerous goods and process chemicals to the secondary processing plant at Meenaar would be minimal and therefore environmentally acceptable. The EPA recommends that, prior to the commissioning of the the secondary processing plant, Ashton should prepare a transport management plan, as part of the EMP, and in consultation with the Department of Minerals and Energy. The plan should meet the requirements of the EPA (see Recommendation 2).

6.3.3 Transport of rare earths

For cerium and the individual rare earths extracted in Stages II and III, rare earths compounds would be produced in the form of a dry powder and stored in storage bins; powder would be packed inside sealed plastic-lined drums varying in size from 1 kg to 10 kg. Drums would be stacked on pallets and shrink-wrapped in plastic film to ensure the integrity of loads. Rare earths concentrates produced in Stages I and II would be packaged in 900 kg lots in 'bulka bags'. All packaging would be to approved Australian and export standards.

Products would be stored on site pending customer demand. Pallets would be shipped in sea containers; smaller quantities would be shipped as general cargo. Loads transported in sea containers would vary in size according to demand. In general, it is expected that load-out quantities would be in the order of 20 t. In this case, approximately 250 loads per annum would be transported by standard trucks (along Great Eastern Highway and Leach Highway) to the North Quay container terminal in Fremantle for shipping. Demand for small quantities of individual rare earths may increase as Stages II and III of the project produce more refined products, leading to a decrease in load size and an increase in load frequency.

The EPA considers, on the basis that the rare earth products would be non-radioactive, of low toxicity, and would be well packaged and handled, that the transport of rare earth products from Meenaar to Fremantle is environmentally acceptable.

6.4 Radiation

6.4.1 Previous assessments by EPA of proposed rare earth plants

The EPA has previously assessed two other proposals to establish facilities to process rare earths in WA. Neither of these proposals has proceeded to production. A brief summary of the EPA's assessments of these proposals is provided in Appendix 5.

6.4.2 Radiation protection standards

The EPA considers that people need protection from exposure to excessive levels of radiation.

The annual average dose for people living in industrialised countries, from background and artificial sources, has been evaluated to be about 2.4 mSv (United Nations Scientific Committee on the Effects of Atomic Radiation 1988). Radon gas in homes contributes nearly half of this radiation.

The PER identifies the legislative requirements and codes of practice which are used to control radiation in Western Australia, most of which are based on recommendations from the International Commission on Radiological Protection (ICRP) and the National Health and Medical Research Council.

In setting radiation protection standards, the ICRP assumes that there is no threshold dose for the induction of cancer and that the effect of radiation is directly proportional to the dose and is independent of dose rate.

The Australian Ionising Radiation Advisory Council has advised the EPA that the dose limits recommended by the ICRP distinguish between people exposed to radiation in the course of its work and members of the public. In their most recent recommendations, dose limits for occupationally exposed employees are set at a level of dose, above which, for regular and continuous exposure over a working lifetime, the consequences for the individual would be widely regarded as unacceptable. The ICRP recommends a dose limit of 1mSv in a year, excluding exposure from natural background radiation and medical exposure. The ICRP considers that continued exposure at this level from deliberate practices which are a matter of choice would be just short of unacceptable.

The two tiered dose limit system has been introduced in Australia in order to focus monitoring resources and control efforts on the most exposed employees.

6.4.3 Assessment of Ashton's proposal

Management approach

Ashton has committed to the ALARA principle (which requires that exposures to radiation be kept as low as reasonably achievable, taking into account social and economic factors) for all components of the project (Commitment 12).

Ashton has committed to comply with all formal regulatory radiation protection requirements. Commitment 13 states that Ashton would meet the Commonwealth requirements for radiation control outlined in the Commonwealth of Australia publications, the Code of Practice on Radiation Protection in the Mining and Milling of Radioactive Ores 1987 and the Code of Practice on the Management of Radioactive Wastes from the Mining and Milling of Radioactive Ores 1982. Both of these codes have been adopted under the Mines Regulations Act Regulations. Similarly, the Western Australian requirements for radiation control outlined in the Radiation Safety (General) Regulations 1983 would be met.

Commitment 14 states that under Ashton's commitment to the ALARA principle, radiation protection design targets to be adopted for all employees would be less than 2 mSv/a and would not require designation of employees as radiation workers.

Prior to commissioning facilities at Mt Weld and Meenaar, Ashton is required to prepare and submit a Radiation Management Plan that would address the management and monitoring of occupational and environmental radiation issues associated with:

- mining and milling
- transport
- residue disposal

to the satisfaction of the Department of Minerals and Energy and of the Radiological Council, with advice from the EPA (Commitment 4).

In its proposal, Ashton has indicated that the design criteria for the rare earths project would include the following measures:

- establishment of a controlled-access area for the barium–radium precipitation stage;
- physical separation of controlled areas from other sections of the rare earths processing operation by use of barriers;
- design of the above areas to resist earthquake damage;
- reduction of air contamination by avoiding the handling of dry material; for example, the wet milling of ore and the disposal of residue in wet form;
- remote operation of process equipment located in the controlled area, to reduce potential exposure times;
- full containment of the process to minimise potential for spillages;
- shielding, where necessary, of equipment and storage areas containing bulk quantities of radioactive material, to reduce exposure rates;
- selection and design of equipment in the controlled area for reliable operation and ease of maintenance;
- use of non-absorbent, easy-to-clean floor surfaces, bunded to contain spills for return to the process;
- provision of facilities for easy and regular washing of floors and equipment. All washings would be returned to the process via floor sumps; and
- provision of operator access via a change room to controlled areas (i.e. the monazite milling and residue filtering facilities).

The proposed radiation protection design criteria for the project are listed in Table 4. Ashton indicates that radiation exposures would be continually reviewed during the operation of the mining and processing operation to identify opportunities to improve practices and procedures.

Table 4. Radiation protection design targets proposed by Ashton - based on PER

Personnel category	Design criteria proposed by Ashton	Relationship to radiation protection standards
Employees	<2 mSv/a	Less than 1/10 the annual dose limit for designated employees
Members of the public	<0.05 mSv/a	Less than 5% of annual dose limit

Sources and management of radiation emissions

The amounts of radioactive thorium and uranium involved in Ashton's proposal are summarised in Table 5.

Table 5. Concentrations and annual tonnages of radionuclides in mine and residue streams (from PER)

Material	Total dry weight	Thorium		Uranium	
	(t/a)	(%)	(t/a)	(%)	(t/a)
Mined ore	50,000	0.07	34.4	0.002	1.25
Beneficiation residue	40,000	0.05	20.4	0.002	0.95
Meenaar plant residue	20,000	0.07	14.0	0.001	0.30

Possible radiation exposure pathways associated with the proposed development comprise:

- External:
  - Exposure to gamma radiation from materials outside the human body.
- Internal:
  - Inhalation of particulate thoron and radon progeny, which form in the atmosphere by the decay of thoron and radon gas escaping from solid materials.
  - Inhalation of airborne particulate matter containing inspirable particles of long-lived alpha-emitting radionuclides.

All three pathways may be of consequence in the handling of members of the Th-232 and U-238 decay chains, which result from the decay of the monazite minerals present in the rare earths ore.

Release of radon and thoron gases may be expected upon exposure of the ore during mining, or during processing of the ore. Thoron (Rn-220) has a very short half-life of only 55 seconds and thus poses minimal risk at any distance away from its source. Ashton considers that both thoron and radon would contribute negligible radioactivity to the total dose exposure of employees in the operation.

The Health Department considers that, as the thorium/uranium content of the ore is only about 1/50 that of beach sands monazite, the radiological impact of the project would be minimal.

Transport of beneficiated ore concentrate to Meenaar

The beneficiated ore concentrate from Mt Weld would have an estimated specific activity of 5.4 x 10^4 at 15% moisture. The activity estimate is based on a concentration of 0.14% thorium and 0.004% uranium on a dry weight basis, as estimated in concentrate from the AMDEL pilot plant (or 0.115% thorium and 0.003% uranium in the paste).

Levels of radiation would be sufficiently low that beneficiated concentrate would not be classified as a radioactive substance under the WA Radiation Safety (Transport of Radioactive Substances) Regulations 1991, the Commonwealth of Australia's Code of Practice for the Safe Transport of Radioactive Substances 1990, or the State and Commonwealth dangerous goods regulations and codes. These specify that radioactive substances are those emitting in excess of 7.0 x 10^4 Bq/kg. For the level of radioactivity in a batch of the concentrate to exceed this statutory limit, a 30% increase above the average would be required. In response to submissions, Ashton considers that such an increase is highly unlikely, given the low variability of radioactivity throughout the orebody and the blending of ores that would occur in stockpiling, beneficiation and storage.

As a result of Ashton's commitment to the ALARA principle in handling this low specific activity substance, many of the practices specified under the above codes and regulations, although not formally required, would be adopted in the transport plan.

The Department of Minerals and Energy has indicated that the concentrate would not be defined as a radioactive substance for the purposes of transport.

Ore beneficiation at Mt Weld and secondary processing at Meenaar

Chemical treatment of ores may increase the radon and thoron emanation by opening up additional release pathways. Chemical attack would be strongest during processing of the beneficiated ore. Estimates by Ashton show that release of both gases during the various phases of processing would be negligible. Potential release rates would be highest for the barium–radium precipitation step. However, Ashton anticipate that actual releases would be low due to the small quantities of residue present at any one time. Enhanced ventilation in this area would ensure that gases did not accumulate to significant concentrations.

Ore beneficiation and processing contain mainly wet stages. Ashton expect that air quality within these operations would be controlled such that the concentration of airborne ore and beneficiated ore would not exceed 0.1 mg/m^3. Uncontrolled venting of material from the calciner might result in an elevation in the internal component of occupational dose. Emission control requirements would be determined according to the results of radionuclide deportment tests currently being conducted by ANSTO as part of a pilot plant study.

No specific radon or thoron control measures are planned by Ashton, as thoron and radon release are predicted to be sufficiently small not to be a problem.

The Australian Ionising Radiation Advisory Council and the Australian Radiation Laboratory has indicated in its submissions to the EPA that it is unlikely that the project would present a serious occupational or public radiation exposure problem. The Department of Minerals and Energy also indicated that radiation is not expected to be a significant hazard at the various stages of the project.

The Department of Minerals and Energy has indicated that the processing of the concentrate will require some level of radiological surveillance.

The Health Department considers that, as the thorium/uranium content of the ore is only about 1/50 that of beach sands monazite, the radiological impact of the project would be minimal. This would require ongoing verification. The Health Department also considers that positional monitoring of radon gases should be used to establish a background level, and that significant increases did not occur.

As discussed in Section 6.2.2, EPA will require Ashton to provide an analysis of the plant product, to assist in the determination of the potential for types of pollution from the calciner

stack. Stack monitoring of particulates and their composition, including heavy metals and radionuclides, would be also be required.

Transport of secondary processing residues to Mt Weld

The 28,500 t/a of secondary processing residue would have a specific activity of 2.3 x 10^4 B/kg at 15% moisture, after blending of all residue streams within the plant. The material would be in the form of a paste able to be pumped following reslurrying. Based on effectively all radionuclides leaving the Meenaar secondary processing plant in the residue , the concentration of radionuclides would be 0.048% thorium and 0.001% uranium in the residue paste.

Should calcium phosphate be separated from the residue at Meenaar, this would increase the level of radiation in this residue to be returned to Mt Weld by approximately one third. At that increased level, radioactivity would be still be less than half that of the transport limit requiring designation as a radioactive substance under the Explosives and Dangerous Goods Act.

At Meenaar, the residue would be stored in a 350 m^3 tank. In accordance with the ALARA principle, this tank would be shielded by a 2 m high earthen wall, approximately 1 m thick, to reduce the potential for exposure of plant employees and of truck drivers to gamma rays.

Following delivery of concentrate to the secondary processing plant at Meenaar, the empty containers would be refilled with residue for transport back to Mt Weld via the same route. Upon arrival at the mine site, the residue would be pumped into below-ground residue ponds. Each pond would be approximately 75 m x 75 m and would hold about 2 years' production of residue. After filling, these ponds would be sealed and capped.

The Department of Minerals and Energy has pointed out that the residues returned to Mt Weld would have less radioactivity than the original deposit, and that the concentrations of thorium and uranium would be below the radioactive waste criteria specified in the relevant Code of Practice. At decommissioning of the residue ponds, the cover would attenuate radon emissions by more than 90% and gamma emissions by more than 99%.

Solid residues and wastewater

The deposition of radioactive waste from the project would be governed by the Commonwealth of Australia's Code of Practice on the Management of Radioactive Wastes from the Mining and Milling of Radioactive Ores 1982. The two waste streams which may come into the scope of the Code would be the residue from the beneficiation plant at Mt Weld and the residue from the secondary processing plant at Meenaar. Wastewater from the Meenaar plant would contain concentrations of radionuclides similar to those found in water supplies around metropolitan Perth (e.g. 10–90 mBq/L of Ra-226 and 15–150 mBq/L of Ra-228) and would not be classified as radioactive.

Precipitation and filtration treatments of neutralised wastewater from the Meenaar plant are expected to remove effectively 100% of the thorium and 99.8% of the uranium as solids in the main residue for return to Mt Weld. The minimal amounts of radionuclides entering ponds with wastewater would not accumulate to higher concentrations, as approximately 7,000 t/a of solids would be deposited with them on evaporation.

Of concern to the EPA is the potential for radionuclides to leach into groundwater from the deposition of solid residue from the secondary processing plant. Within the solid residue streams, radionuclides would occur as high surface area hydrous oxides and hydroxides. Although both thorium and uranium would be largely insoluble under most conditions likely to be encountered, radium would be fairly soluble in saline groundwaters.

Ashton expect that all radionuclides passing to the cerium circuit would be precipitated out during neutralisation of the wastewater. Radium in the liquor stream passing to the rare earth solvent extraction process would be removed by precipitation with sulphate. Should this process be shown to remove unacceptably high levels of rare earths, Ashton has indicated that a different, equally efficient method of radium removal would be undertaken. The radionuclides in solid waste resulting from neutralisation of wastewater and precipitation of radium would be returned to Mt Weld in the general residue stream.

Ashton predicts that the lead component (Pb-210) in the rare earth liquor would be effectively removed by precipitation with sulphate. This process would also occur in the impurity removal stage in the isolated section of the processing plant. The residue would then be blended into the major waste stream. As Pb-210 is part of the uranium chain that occurs at very low concentrations, amounts of lead residue would be small.

As the orebody within the carbonatite pipe at Mt Weld contains levels of radionuclides above those to be deposited in residue structures, pollution of soils and waters by radionuclides from wastes is unlikely to have a significant impact. Baseline measurements of groundwater radioactivity at Mt Weld show that levels of alpha and beta radioactivity are presently about twice the action levels specified by the Department of Health for drinking water (action levels for gross alpha or gross beta are 0.1 Bq/L; values in excess of these do not necessarily mean that the water is unfit for drinking). Measured values in groundwater at Mt Weld are 0.14 Bq/L and 0.11 Bq/L for gross alpha, and 0.38 Bq/L and 0.25 Bq/L for gross beta. Ashton's containment measures of residues within ponds appear to be largely aimed at the salts from by-products of the beneficiation and caustic cracking processes. Nevertheless, the compacted clay liner of the ponds would retard any large movement of radionuclides.

Prior to commissioning residue disposal facilities for these streams, Ashton would obtain approval for a management plan covering operations at the facilities from the Department of Minerals and Energy, the Radiological Council, the EPA and other relevant authorities. The management plan would cover the design of the facility, its operation and final rehabilitation.

The Australian Radiation Laboratory has indicated that, given the chemical state of radium and the particle size of the residues, it is possible that radon emissions in the residues will be significantly greater than in the ore. In response to this issue, Ashton considers that radon emissions from residues would be inconsequential given the projected levels of radon emissions from process materials during mining, beneficiation and processing. The Health Department considers that radon levels should be measured for verification purposes.

It is considered that, whilst radon emissions may be higher in the residues as compared to the ore, the concentration of uranium (the parent of radon) in both residue and ore is very low, and within the range of background values. Covering of the residue ponds would result in negligible radon emissions from the residue.

The EPA has recommended previously in this report (Section 6.1.3) that Ashton should prepare a plan for residue disposal and wastewater management at Mt Weld, as part of the Environmental Management Programme (EMP), and in consultation with the Water Authority of Western Australia, the Health Department of Western Australia, and the Department of Minerals and Energy of Western Australia. The plan should meet the requirements of the EPA.

Public exposure

With the exception of the transport component, pathways of exposure for the public not directly entering Ashton premises at Mt Weld or Meenaar would be as follows:

- Gamma radiation: Ashton considers that sources are of such low specific activity that doses at the boundaries of the plants would be indistinguishable from background levels.
- Radon and thoron: Ashton predicts that emissions within the plants and mine would be sufficiently low as to be indistinguishable from background levels at the plant boundary.
- Inhalation of radionuclides: Strict management of concentrate and residues by Ashton at Meenaar would prevent occurrence of any significant concentration of dust containing radionuclides; small amounts of dust containing radionuclides may escape from the mine and stockpile at Mt Weld but would be unlikely to come into contact with people in the vicinity in quantities that would result in measurable doses.

Visitors to the mine and plants would be regulated such that there was little chance of their receiving a discernible portion of the 1 mSv/a dose recommended as the maximum increment allowable above background levels. Under Ashton's commitment to the ALARA principle, radiation protection design targets to be adopted for members of the public would reduce the

statutory 1 mSv/a required by the Commonwealth of Australia's Code of Practice on Radiation Protection in the Mining and Milling of Radioactive Ores 1987 to 0.05 mSv/a (Commitment 15).

Monitoring

Radiation monitoring is required under the relevant codes and regulations adopted under the Mines Regulations Act. Ashton's proposed environmental monitoring plan is shown in Table 8. The details of the actual programmes would be determined as part of the Radiation Management Plan developed in consultation with the Department of Minerals and Energy and the Health Department. An intensive monitoring programme would be initially undertaken by Ashton to confirm predictions and to identify areas requiring attention (in particular levels in barium–radium precipitation and at the plant boundary).

Ashton would monitor the health of employees in accordance with the *Radiation Safety Act 1975* and other requirements of the Health Department. The final programme and reporting requirements would be determined within the Radiation Management Plan, in consultation with the Radiological Council and the Department of Minerals and Energy, before the commencement of operations.

The Health Department considers it important that there be on-going verification that the radionuclide content of the ore and concentrate remains low throughout the operation, to ensure that radiation exposure is not significantly greater than that predicted in the PER.

Table 6. Environmental radiation monitoring programme

Radiation parameter	Location monitored	Frequency of measurement
Absorbed gamma dose	Mine and plant perimeter	Biannual surveys
Radionuclides in air	Sites around mine or plant	Biannual surveys
Radon and thoron progeny	Sites around mine or plant	Biannual surveys
Radionuclides in water	Bores around evaporation ponds and disposal dams	Monthly

Conclusion

The EPA received submissions from the Department of Minerals and Energy, the Department of Health, the Australian Radiological Laboratory and the Australian Ionising Radiation Advisory Council about radiation aspects of the Ashton proposal. The EPA considers that Ashton's response has adequately addressed the issues raised in these submissions.

The submission by the Department of Minerals and Energy considers that radiation is not expected to be a significant hazard in the Ashton proposal. As a result of earlier discussions with Ashton, and an analysis of the PER, the Department concluded that the facility, including associated waste management systems, could be designed, constructed and operated in such a manner that radiological impacts to the community would be well below national and international limits, and that commitments by Ashton would be sufficient to ensure this would be the case.

The Health Department considers that, as the thorium/uranium content of the ore is only about 1/50 that of beach sands monazite, the radiological impact of the project would be minimal.

The EPA considers that effective removal of radionuclides from the wastewater is a key component to the environmental acceptability of the plant. This issue was also raised by the

Australian Radiation Laboratory. Ashton will be required to provide further details on the alternative radium removal process should this be necessary, prior to commissioning of the secondary processing plant. Efficient removal of radionuclides in the plant liquor stream will need to be demonstrated by Ashton before a Licence to operate the plant will be granted by EPA. Such details of radiological significance will be submitted to the Department of Minerals and Energy and the Radiological Council for assessment.

The EPA considers that the environmental impacts of radiation associated with the proposal are manageable and therefore acceptable. The EPA considers that, prior to the commissioning of the beneficiation and secondary processing plants, Ashton should prepare a radiation management plan, as part of the EMP, and in consultation with the Department of Minerals and Energy and the Department of Health. The plan should meet the requirements of the EPA (see Recommendation 2).

7. Conclusions and recommendations

The EPA has identified a number of environmental impacts associated with the proposal by Ashton. Based on its assessment of the proposal and additional information provided by the proponent in response to questions raised as a result of the assessment process, the EPA makes the following conclusions and recommendations:

Recommendation 1

The Environmental Protection Authority has concluded that the proposal by Ashton Rare Earths Ltd is acceptable and all impacts are manageable, either by the environmental management commitments given by the proponent, or by the Environmental Protection Authority's recommendations in this report.

In reaching this conclusion, the Environmental Protection Authority 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.**

Accordingly, the Environmental Protection Authority recommends that the proposal could proceed, subject to the proponent's commitments to environmental management (Appendix 1) and the Environmental Protection Authority's recommendations in this report.

The EPA believes that any approval for the proposal based on this assessment should be limited to five years. Accordingly, if the proposal has not been substantially commenced within five years of the date of this report, then such approval should lapse. After that time, further consideration of the proposal should occur only following a new referral to the EPA.

The EPA notes that during the detailed implementation of proposals, it is often necessary to make minor and non-substantial changes to the designs and specification which have been examined as part of the EPA's assessment. The EPA considers that subsequent statutory approvals for this proposal could make provision for such changes, where it can be shown that the changes are not likely to have a significant effect on the environment.

Recommendation 2

The Environmental Protection Authority recommends that the proponent should prepare and implement an Environmental Management Programme to meet the requirements of the Minister for the Environment, describing plans for, but not necessarily be limited to:

- **conservation of native flora and fauna at Mt Weld;**
- **rehabilitation of disturbed sites, overburden dumps and residue ponds at Mt Weld;**
- **contingency plans for major seismic events at Meenaar;**
- **radiation management;**
- **solid and liquid waste management at Mt Weld and at Meenaar;**
- **visual impacts and landscaping at Mt Weld and Meenaar; and**
- **periodic reporting of monitoring results and consequential changes to environmental management.**

The timing of the preparation and review of the implementation of these plans should meet the requirements of the Environmental Protection Authority.

The Environmental Protection Authority concludes that the emission and monitoring of noise, atmospheric contaminants, and solid and liquid waste disposal associated with the construction and operations of the beneficiation plant and minesite at Mt Weld and secondary processing plant at Meenaar, should be controlled through conditions imposed by Works Approvals and subsequently, Licences, under the Environmental Protection Act.

The EPA points out that the proponent's compliance with Environmental Conditions and the conditions of Works Approvals and Licences will be periodically audited. Pollution control limits and other conditions will be periodically reviewed and may be modified by the EPA in the light of operating experience.

Appendix 1

List of environmental management commitments by Ashton Rare Earths Ltd

1 GENERAL

1.1 PROJECT AMENDMENT

Commitment 1 Details of any plan to significantly alter the processing or operation of the project from that proposed in this PER would be referred to the EPA for environmental assessment.

1.2 LEGISLATIVE COMPLIANCE

Commitment 2 The construction and operation of the project would be undertaken in accordance with the requirements of relevant Commonwealth, State and local authority legislation, regulations and codes of practice.

1.3 MANAGEMENT PROGRAMME

Commitment 3 Prior to commissioning of facilities at Mt Weld and Meenaar, Ashton would prepare and submit an Environmental Management Programme that would address, where appropriate, the monitoring and management of the following:

- atmospheric emissions (Commitments 10, 20, 29)
- noise emissions (Commitments 11, 35, 36)
- water management at Mt Weld (Commitments 21, 23)
- chemical handling and storage (Commitment 25, 27)
- solid and liquid residues (Commitments 22, 30, 31, 33, 34)
- transport (Commitments 38, 40)
- workforce management (Commitment 16)
- rehabilitation and decommissioning (Commitments 17, 18, 19, 37)
- social impacts (Commitment 28).

The Environmental Management Programme would be developed in consultation with, and to the satisfaction of, the EPA.

Commitment 4 Prior to commissioning facilities at Mt Weld and Meenaar, Ashton would prepare and submit a Radiation Management Plan that would address the management and monitoring of occupational and environmental radiation issues associated with:

- mining and milling
- transport
- residue disposal

to the satisfaction of the Department of Mines and the Health Department, with advice from the EPA.

1.4 ANNUAL REPORTING

Commitment 5 Annual reports that described the actions undertaken to comply with these environmental management and monitoring commitments would be prepared by Ashton and submitted to the appropriate authority.

2 CONSTRUCTION

2.1 GENERAL

Commitment 6 Ashton would not commence construction of the secondary processing plant until the design and status of the Meenaar Industrial Park buffer zone had been resolved to the satisfaction of the Minister for the Environment.

Commitment 7 All construction materials and practices would comply with relevant Australian standards and codes of practice.

Commitment 8 Solid refuse and material wastes would be removed from construction sites and disposed of in accordance with the requirements of the Shire of Laverton (for the Mt Weld site) and the Shire of Northam (for the Meenaar site).

2.2 REHABILITATION

Commitment 9 Where practicable, vegetation and topsoil cleared during Mt Weld site preparations would be used to rehabilitate disturbed areas.

2.3 POLLUTION CONTROL

Air

Commitment 10 Dust suppression measures, including application of water from tankers, would be implemented at Mt Weld and Meenaar to minimize dust generation during site preparation and construction activities.

Noise

Commitment 11 Construction activities at Mt Weld and Meenaar would be carried out in accordance with statutory requirements relating to noise, and would incorporate appropriate management techniques to ensure that occupational and ambient noise levels were within acceptable limits set by the EPA and the Department of Occupational Health, Safety and Welfare.

3 RADIATION

3.1 GENERAL

Commitment 12 The ALARA principle (which requires that exposures to radiation be kept as low as reasonably achievable, taking into account social and economic factors) would be adopted for all components of the project.

3.2 LEGISLATIVE COMPLIANCE

Commitment 13 The Commonwealth requirements for radiation control outlined in the Code of Practice on Radiation Protection in the Mining and Milling of Radioactive Ores 1987 and the Code of Practice on the Management of Radioactive Wastes from the Mining and Milling of Radioactive Ores 1982 would be met. Similarly, the Western Australian requirements for radiation control outlined in the Radiation Safety (General) Regulations 1983 would be met.

3.3 RADIATION PROTECTION DESIGN TARGETS

Commitment 14 Under Ashton's commitment to the ALARA principle, radiation protection design targets to be adopted for all employees would be less than 2 mSv/a and would not require designation of employees as radiation workers, which would allow a 20 mSv/a dose limit under the International Commission on Radiological Protection draft recommendations (1990).

Commitment 15 Under Ashton's commitment to the ALARA principle, radiation protection design targets to be adopted for members of the public would reduce the statutory 1 mSv/a required by the Commonwealth of Australia's Code of Practice on Radiation Protection in the Mining and Milling of Radioactive Ores 1987 to 0.05 mSv/a.

4 MT WELD OPERATIONS

4.1 CONSERVATION

Commitment 16 An education programme for all employees would be implemented to outline the purpose of imposing restrictions on domestic pets, firearms and recreational use of motor vehicles.

4.2 REHABILITATION AND DECOMMISSIONING

Commitment 17 Ashton would participate in an appropriate programme to control feral animals (goats and rabbits), in consultation with the Agricultural Protection Board and pastoral owners, prior to the commencement of rehabilitation measures.

Commitment 18 Rehabilitation at Mt Weld would be progressively undertaken in accordance with EPA and Department of Mines' guidelines. Rehabilitation activities would be reported annually to the Department of Mines.

Commitment 19 A plan outlining the decommissioning of the Mt Weld facilities would be prepared by Ashton before commencement of operational mining and commissioning of the beneficiation plant. The decommissioning plan would be prepared in consultation with the EPA and the Department of Mines. The decommissioning strategy would follow the guidelines of the Commonwealth of Australia's Code of Practice on the Management of Radioactive Wastes from the Mining and Milling of Radioactive Ores 1982.

4.3 POLLUTION CONTROL

Air

Commitment 20 Dust control measures would be implemented to comply with Department of Mines' regulations.

Water

Commitment 21 A water management plan, including water conservation, would be prepared by Ashton to detail appropriate measures to manage the groundwater resources in the carbonatite pipe area. The plan would be prepared prior to the commencement of mining operations, in consultation with the EPA and the Water Authority.

Commitment 22 A management plan for the disposal of residues from the Meenaar secondary processing plant at Mt Weld would be prepared by Ashton prior to commissioning of the project. The plan would be prepared in consultation with the EPA and the Department of Mines.

Commitment 23 A groundwater monitoring programme would be prepared in consultation with the Water Authority.

5 MEENAAR OPERATIONS

.5.1 GENERAL

Commitment 24 Ashton would co-operate with other occupants of the Meenaar Industrial Park in the development of a comprehensive safety and environmental protection programme for the park.

5.2 SAFETY

Commitment 25 The storage and handling of hazardous materials would be undertaken in accordance with relevant statutes and codes, and Ashton would institute an ongoing worker safety training programme.

Commitment 26 An emergency management plan would be developed by Ashton prior to commissioning, in consultation with the Department of Mines. The plan would include measures to be taken in the event of seismic activity.

Commitment 27 The LPG storage vessel would be designed and operated in accordance with *LP Gas: Storage and Handling* (AS 1596—1989), and would incorporate safety measures such as a fixed water spray (deluge) system as described in that standard.

5.3 SOCIAL

Commitment 28 Social impact monitoring would be undertaken to address local issues.

5.4 POLLUTION CONTROL

Air

Commitment 29 A programme would be established upon commissioning to monitor the following parameters:

- concentration and mass emission rate of sulphur dioxide
- concentration of oxides of nitrogen
- volume flow rate
- temperature
- boiler fuel feed rate over the duration of the test.

Water

Commitment 30 A total containment policy would be adopted for wastewater and surface runoff from the plant area.

Commitment 31 Studies would be undertaken by Ashton during the design phase of Stages II and III to identify an economic means of removing the nitrate from the wastewater before it entered the evaporation ponds.

Commitment 32 Plans and associated documentation for the design of the Meenaar facility and evaporation ponds to withstand predicted seismic events would be prepared by Ashton prior to construction, in consultation with the EPA and the Water Authority.

Commitment 33 A groundwater monitoring programme would be implemented. The results of this monitoring would be issued annually to the Water Authority and the EPA.

Solids

Commitment 34 Ashton would continue to investigate the feasibility of selling the calcium phosphate material produced from regeneration of caustic soda or otherwise making it available to others (for possible use as fertilizer feedstock).

Noise

Commitment 35 All potential noise-generating equipment would incorporate effective sound-proofing measures such that, during the operation of the plant at full capacity, noise at the nearest residence would not exceed those limits set by the EPA.

Commitment 36 A noise monitoring programme would be implemented.

5.5 DECOMMISSIONING

Commitment 37 A plan outlining the decommissioning of the secondary processing plant would be prepared by Ashton before commissioning the plant, in consultation with the EPA. This decommissioning strategy would follow the guidelines of the Commonwealth of Australia's Code of Practice on the Management of Radioactive Wastes from the Mining and Milling of Radioactive Ores 1982.

6 TRANSPORT OPERATIONS

6.1 LEGISLATIVE COMPLIANCE

Commitment 38 Transport and handling procedures would comply with the requirements of the Commonwealth of Australia's Code of Practice for the Transport of Dangerous Goods by Road and Rail 1987 and the Commonwealth of Australia's Code of Practice for the Safe Transport of Radioactive Substances 1990, together with the Western Australian Dangerous Goods (Road Transport) Regulations 1983 and the Radiation Safety (Transport of Radioactive Substances) Regulations 1991.

6.2 EMERGENCY PROCEDURES

Commitment 39 Emergency procedure guides and emergency contacts would be documented and available in vehicle cabs, and all drivers would be instructed in the actions, as specified under the Western Australian Hazardous Materials Emergency Management Scheme, to be taken in the event of an accident.

6.3 MONITORING

Commitment 40 A programme of occupational health and safety monitoring of transport drivers would be developed by Ashton prior to commissioning, in consultation with the Health Department.

Appendix 2

Response by Ashton Rare Earths Ltd to issues raised in public submissions on the Public Environmental Review.

ASHTON RARE EARTHS LTD

RESPONSE TO ISSUES RAISED IN SUBMISSIONS ON THE PUBLIC ENVIRONMENTAL REVIEW FOR THE MT WELD RARE EARTHS PROJECT

Document No. PE1016-31-04-041

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PE1016/300

MINE SITE ISSUES

1 GROUNDWATER

1.1 How much dewatering would occur from the unconfined aquifer?

Coffey Partners International Pty Ltd (Coffey) determined in their geotechnical studies (Coffey 1991) that 'the shallow aquifer would be expected to contribute about one third of the total quantity pumped'. Thus some 4,000–5,000 ML (of the total 13,000–14,000 ML dewater) would come from the unconfined (shallow) aquifer.

1.2 The amount of dewatering (14 MM^3) from the confined aquifer is substantial. How has this been calculated?

Using the results of previous hydrogeological and bore log studies from Granny Smith Gold Mine Water Supply Field, Coffey (1992) undertook modelling studies to analyse a multi-layered plan model operating with time varying conditions using a finite element mesh and seepage analysis programme (CAPMESH and CAPSEEP). Due to conservative assumptions, especially the specific yield of the confined aquifer, the actual amount of dewatering eventually required may be lower. On the basis of ongoing studies of hydrogeology at Mt Weld, Ashton presently estimate that total dewatering may be able to be reduced to 9,000–10,000 ML. Further testing would be undertaken as part of the final feasibility studies, to confirm these results.

1.3 What measures could be taken to minimize the amount of dewatering of the confined aquifer?

As indicated in Section 8.2.2 of the PER, the amount of dewatering of the confined aquifer is being minimized by the following:

- Granny Smith mine modifying their bore field to ensure drawdown occurs in the mine pit region rather than elsewhere in the carbonatite pipe.

- The production bore field for the Mt Weld Project will also be located to assist with dewatering.

A number of other options to minimize the amount of dewatering have been investigated, including the use of a grout curtain. All were found to be uneconomic and did not significantly reduce the amount of dewatering over the proposed method.

1.4 Has it been established that there would not be substantial leakage of water stored in the pit at the Granny Smith mine?

Hydrogeological studies undertaken for Ashton confirm that pits at Granny Smith are the only practical surface reservoirs available to receive dewatering. Was this water to be disposed at other sites, adverse environmental impacts could result. Storage at Goanna Pit offers a good change to conserve much of the dewatering for future use; however, if losses were substantial, they are predicted to occur without adverse impacts.

1.5 A high density residue slurry would appear to reduce water usage, accelerate drying and reduce the risk and rate of seepage in the ponds. Why is the solids content of the residue (8%) so low and what options are available to the company to increase this?

Ashton have undertaken feasibility studies to investigate the use of slurries of various density. The low density slurry is the most economic for this process. It does not alter the production requirement from the Mt Weld water supply bore field.

It should be noted that the low density slurry residual disposal system incorporates recycling of water as detailed in Section 4.2.3 of the PER.

1.6 More information should be provided on the proposed groundwater monitoring programme (to the same degree of detail as given for Meenaar).

The location of the ponds at Mt Weld has yet to be finalized. Further geotechnical studies are required to determine suitable pond locations away from commercial ore bodies. Detailed information of the proposed groundwater monitoring would be provided in the Environmental Management Programme (EMP) and Works Approval application once the location of the ponds are finalized.

1.7 What monitoring would be undertaken in relation to the proposed groundwater disposal practices?

In addition to bore log monitoring, as currently undertaken in the Mt Weld Water Supply Bore Field, and groundwater monitoring (as would be detailed in the EMP for the residue ponds) water stored at Granny Smith would also be monitored.

It is anticipated that the level and salinity of water in the Goanna Pit would be regularly monitored and, as outlined in the draft Water Supply Agreement, the 'Mt Weld/Granny Smith pipeline' would be monitored. This would be in accordance with the Department of Mines and the Water Authority regulations. The pipeline would be either visually inspected at least every twelve hours or an approved telemetric system would be installed.

1.8 When would the proposed water management plan be prepared?

The Water Management Plan would form part of the Water Supply Agreement between Placer (Granny Smith) Pty Ltd, Ashton Rare Earths and CSBP & Farmers Ltd which is currently under discussion. The Water Management Plan would also form part of the EMP and be in accordance with the requirements of the Water Authority and the EPA. A Water Management Strategy has recently been completed and submitted to the Water Authority.

2 MINING AND BENEFICIATION

2.1 How variable is the radionuclide content of the ore and would this need to be managed?

The concentration of uranium and thorium in the Mt Weld orebody has been estimated from a set of 498 samples taken from series of cores located within the 5-year pit, in the annulus of the 5-year pit and outside the 5-year pit. The radionuclide level used to characterise the radioactivity of ore in the PER was the mean of all samples. Variation of individual samples around the mean was not large: for the most abundant radionuclide, thorium, no sample was over twice the concentration of the mean and most samples were within 20% of the mean. Variation was more extensive for uranium although this element was present in minor quantities only (less than 10%).

As the ore processed each year will represent a mixture of several sites within the pit, annual averages of radionuclide content should be close to the mean value used to calculate annual occupational dosage. Although this suggests that no additional measures will be necessary to manage radionuclide content of processed ore, the concentration of radionuclides in mined ore will be measured regularly.

2.2 Would there be on-going monitoring of the ore to ensure that the radionuclide content remains low throughout the operation?

Refer to Response 2.1.

2.3 Would the design of the earthen wall be sufficient to retain a large spillage of concentrate paste from the storage tank?

The purpose of the earthen wall around the tank storing concentrate at Mt Weld would be to act as a shield to reduce the gamma radiation emissions to employees working in this area. As the concentrate will be stored as a paste with only limited mobility without being pumped, large spillages are very unlikely and would have little propensity to move. Thus the earthen wall could effectively contain any spillage. The contents of the tank are effectively those of the ore with the rare earths component doubled. Thus spillage would be unlikely to cause a significant pollution hazard and spills could be readily cleaned up.

2.4 Would there be a detection system below the earthen wall to detect leakage?

No in situ detection equipment would be installed around concentrate storage areas. As the concentrate would have a low moisture content, there would be little chance of leakage of fluid. Walls surrounding storage areas would have at least one entry point for access to visually assess condition of equipment or loss of concentrate paste. See comment in 2.3 on tank contents.

2.5 What is the ultimate fate of the sodium sulphide reagent in the process and would hydrogen sulphide be generated?

The great majority of sulphides within the beneficiation process would eventually be discharged to the residue ponds. At the pH value likely to occur during sodium sulphide addition (approx pH 11) very little sulphide would be in solution as the volatile form, H_2S. Nonetheless, this section of the building would be provided with enhanced ventilation to ensure that build-up of H_2S does not occur.

3 RESIDUE STORAGE

3.1 What are the chemical and mineralogical compositions of the beneficiated residue and the Meenaar residue?

The chemical and mineralogical composition of the residue are:

- Meenaar residue – refer Table 6.2 of the PER.

- Beneficiated residue – ground ore depleted of 50% of the rare earths. The residue has a high iron content mainly in the form of goethite and ilmenite. Major solid contituents of the residue would be goethite (60%), rare earths minerals (11%), ilmenite (6%) and clay/quartz (6%).

3.2 Would radionuclides in residues be in different chemical and physical form to that in the ore, such that this could influence their long term environmental behaviour?

The residue returned to Mt Weld would contain radionuclides at levels below those occurring in the ore given the diluting effects of the process chemicals. Even though the residues would be in forms different from that in the ore, the absolutely low levels and the low solubility of radionuclides would inhibit the migration of radionuclides from the residue bodies. The possible movement of radionuclides would be studied as part of the Radiation Management Plan.

3.3 Would radon emanation from residues be significantly greater than from the ore?

Radon emissions from residues would be inconsequential given the projected levels of radon emissions from process materials during mining, beneficiation and processing.

3.4 What would be the pH, ionic composition and concentration of the 50 mL/annum of water which is predicted to leak from the beneficiated residue ponds?

The water in the beneficiated residue ponds would have a pH 8–8.5. Due to evaporation, the salinity of the pond water would become greater than process water. Under the water balance conditions specified in Section 8.2.3 of the PER, the principal component of the leachate is likely to be sodium bicarbonate at concentrations around 3,000 ppm.

Added to the 'background' salinity of process water, this would yield an eventual salinity of 5,000–7,000 ppm for leachate. Such levels are within measured salinities of the unconfined aquifer (5,000–8,000 ppm) and thus unlikely to have detectable impacts on the groundwater.

The high geothite content in the beneficiated residue would aid with the sealing of the ponds by 'clogging' the pores of the liner. After the first year of operation, leakage rates are estimated to be less than 10 ML/a. This phenomenon would counteract the tendency for ponds to increase in salinity over some years of operation.

3.5 To what extent would the covering of the ponds on the Meenaar residue attenuate radon emissions? At what level would these emissions continue after rehabilitation?

Refer to Response 3.3.

3.6 What are the potential exposure pathways from the radioactive components of the residues, particularly after operations cease at mt weld?

The potential exposure pathways for residue at Mt Weld are:

- gamma radiation above the residues
- inhalation of dust entrained from the residue body
- migration of radionuclides from the residue body into groundwater.

Gamma radiation levels would fall within the spread of common natural background values in view of the 2 m soil and rock cover to be placed over the residue. The soil/rock cover would also prevent dusting and therefore any elevation in the background of atmospheric radionuclides. The movement of radionuclides from the orebody would not be of consequence as discussed in Section 5.3.2 of the PER.

3.7 More information should be provided on the beneficiation residue ponds, such as depth of free-board, expected drying times, methods to minimise seepage, and rehabilitation of the structures.

As defined in the Department of Mines interim guidelines on tailings storage, the beneficiated residue ponds are a significant storage dam. All residue storage areas would comply with Department of Mines regulations.

The conceptual design of the beneficiation residue ponds is shown in Figure 4.6 of the PER. The final design would comply with the Mines Department's guidelines.

Each pond would have a capacity to store 5 to 7 years of beneficiated residue. As indicated in Section 8.2.3 of the PER, preliminary investigations have determined that the permeability of the duricrust is 10^{-6}–10^{-5} cm/s. If detailed investigation failed to confirm this, then a clay liner, using lake clay similar to the Meenaar residue storage area, would be installed.

Rehabilitation of the beneficiation pond would be similar to the Meenaar residue storage areas, as detailed in Section 8.2.12 of the PER. However, as the beneficiation residue would only have radioactivity at background levels, a high clay content layer would not be required.

3.8 To what extent do the residue storage areas comply with the interim guidelines recently issued by the department of mines?

The conceptual design is in agreement with the Department of Mines guidelines and as stated in Response 3.7, the final design and construction would comply with the Department of Mines guidelines.

4 NATIVE FLORA AND FAUNA

4.1 What are the likely differences between the flora survey conducted under the drought conditions of April 1991 and a survey done after significant rainfall (such as exists in winter 1992)?

Flora surveys undertaken after significant rains would be expected to show an increased abundance and diversity of vegetation.

The flora of the carbonatite area is similar to the widespread mulga woodlands of the Goldfields region. As the alluvium cover over the pipe is some 20 m thick and is typical of the surrounding area flora over the pipe would be unlikely to respond to rain differently to the surrounding flora. The description of the biological environment provided in Section 8.1.6 of the PER would still be valid.

Botanists have been engaged to undertake another flora and vegetation survey in spring 1992 when species diversity should be at its greatest. The survey is expected to confirm the results of the previous survey and to increase the number of species recorded in the Mt Weld area.

5 REHABILITATION

5.1 What are the envisaged end uses for the land and the various components of the project? Has this factor been taken into account in the rehabilitation objectives?

Rehabilitation objectives and methods are detailed in Section 8.2.12 of the PER (for the Mt Weld site) and in Section 9.2.14 of the PER (for the Meenaar site).

It is envisaged that Mt Weld will return to grazing land and that other mining may be carried out in the carbonatite pipe. The end use for Meenaar is envisaged to be industrial use. These factors and various end uses have been taken into consideration in determining the methods of rehabilitation to be used.

The rehabilitation method, trials and monitoring programmes would be further detailed in the EMP in accordance with Commitments 17, 18, 19 and 37 of the PER.

Rehabilitation would be undertaken to ensure that it is successful through the use of the most practicable rehabilitation methods. Rehabilitation would meet the requirements of the regulatory authorities.

5.2 Would Ashton undertake further research, such as re-vegetation trials and waste characterization, to ensure that the rehabilitation is successful?

Refer to Response 5.1.

5.3 Would the sequencing of overburden placement ensure that saline material does not bury non-saline waste?

Refer to Response 5.1.

5.4 To what extent would the project impact on the local landscape, particularly the waste dumps? Upon decommissioning of the mine, would these dumps remain, or would they be used to backfill the open pit?

The waste dumps would not be used as backfill in the open pit due to:

- the real potential for future mining in the pit area;
- the low impact that the rehabilitated waste dump would have on the local landscape;

- the high cost of backfilling which would adversely affect the viability of the project.

As indicated in Section 4.2.4 of the PER, the waste dumps would cover an area of 17 ha and be 10 m in height. Rehabilitation of these dumps would commence at the end of the earthwork construction stage and would be undertaken in the manner described in Section 8.2.12 of the PER.

The waste dumps would form part of the local landscape and would be visible from outside the lease area. Due to the distance of the Mt Weld mine site from populated areas and the presence of similar features in the region, the impact on the local landscape of the waste dumps would be minimal.

TRANSPORT ISSUES

6 TRANSPORT

6.1 Many submissions raised concerns about the impact of additional heavy transport passing through built up areas between Meenaar and Mt Weld, carrying chemicals, low-level radioactive concentrate and residue. how has Ashton taken into account the noise, vibration, safety and nuisance impacts on the communities along the transport route?

The relative increase in traffic and the associated potential environmental impacts expected to result from the construction and operational phases of the project have been outlined in Sections 8.2.1, 8.2.8, 9.2.1 and 9.2.7 of the PER. The estimated increases in traffic are limited to approximately two trucks passing either way along these roads each day: generally representing less than 1% of the recorded annual average daily traffic along the proposed routes. As indicated in the PER, the small increases in heavy haulage traffic would result in more frequent short-term increases in noise levels and possibly vibrations typically associated with the current volume of heavy traffic using the proposed transport routes. However, Ashton are examining ways of reducing this traffic load further by decreasing the volume of residue requiring transport to Mt Weld.

Project related traffic is unlikely to significantly decrease road user safety (refer Response 6.3). Communities near the transport routes are unlikely to be significantly inconvenienced by the small increases in traffic associated with the project.

6.2 Many submissions advocated the use of rail instead of road, for the transport of material to and from Mt Weld and Meenaar, and also from the large quantity of dangerous goods transported from Kwinana to Meenaar. Under what circumstances would Ashton consider using rail instead of road transport for the movement of these materials?

A summary of a detailed evaluation of alternative transport options (mode of transport and routes) was provided in Section 3.3 of the PER. The rationale for the preferred option for the transport of concentrate and residues (Section 3.3.1), feedstock chemicals (Section 3.3.2) and rare earth product (Section 3.3.3) was also provided.

The main advantages of road transport over the road-rail option for the Mt Weld project included:

- lower operating and capital cost
- greater operational control and scheduling flexibility
- no significant differences in risk of spillage resulting from accidents.

Of these, significant changes to the cost competetiveness of the road-rail option relative to the road-only option would permit Ashton to revise the preferred transport option (refer Response 12.4 and 14.2). Any improvement in the cost competetiveness of the road-rail option would need to be sufficiently large so as to compensate for the lower operational control and flexibility associated with this option. Alternatively, the road-rail option would need to be amended such that operational control and flexibility are significantly improved.

6.3 To what extent has Ashton taken into account the danger its heavy and dangerous goods traffic poses to other road users and communities along the route?

Compliance with the requirements of regulatory authorities and licence/permits issued for vehicles and to drivers would ensure that the established safety standards would be met. These safety standards have been developed to ensure that the risk of accidents is minimized. One of the conditions of contract for transport operators engaged by Ashton would be that these safety standards are met.

6.4 How would Ashton ensure that the concentrate and residue carried in the trucks does not exceed the radiation limit of 7 x 10^4 Bq/kg, or alternatively identify those that do exceed this level (which would require special labelling and handling, as specified under the explosives and dangerous goods act and associated regulations)?

The estimate of the radioactivity level of the concentrate to be carried to Meenaar is based on the mean level of radionuclide concentrations within the ore samples assayed by Ashton (see response to 2.1). This estimate (5.4 x 10^4 Bq/kg) is 20% below the limit specified by regulations as designating a radioactive substance for the purposes of transport (7.0 x 10^4 Bq/kg). Variation of radionuclide concentration in the ore samples is sufficient only in a small percentage of cases to produce concentrate which exceeds the limit. However, ore being processed will be mined from a variety of sites within the pit and concentrate from a number of days production will be constantly blended within a large holding tank before shipment. Thus the radioactivity of concentrate is likely to be close to mean levels. Regular measurement of the activity of concentrate will be undertaken to ensure that levels are below statutory limits. Should a high activity occur within the holding tank, transport will await reduction of activity through further blending.

6.5 What plans does Ashton have to monitor radiation levels in built-up areas through which their trucks would pass?

The assessment of radiation risks associated with transport, presented within the PER (Section 6.5), shows clearly that there is no conceivable scenario under which normal transport operations could present a public radiation hazard. Monitoring of radiation within built-up areas (which would include existing background levels) is not warranted given the brief passage of trucks through these areas. The levels of radiation associated with trucks will be monitored as part of Ashton's normal occupational radiation monitoring programme. Using these values and estimates of the time spent by trucks in

built-up areas, calculations of the minimal levels of radiation contributed by transport could be made.

6.6 Has Ashton considered worst case scenarios for accidents involving the transport of dangerous goods? What options are available to Ashton to minimize potential disasters in areas of high population?

The transport of dangerous goods associated with the project is restricted to the movement of LPG and some process chemicals used at Meenaar. Trucks carrying similar loads already travel along this route. Such transport is regulated by the Explosives and Dangerous Goods Act 1961 and its Regulations, and emergency responses to accident scenarios have been developed under the Western Australian Hazardous Materials Emergency Management Scheme (WAHMEMS). For these reasons, consideration of worst case scenarios for accidents involving these goods and their management was not treated in the PER. Ashton would meet all regulatory requirements and will liaise with regulatory authorities to ensure appropriate management for emergency responses is in place.

6.7 What emergency procedures would be required of this Police, Fire Bridgade and State Emergency Service in the event of an accident involving plant residue, concentrate and chemicals?

An indication of the probable response required by emergency services and Ashton personnel in the event of a major spillage of concentrate or residue is outlined in Section 6.6 of the PER. The final form of this response would be negotiated between Ashton and emergency services under WAHMEMS before transport operations commence.

6.8 Would there be any modifications and upgrading to the Great Eastern Highway to accommodate additional traffic for the Ashton project, particularly in the vicinity of the Meenaar plant and between Meenaar and Cunderdin?

The CER for the Meenaar Industrial Park (prepared by the Industrial Land Development Authority and the Department of State Development) states that the intersections of the Great Eastern Highway and the Meenaar access roads would be designed to Austroads Intersection Type C standard. It is expected that the intersections would have off-set turning lanes to allow vehicles to turn off the highway and to join the highway with maximum safety. It is also expected that the intersections would have suitable lighting. The modification of the intersections is the responsibility of the proponents for the Meenaar Industrial Park, not Ashton.

Maintenance and upgrading of sections of the Great Eastern Highway would be undertaken by the MRD as part of their normal rural road maintenance programme.

MEENAAR ISSUES

7 GROUNDWATER AND SURFACE WATER

7.1 Where are the nearest sources of valuable or high quality groundwater referred to in the PER (Section 9.2.2)?

The statement made in Section 9.2.2 of the PER was 'The soils (at the site of the secondary processing plant) have low permeabilities and the groundwater is saline and contains high levels of nitrate and sulphate. These factors would assist the retention of any leachates from the evaporation ponds within the plant site and would not contaminate any existing high quality or valuable groundwater in the region'. The intent of this statement was to indicate that because the immediate area does not contain high quality groundwater, potential leachates could not affect high quality groundwater.

The absence of high quality groundwater in the region is suggested in Section 9.1.4 of the PER, which refers to a number of bores and wells which have mostly been abandoned, possibly due to low yield or high salinity. Hydrogeological studies confirm this suggestion for the immediate area of the Ashton plant (see response 7.2.)

7.2 More information should be provided on the quality, quantity and distribution of groundwater in the Meenaar area. How does this quality compare to accepted standards for various uses?

The hydrogeological studies were commissioned to determine the nature of the conditions at the site of the secondary processing plant. The purpose of these studies was to enable an assessment of the suitability of the site for establishing evaporation ponds and to evaluate the potential environmental impact of a loss of containment from such ponds. The PER contains sufficient information on the groundwater in the area of the secondary processing plant to permit an assessment of environmental impacts. Additional information on the quality, quantity and distribution of groundwater in the Meenaar area and any comparative water quality analysis with 'acceptable standards for various uses' would be of limited value to the consideration of possible environmental impacts of Ashton's plant. Full technical reports on the hydrogeology studies have been provided to the EPA and were made available to the public during the eight-week public review of the PER.

7.3 What evidence is used to conclude that isolated bodies of groundwater and seepages rather than a single body of groundwater underlie the site?

The drilling programme of the hydrogeological studies found significant variations in water levels and salinity, and a lack of groundwater in some boreholes. These findings

provided evidence that there are isolated bodies of groundwater and seepages with different heads and of different quality beneath the site of the secondary processing plant. Should a single body of groundwater lie beneath the site, then the water quality of groundwater samples from the boreholes and the water levels recorded in each borehole would have been similar over the site.

7.4 How would surface water be contained on site? what are the likely impacts, of total on-site containment of surface runoff water i.e. groundwater recharge rates, downstream impacts, particularly on adjacent properties, e.g. mounding of saline groundwater? How would these impacts be monitored and (if significant) managed?

Section 4.3.8 of the PER states that stormwater runoff would be directed (via a system of open channels) to a centralized drainage sump and that stormwater runoff would be contained entirely within the plant site. Figure 4.8 provides a conceptual site plan of the secondary processing plant, including the location of the main drainage sump. This drainage sump would be designed to have sufficient capacity to accommodate an extreme rainfall event.

The potential impacts of on-site containment of surface runoff would be comparable to the effects on the hydrology resulting from the establishment of a farm dam with an equivalent catchment area. Groundwater and downstream impacts are considered likely to be minimal and not require additional monitoring to that associated with residue ponds.

7.5 What data have been assessed to indicate what geological controls might be present to influence groundwater distribution?

As indicated in Response 7.1, Section 9.1.4 of the PER contains a summary of the findings of hydrogeological studies undertaken at Meenaar by Rockwater (1992). These findings were largely based on the information provided by an on-site drilling programme. Drilling involved the establishment of fifteen bores (up to a depth of 29 m) to determine lithology and depth to bedrock beneath the site.

Specific information was obtained on the following:

- depth and quality of groundwater
- directions of groundwater flow and flow rates
- hydraulic connection with the Mortlock River
- presence of permeable or impermeable layers
- in situ and compacted hydraulic conductivities of the soils
- phosphorus retention indices of the soils.

In addition to the drilling programme, the records of the Geological Survey of Western Australia were also reviewed to provide information on the general area of Meenaar.

8 WASTES, PLANT RESIDUES AND EVAPORATION PONDS

8.1 What arrangement does Ashton have for the disposal of septic waste?

Section 4.3.8 of the PER states that sewage would be treated in a septic tank disposal system approved by the Health Department. Contractors would be engaged to maintain and remove sludge from the septic tank for disposal in accordance with the Shire of Northam. Options for the disposal of septic waste would be determined following consultation with the Shire of Northam.

8.2 In addition to nitrates and phosphates, would there be any other waste components from the plant that could have a potential beneficial use?

Other than nitrates and phosphates, no additional component of the waste streams currently has the potential to have a beneficial use. Should any components of the waste stream in the future have a potential beneficial use, Ashton would consider making the component available if it is economic to do so.

8.3 Would the water in the evaporation ponds constitute a hazard for bird-life?

The water in the evaporation ponds would not be hazardous to birdlife upon contact. Section 9.2.8 of the PER states that the only constituents of the wastewater in the evaporation ponds which can be toxic to wildlife (including birds) are aluminium and barium; however at the concentrations expected, the wastewater would not be toxic or harmful if consumed by birdlife in the volumes normally expected. The radionuclides present in the wastewater would be at levels similar to those in existing Western Australian water supplies and would therefore not affect birdlife.

8.4 How would the pond design prevent overflow in a major rainfall event?

The evaporation ponds would only collect rainfall which falls directly into the open area of the ponds or on the inside slopes of the embankments. No runoff from upslope areas would be permitted to collect in the ponds. For this reason, the catchment of each pond would be limited to the area of that pond (refer Figure 4.8 of the PER).

The evaporation ponds would be designed in consultation with the Water Authority and the Department of Mines with a freeboard which has sufficient capacity to contain the highest twenty-four hour rainfall event recorded to date (i.e. 109 mm on 9 March 1934) or if greater, the 1 in 50 year storm event.

8.5 How has the siting of the ponds taken into account local geological conditions, soil types and depth to groundwater?

During the preparation of the PER, Ashton commissioned two separate specialist consultant hydrogeologists to evaluate conditions at the site of the secondary processing plant. The Rockwater studies (refer Section 9.1.4 of the PER) provided a detailed assessment of the hydrogeology of the site. Ashton also obtained advice from a consultant engineer who specializes in building design in seismic areas, with particular

advice being sought on evaporation pond design. The final design and siting of the evaporation ponds would take into account the data from these sources.

8.6 What are the most common environmental problems associated with the operation of evaporation ponds and how would Ashton ensure that these would not occur at Meenaar?

If properly designed, constructed and operated, evaporation ponds do not cause environmental problems. The evaporation ponds to be established at Meenaar would be properly designed, constructed and operated and would comply with the current standards required for such structures. Commitment 32 of the PER indicates that plans and associated documentation for the design of the ponds to withstand predicted seismic events would be prepared by Ashton prior to construction, in consultation with the EPA and the Water Authority. Section 4.3.7 and 9.2.5 of the PER outline the proposed measures to ensure that the evaporation ponds are well designed and constructed.

8.7 Would the design and construction of the ponds be supervised by a competent geotechnical engineer?

Yes.

8.8 What are the concentrations of, and how soluble are, radium, lead, thorium and uranium in the residues that would be disposed of in the evaporation ponds on site, and the residues destined for Mt Weld?

The concentrations of radionuclides in Meenaar wastewater and residue and their solubilities are detailed in Section 5.3.2 of the PER. The concentration of radionuclides in wastewater entering evaporation ponds at Meenaar was calculated to be so low (less than 1 kg in 7,000 t of solids each year) that it was effectively zero for the mass balance shown in Figure 5.3 of the PER. As noted in Section 5.3.2, the only radionuclide with an appreciable solubility under conditions likely to be encountered by the solid Meenaar residue was radium which would be stored at Mt Weld at concentrations below those of the nearby orebody.

8.9 Would inputs into the ponds be monitored, particularly radionuclides?

Regular monitoring of wastewater entering the Meenaar evaporation ponds would be developed under the EMP. Parameters to be monitored would include radionuclides.

8.10 Would the predicted 7,000 t/a of solids in the ponds remain at Meenaar or would they be returned to mt weld?

The suspended and dissolved solids contained in wastewater from the secondary processing plant would be contained in the evaporation ponds and not returned to Mt Weld. As stated in Section 9.2.3 of the PER, the wastewater directed to the evaporation ponds during Stage II and III would contain nitrates but would have negligible levels of radioactivity. Commitment 31 of the PER indicates that studies would be undertaken by Ashton during the design phase of Stages II and III to identify an economic means of

removing the nitrate from the wastewater before it enters the evaporation ponds. Any effective and economic means of removing the nitrate would therefore reduce the volume of solids to be stored in the evaporation ponds. Furthermore, Ashton is continuing to investigate means of reducing the volume of solids in the wastewater stream.

8.11 What plans does the company have for the decommissioning and rehabilitation of the evaporation ponds, particularly in terms of a 'walk away' solution?

The issue of decommissioning and rehabilitation of the secondary processing plant has been addressed in Section 9.2.14 of the PER. In addition, Commitment 3 indicates that the EMP would address decommissioning and rehabilitation. The EMP would specifically address the issue of decommissioning and rehabilitation of the evaporation ponds at Meenaar.

The objectives of decommissioning and rehabilitation are presented in the PER. The objectives are to:

- minimize any short-term or long-term health risks;
- restore the site to a condition suitable for industrial use or other uses, as may be appropriate at the time of decommissioning;
- ensure that no ongoing additional liability for the project is incurred by the State Government.

These objectives would apply to the decommissioning and rehabilitation of the evaporation ponds.

9 NOISE, DUST, ODOURS AND VISUAL IMPACTS AT MEENAAR

9.1 On what basis does Ashton consider that wind data in the PER (from Northam) is representative of the Meenaar area?

Wind data are available from the Bureau of Meteorology for Northam, York and Cunderdin. No wind data are available for Meenaar or Grass Valley. Advice was provided by the Bureau of Meteorology that the data for Northam are likely to be representative of wind conditions at Meenaar. The data provided in the PER are sufficient for the purposes of environmental assessment.

9.2 Would atmospheric emissions vary significantly during operation, particularly under startup and shutdown conditions? if so, what plans does Ashton have to monitor emissions and control excessive emissions?

During normal operation, atmospheric emissions would remain constant at the levels shown in Table 4.4 of the PER. As with most industrial processing plants, emissions

may vary during startup and shutdown conditions. Details of the monitoring of atmospheric emissions would be provided to the EPA in the EMP.

9.3 What is the likely composition of the particulates that would be emitted to the atmosphere from the plant?

The process of calcination, using LPG to burn off residual reagents and organic matter would generate small emissions of particulate matter. Particulates emitted to the atmosphere would mostly consist of small particles of ore which become attached to water vapour. As indicated in Section 4.3.6 of the PER, wet scrubbers would be installed to treat air discharges from the calciner and heaters prior to being vented to the atmosphere. The wet scrubbers would capture almost all of the particulates generated.

9.4 What are the predicted radionuclide concentrations in the emitted material and what would be the likely environmental impact?

Particulate matter emitted from the stack would have negligible concentrations of radionuclides which would not differ from normal background levels. This would be confirmed by the monitoring programme for atmospheric emissions.

9.5 What assurances can Ashton provide to nearby farmers that noise and atmospheric emissions from the plant will not harm their health and livestock, nor contaminate their produce?

The maximum noise limits likely to be set by the EPA are provided in Section 9.2.1 of the PER, while the air quality standards likely to be set by the EPA are provided in Table 9.5 of the PER. These levels have been established by the regulatory authorities to ensure that human health and public amenity are protected. Ashton would ensure that noise and atmospheric emissions from the secondary processing plant comply with these levels. As indicated in Section 9.3.2 and 9.3.3 of the PER, monitoring would be undertaken to ensure compliance with these emission levels.

9.6 Would there be any independent monitoring or auditing of Ashton's monitoring activities

The issue of monitoring and auditing would be addressed in the EMP. Monitoring and auditing can be undertaken either by the proponent or by suitably qualified and experienced independent consultants. Ashton would determine who would undertake monitoring and auditing prior to plant commissioning. In addition, the EPA has a statutory role to undertake audits to ensure operators comply with their environmental commitments and conditions; the EPA would therefore be expected to conduct audits to ensure Ashton comply with its environmental commitments and conditions.

9.7 What is the height of a 'typical wheat silo' referred to in Figure 9.9 of the PER?

The height of the 'typical wheat silo' shown in Figure 9.9 of the PER is about 22.5 m above ground level.

9.8 What would be the height of the emissions stack?

The height of the stack shown in Figure 9.9 of the PER is about 28.5 m above ground level.

9.9 One residence, located about one kilometre east of the plant site appears to have been over-looked in the PER. How did Ashton identify residences in the vicinity of the proposed plant site?

Figure 9.7 of the PER should have shown an additional residence located 1 km east of the Meenaar Industrial Park. The location of residences was determined on the advice from proponents of the Meenaar Industrial Park and from observations made during visits to the site.

10 RISKS AND HAZARDS

10.1 Advice to the authority is that the LPG storage vessel should be mounded, in order to avoid avoidable risk (recent studies have shown that the automatic water sprays as proposed in the PER do not provide sufficient protection to prevent bleve in all credible cases of jet impingement). Would the LPG tank be mounded?

The preliminary risk contours (shown in Figure 9.8 of the PER) indicate that the individual risk levels for the secondary processing plant (without mounding of the LPG storage vessels or provision of automatic sprays) are well within those levels which are considered acceptable to the EPA for a new industrial installation. Addition of an automatic water spray system was considered by Ashton's risk management consultants to provide an adequate further reduction of risk level under EPA criteria. In discussions with the EPA and the Department of Mines, Ashton has already reduced the original level of LPG storage to one which ensured that these risk guidelines would be met.

Recent studies examining the merits of mounding large (over 1,000 m^3) LPG tanks suggest that mounding of smaller units (such as that at Meenaar) would incur a 10% cost penalty and there might be a greater risk of tank corrosion. Thus mounding of the LPG storage vessels is not proposed at this time.

10.2 How much ammonia would be used and stored at the site? Would ammonia be used in the stripping section of the solvent extraction plant?

Table 4.3 of the PER indicates the process chemicals required and the volumes to be stored at the secondary processing plant. No ammonia is to be used or stored at Meenaar.

As indicated in Section 1.3 of the PER, any significant alteration in processing or operation (including the use and storage of large volumes of ammonia) would be referred to the EPA for possible separate environmental assessment.

10.3 What contribution would Ashton make to public safety and rescue support for emergences in the area around Meenaar?

Regional emergency facilities and services would be expected to be primarily responsible for appropriate action in the event of emergencies in the Meenaar area. If required, and if such an action does not in any way jeopardize the safe operation of the plant, Ashton would assist in responding to identified emergencies. The principal facilities which could be made available by Ashton are the first-aid station and communications system.

10.4 Is Meenaar in a zone 1 or zone 2 seismic region?

Section 9.1.5 of the PER describes the earthquake zone classification for the Meenaar area from two sources. As stated, the SAA Earthquake Code (AS 2121-1979) classifies the area within which Meenaar lies as a Zone 2 category. Gaull and Michael-Leiba (1987) ascribe a Zone 1 to an area which includes Meenaar. The difference in classifications is due to the different methodologies used; the two classifications are not directly comparable.

10.5 The height and length of the Meckering fault line quoted in the PER is at variance with other sources of information i.e. 'souvenir booklet, 1988– meckering earthquake - October 14, 1988' – Meckering agricultural society (inc). What are Ashton's references on this subject?

The information on the length and uplift of the Meckering fault line in Section 9.1.5 of the PER was provided verbally by the Bureau of Mineral Resources. However, the summary for the Meckering earthquake (Geological Survey of Western Australia, Bulletin 126) states that 'the maximum displacement of the Meckering Fault was 2 m vertical, 1.5 m dextral slip and 2.4 m heave measured at the centre of the arc'. At the end of the arc, uplift was significantly lower: about 76 mm at each end. These data on uplift associated with the Meckering earthquake should replace those stated in the PER.

10.6 What information has been used to ensure that the plant and dangerous goods storage facilities would not be located over unstable geological rock-types or structures?

The same sources of information as those described in Response 8.5 have been used to determine whether unstable geological rock-type or structures occur at the site of the secondary processing plant. Further geotechnical work may be undertaken during the final design phase.

11 RADIATION

11.1 What plans does Ashton have to contain and manage an on-site spillage of radioactive material, particularly as a result of a major seismic event? How would contaminated soil, groundwater and other materials be cleaned up or disposed of?

The measures outlined in Section 9.2.5 of the PER would ensure that the secondary processing plant could withstand seismic events of the magnitudes considered credible and that on-site spillage of radioactive material is prevented. Ashton does not expect any spillage of material or contamination of soil or groundwater to occur at the Meenaar site. In the unlikely event that a spillage does occur, the spilt material would be recovered and either reprocessed or stored. Any contaminated soils would be transported to Mt Weld for disposal.

Groundwater monitoring would be undertaken which would detect any contamination. As the level of radionuclides present in the wastewater to be stored in the lined evaporation ponds would be similar to those in existing Western Australian water supplies and because any spillages would be rapidly recovered or removed from site, contamination of groundwater is most unlikely.

11.2 What quantitative detail is used to substantiate claims that radiation doses would be small for workers and negligible for the public?

Section 5.2 of the PER provides a detailed treatment of the formulae and assumptions used to estimate radiation doses likely to be received by the worst effected members of the employees and public. This treatment follows recommendations of the United Nations Scientific Committee on the Effects of Nuclear Radiation. The radionuclide concentrations on which calculations are based are given in Section 6.1.1 (concentrate) and Section 6.2.1 (residue) of the PER.

11.3 Is it valid to regard the potential for exposure from internal sources of radiation to be negligible when there is a calcination stage in the process?

Uncontrolled venting of material from the calciner might result in an elevation in the internal component of occupational dose. Emission control requirements would be determined according to the results of radionuclide deportment tests currently being conducted by ANSTO as part of a pilot plant study.

11.4 What is the basis for the target dose of 2 mSv/a for non-designated employees in table 5.3 of the PER?

As described in Section 5.1.3 of the PER, the 'Planned' limits of Table 5.3 (including those of non-designated employees) are drawn from the latest recommendations of the International Commission on Radiological Protection.

11.5 What employees in the barium-radium precipitation unit need to be classified as 'designated' or 'non-designated' employees?

Table 5.6 of the PER shows radiation protection targets for all Ashton employees as less than 2mSv/a which would place them below existing and proposed criteria for 'designated employees'. The section on Beneficiated Ore Processing in Section 5.2.1 of the PER describes how the operations of the barium-radium precipitation unit would be managed to ensure minimal doses to workers.

11.6 It may be too simplistic to extrapolate occupational doses from the proposed Port Pirie plant by only taking into account the relative activities of the two feedstocks. What are the differences and similarities between the two processes that might influence occupational doses?

This procedure was used to estimate only the gamma component of occupational dose. It is important to note that the protocol indicates that this component represents less than 10% of the estimated total dose. If, for example, the method has resulted in the gamma component being underestimated by a factor of, say, x3, the total value remains substantially less than the design figure of 2 mSv/year. It is intended to perform a gamma modelling exercise at the engineering design stage similar to that described in the Port Pirie proposal. In the current project, the modelling procedure would be refined by using the results to ensure that the layout of plant vessels is consistent with the ALARA principle.

11.7 Would barium chloride and sulphuric acid need to be added to produce a radium-barium sulphate precipitate, considering the low level of barium in the ore?

The present procedure for precipitating radium in the barium-radium precipitation step does not require the addition of barium chloride or sulphuric acid.

11.8 What levels of radionuclides would be precipitated prior to blending with other residue destined for Mt Weld?

The disposition of radionuclides within the secondary processing plant is shown in Figure 5.2 of the PER.

11.9 If phosphate is separated from the residue, does the resultant higher level of radiation in the transported residue then require labelling of the residue under the Explosives and Dangerous Goods Act and associated regulations?

Separation of calcium phosphate from the residue to be returned to Mt Weld would increase the level of radiation in this residue by approximately one third. At that increased level, radioactivity would be less than half that of the transport limit requiring designation as a radioactive substance under the Explosives and Dangerous Goods Act.

11.10 Would the company give consideration to the separation and disposal of radioactive components from the process at the Mt Walton facility, instead of at Mt Weld?

Ashton has considered this option and rejected it on the following grounds: The separation of radionuclides during secondary processing with subsequent disposal at Mt Walton would create a component of the project dealing with high level radioactive waste. This would require some employees to be designated as radiation workers and necessitate the transport of a highly radioactive substance. Blending of radionuclides back to the main residue stream and disposal at their site of origin at levels occurring naturally at that site is the most environmentally responsible option.

11.11 Some submissions expressed concern about the role of ansto in the pilot plant trials for Ashton, bearing in mind the recent press coverage of an alleged lack of safety procedures at the lucas heights facility discovered by NSW EPA. would Ashton like to comment on this?

Safety procedures at the ANSTO facility at Lucas Heights are not relevant to the Mt Weld Project.

12 SITE SELECTION

12.1 How do factors such as the necessity for a larger buffer zone and the exclusion of rail and gas infrastructure affect the selection of Meenaar as the preferred site over other areas?

The establishment of a buffer zone around the Meenaar Industrial Park is a matter for the proponents of the Meenaar Industrial Park, not Ashton. It would be expected that a buffer zone would be required around any new industrial setting in which the secondary processing plant was to be located.

As indicated in Table B.2 of the PER, of the six sites considered in the detailed sites evaluation study, only East Rockingham, Kemerton and Geraldton (Narngulu) have existing access to natural gas; all other sites (Collie, Kalgoorlie and Northam) require LPG to be transported from Perth. Although it may be more economic to connect directly into existing natural gas distribution lines (where it is available), the cost of transporting LPG to Meenaar makes it a viable option.

The most important criterion in the selection of an appropriate transport option is cost. As the project is a commercial venture, and if all other factors are equal, the most economic option would be preferred. Taking into account the need to transport concentrate and residue, feedstock chemicals, LPG and rare earth product, the absence of an existing rail access is not considered a disadvantage for the Meenaar site.

12.2 On what basis is the Meenaar site considered by Ashton to be less constrained than Kalgoorlie from a public health point of view?

The sites evaluation study defined public health as the potential for off-site effects on adjacent workers and residential areas resulting from radiation or other exposure under an accident scenario. Table B.6 of the PER indicates that the degree of management required to avoid impact in terms of public health at the Northam (Meenaar) site was minor, compared with moderate for the Kalgoorlie (Gidgi) site. However, based on the criteria for public health outlined in Table B.3 of the PER, the degree of management required to avoid impact at both Kalgoorlie and Meenaar should be assessed as moderate. This does not in any way affect the overall findings and conclusion of the sites evaluation study; public health was not a major or overriding constraint or a significant constraint at either Kalgoorlie or Meenaar.

12.3 On what basis is the utilization of land for a site near Kalgoorlie considered by Ashton to be similar to utilization of productive agricultural land at Meenaar?

The sites evaluation study defined utilization of land as the availability and effectiveness of utilizing the land for the required area of evaporation ponds. Table B.4 of the PER indicates the rationale for the assessment of utilization of land for Kalgoorlie (Gidgi) and Northam (Meenaar). Both Kalgoorlie and Meenaar have sufficient capacity to accommodate the area required for evaporation ponds (areas indicated in Table B.2 of the PER) and the degree of management required to avoid impact was assessed as being minor for both sites. Additional factors which made the assessment of Kalgoorlie and Meenaar the same in terms of utilization of land included:

- the Meenaar site is poor agricultural land which has low productivity (refer Section 7.8 of the CER for the Meenaar Industrial Park);
- there was some uncertainty with the proposed Gidgi site as the area was considered by the Department of Mines to have potential for potential future mining.

12.4 What factors would need to change for Ashton to have considered Kalgoorlie or Mt Weld as the optimum site for the secondary processing plant? If these changes could occur in the near future, is it too late for Ashton to relocate their proposal?

As indicated in Section B.2.4 of the PER, the capital and operating costs associated with the Kalgoorlie site were assessed to have major or overriding constraints. The principal reasons for the high capital and operating costs for the Kalgoorlie site relative to the base case (Kwinana) and Meenaar, were the costs associated with the transport of feedstock chemicals and LPG, provision of water and construction costs. The additional costs associated with transporting chemicals and LPG the longer distance from Perth to Kalgoorlie (instead of Meenaar) are significantly higher than the cost savings associated with transporting concentrates and residues the shorter distance from Mt Weld to Kalgoorlie (instead of Meenaar).

Although Ashton is not scheduled to make a development decision on the project until December 1992, at this stage of the environmental assessment process, Ashton is committed to the proposed site of the secondary processing plant at Meenaar. Any proposal to relocate the plant would be subject to a new environmental approval process for the secondary processing plant which would necessitate a substantial delay in the project schedule. For the Kalgoorlie site to become more attractive, substantial subsidies for both the capital works and the ongoing operations would be required.

13 SOCIAL ISSUES

13.1 How would the proponent ensure that local residents of the Avon Valley community have the opportunity to be employed?

Employment opportunities for local residents in the Avon region would be created in the construction and operation phase of the project for those with appropriate skills (refer Section 4.3.10 of the PER). Employment positions would be advertised in local and statewide newspapers, with local residents encouraged to apply. The most important criterion for employment would be appropriate skills. Local recruitment is considered to be economically attractive to Ashton and beneficial to the local community.

13.2 How would job training be provided for local people who have insufficient skills to be employed on the project?

Existing education and training facilities and services would be available for local residents with insufficient skills to gain appropriate training for possible employment at the Meenaar plant. The Northam TAFE centre runs full-time courses in basic industrial skills, business study programmes, office and secretarial studies and community skills programmes. The TAFE extension service also runs short vocational training courses and a number of part-time certificate courses. TAFE has the capacity to provide flexible training programmes to the workforces of any new industries establishing in the region. When a decision is taken to proceed with the project, Ashton would consult with the Northam TAFE centre on the matter of training needs. It is anticipated that additional training courses in chemistry and engineering would need to become available.

13.3 How would local contractors be given maximum opportunity to service the project?

Local companies will be invited to tender for contracts to service various requirements of the secondary processing plant. Depending on the competetiveness of these contract tenders, local contractors would be engaged. It is expected that most service contracts would be awarded to local companies.

13.4 How would the local community be involved in monitoring the projects impacts on an ongoing basis?

Specific details of monitoring would be provided in the EMP to be submitted to the EPA. Monitoring is expected to be undertaken by Ashton or by appropriate suitably qualified consultants. The results of monitoring would be provided to the Meenaar Industrial Park Management Committee (refer Section 8.15 of the CER for the Meenaar Industrial Park) and a summary of the findings made available to the local community.

13.5 What procedures would be used to assess any claim for damages to property or health arising from the project's operations?

Any claims for damages would be required to follow normal judicial procedures. No special procedures would be developed to assess such claims outside of the normal legal system. In the unlikely event of any grievance, it would be expected that issues of concern could be resolved through consultation and negotiation with the affected parties.

14 CHANGES TO THE PROPOSAL

14.1 What changes to the proposal does the company propose or are likely to occur since the PER was released to the public for comment?

No aspect of the project, as outlined in the PER, has been revised since the document was made available for public comment. Further investigations of dewatering operations have suggested that it may be possible to reduce the amount of dewatering required at Mt Weld (see Responses 1.1 and 1.2), but this is yet to be confirmed. At present, no other aspect of the project is proposed to be revised. Ashton will continue to pursue the use of 'best available technology' for environmental protection and where possible alter the project to meet this objective.

14.2 What commitments would be added or changed to reflect public submissions?

As no aspect of the project has been revised (refer Response 14.1). The only revision to the list of commitments provided in Chapter 10 of the PER has been the amendment of the version of the Dangerous Goods (Road Transport) Regulations from 1983 to 1992 in commitment 38. Should public submissions have warranted it, then Ashton would consider revising these commitments. The EPA summary of issues arising from submissions does not contain any issue which would warrant further revision to the existing commitments.

As a result of concerns expressed in some public submissions received by the EPA in relation to transport options, Ashton have offered an additional commitment to the existing list of commitments. The proposed additional commitment is as follows:

Commitment 41 Ashton would undertake a further comparative review of the practicability of the transport options (road-rail versus road only) for the Mt Weld project prior to the commencement of construction of transport-related facilities at Mt Weld and Meenaar. The results would be made available to the EPA.

Appendix 3

List of people and organisations who made submissions.

Appendix 4

Conceptual environmental monitoring programme, as proposed by Ashton Rare Earths Ltd in the Public Environmental Review (excluding radiation monitoring)

Parameter	Equipment	Location	Frequency	Data	Frequency of reporting	Reporting to
Groundwater	Slotted bores and electro-submersible pumps	To be determined	Monthly; to be reviewed after 2 years	Refer to text, but subject to Water Authority licence conditions	Annually, but subject to Water Authority licence conditions	Water Authority and EPA (subject to licence conditions)
Stack gases	Lear Siegler GS80	Stack or ducting to stack	Quarterly; to be reviewed after 1 year	Refer to text, but subject to EPA approvals and licences	Six monthly	EPA (subject to licence conditions)
Noise	Sound level meter and possibly data logger	Adjacent to nearest residences and possibly Grass Valley	Quarterly; to be reviewed after 1 year	Sound power levels	Annually (subject to EPA requirements)	EPA (subject to licence conditions)

Appendix 5

Previous assessments by EPA of proposed rare earth plants

PJ Rodgers

Mr A Cooke

Mr J Dixon

NJ Alcock, Shire Clerk, Cunderdin Shire Council,

Mr A Thomas, Secretary Australian Ionising Radiation Advisory Council

Mr I Thornton, Water Authority of Western Australia

Mr G Cooke

Dr MB Cooper, Australian Radiation Laboratory

LP Strugnell, Town Clerk, City of Kalgoorlie-Boulder

Mr A Bradley, Department of Mines

PW & AM Laird

M Wylie, Explosive And Dangerous Goods Division , Dept of Mines

Ms J Hammond

Mr PA Collin

RE Turner, Shire Clerk, Shire of Laverton

RA & J Cooke

BH Wittber, Town Clerk, Town of Northam

Mr I Buchhorn

Mr B P Wall, Director, Environmental Health Health Department of Western Australia

Mr P Dempster

Ms L Hockey

Ms R Siewart, Co-ordinator, Conservation Council of Western Australia

R Heyhoe

Mr L Gentle

AJ Middleton, Secretary, Avon Community Development Foundation

Mr C Howrie

Mr H Gallagher, Kalgoorlie-Boulder Chamber of Commerce

Ms S Brandenburg, Chairman, Central Regions Development Advisory Committee

JB Horner

Mr D Popham

MW & LJ Scale

Narngulu - Allied Eneabba Ltd

Allied Eneabba Ltd proposed to establish a plant at Narngulu near Geraldton in 1985, using 12,000 t/a of monazite and 100 t/a of zenotime feedstock, which were residual phosphate minerals derived from local mineral sands production. A number of chemical processes would have been involved, using caustic and acid dissolution, precipitation, solvent extraction and ion exchange stages to produce a heavy rare earths concentrate. About 18,000 t/a of dissolved and suspended solids in 580 ML/a of wastewater would have been collected in evaporation ponds at the plant and 6,000 t/a of low level radioactive thorium residue would have been disposed of in shallow, clay-lined pits at either the plant site or the company's mine site at Eneabba.

The major environmental issues included consideration of thorium residue disposal, evaporation pond management and radiation safety. The EPA recommended against disposal of thorium residue at Eneabba due to the difficulties in modelling movements in the good quality groundwater that existed there, and determined that the company should investigate disposal sites at Narngulu. The EPA concluded that the project would be environmentally acceptable and construction could commence prior to finalising residue disposal and evaporation pond details, provided the company abided by its environmental management commitments and a number of recommendations by the EPA, including the development of detailed design of the waste management system by the company in accordance with the Code of Practice, establishment of a specialist committee by the State to review these designs and to assess environmental effects and monitoring programmes, the State's investigation for a Government radioactive site to be guided by the specialist group, a thorium residue study programme, details on radioactive materials transport, and the preparation of reports to the State on environmental management, triennial reports of which would be public documents.

Pinjarra - Rhone Poulenc Chimie Australia Ltd

Rhone Poulenc Chimie Australia Ltd proposed to establish a rare earths treatment plant at Pinjarra in 1988. The proposal had two stages. At full production, the first stage proposed to treat 15,000 t/a of monazite derived from local mineral sands producers. The process involved wet grinding and hot caustic dissolution, to produce an intermediate product containing rare earths hydroxides. Dissolved trisodium phosphate would be neutralised with lime to produce 8,000 t/a of calcium phosphate residue, which was to be disposed with wastewater in evaporation ponds at the Pinjarra plant site. The second stage involved treating half the intermediate product with nitric acid and ammonia to produce soluble rare earth nitrates, and a filter cake of thorium hydroxide, impurities and water, which would be transported to a remote site for disposal. The rare earth nitrates, after purification and solvent extraction, would be converted to rare earth salts. The second stage would produce ammonium nitrate and other wastes, such as ammonium chloride, rare earths nitrates and radium 226 and 228, which would be disposed of in the evaporation ponds.

The EPA's assessment of the Environmental Review and Management Programme identified that potential radiological impacts were the main environmental issue of concern with Stage I. The main areas of potential radiation exposure were transport of monazite feedstock, transfer of feed to the mill, milling of monazite, and transport of the intermediate product. Ground and surface water impacts associated with the storage of highly insoluble calcium phosphate residue in the evaporation ponds were considered manageable, and unlikely to pose a major risk to the Peel-Harvey inlet, which has a severe nutrient enrichment problem, in a worst case situation.

The EPA concluded that Stage I of the proposal was environmentally acceptable and recommended that it could proceed, subject to the the proponent abiding by the environmental management commitments, and the EPA's recommendations. Of major importance to the EPA was the proponent's commitments to management of principal sources of radiation exposure, the ALARA principle (as low as reasonably achievable) to minimising radiation doses, and management of the closure and rehabilitation of the evaporation ponds. The EPA further recommended that the proponent prepare a groundwater monitoring plan prior to commissioning, problem rectification and modification of future ponds if pond leakage was

detected, restrictions to rail only transport of rare earths product from Pinjarra to Fremantle, and preparation of a decommissioning plan.

The EPA considered, that for Stage II of the proposal to be acceptable, it should:

- demonstrate that the environmental impacts during the operational phases are manageable;
- require a "walk-away" option after completion of the project and so be environmentally acceptable in the long term; and
- not create any occupational health problems.

Approximately 16,000 t/a of ammonium nitrate would have been disposed of in evaporation ponds at Pinjarra. The EPA was concerned about the potential for the highly soluble ammonium nitrate to seep through the clay lined evaporation ponds, and to contaminate the groundwater and the Peel-Harvey Inlet, either during operations or after their cessation. The EPA concluded that it would be necessary to remove the ammonium nitrate from the evaporation ponds to make the ponds environmentally manageable in the long term. It was determined that 12,000 t/a of the ammonium nitrate would be low enough in contaminants to be commercially saleable. The balance of 4,000 t/a would be contaminated with 7 g/t of radium, and could not be sold unless the radium was removed. Disposal of this material (in solution) at the Health Department's Integrated Waste Disposal Facility at Mt Walton was suggested, however no environmentally acceptable transport proposal was put forward. An alternative proposal by the company was deep well injection of the radium-contaminated ammonium nitrate. In comparable plants in America and France, a radium removal circuit cleans the ammonium nitrate, which enables all this material to be sold. A radium removal circuit can cause high levels of gamma radiation in that section of the plant, and it was accepted by the proponent that such a circuit would probably not meet the standards set in this state.

The EPA considered that transport of thorium hydroxide residue to the Health Department's Integrated Waste Disposal Facility by road and rail in iso-containers would meet the requirements of the Code of Practice for the Safe Transport of Radioactive Substances. The proposal to dispose of low level radioactive thorium residue was considered to be acceptable to the EPA.

Prior to the EPA reporting on Stage II, the proponent withdrew from the project, citing changed economic circumstances as the reason.

To ensure compliance with EPA's atmospheric emission limits, Ashton would be required to carry out out air pollution modelling, prior to the issue of a Works Approval. Further information on specifications for pollution control equipment would also be required at this stage. Ashton will be required to provide an analysis of the plant product, to assist in the determination of the potential for types of pollution from the calciner stack. Stack monitoring of particulates and their composition, including heavy metals and radionuclides, would be required. As indicated previously, should Ashton's proposal proceed, it is suggested that a meteorological station is established and operating at Meenaar as soon as possible, to ensure that adequate data are acquired for the purposes of atmospheric pollution modelling.

The EPA considers that, subject to Ashton abiding by its commitments and meeting the requirements specified by the EPA, atmospheric emissions from the construction and operation of the proposed secondary processing plant site are likely to have minimal impact on nearby residents, and would be environmentally acceptable.

Visual impact

The secondary processing plant at Meenaar is likely to be partially visible from the nearest neighbour's residence (500 m to the north), as only Great Eastern Highway and the established vegetated area separate the homestead and the site. The most prominent component of the plant would be the emissions stack, which would be about 28 metres above ground level. A glow-haze associated with the lights required for night-time operation would be visible to users of Great Eastern Highway and possibly some residents.

A 30 m area between Great Eastern Highway and the railway contains trees and shrubs that visually screen the plant site. A rehabilitation and landscaping programme is expected to be undertaken within the Meenaar Industrial Park by the Industrial Lands Development Authority (now part of Landcorp) to establish native trees and shrubs, providing further screening of the plant. However, this visual screen would take some time to become established.

The location of the secondary processing plant in a broad valley also reduces the visibility of the plant from Great Eastern Highway; however, it is not expected that it would be entirely obscured. Although the conceptual plan for the Meenaar Industrial Park includes a vegetated area to the east of the plant site, the secondary processing plant may be visible from the elevated section of Great Eastern Highway to the east of Meenaar. Partial views of the plant may also be obtained from other sections of Great Eastern Highway not screened by road cuttings or embankments.

To minimise potential impacts on road safety and neighbourhood amenity, Ashton would direct all external lighting inward towards the premises and shield it from the direction of residences.

Ashton would landscape the secondary processing plant to visually screen the site from the Great Eastern Highway. The landscaping would include the establishment of a vegetative screen within the internal buffer area using local native trees and shrubs in strategic areas. A 2 m landscaped earth mound, taking into account natural drainage patterns, may also be established along the northern perimeter to screen the plant. Similarly, the bunds of the evaporation ponds would provide a screen along the eastern boundary.

The EPA considers that Ashton's proposed secondary processing plant site would have minimal visual impact and would be acceptable, if landscaping and lighting control were carried out as described in the PER. The EPA recommends that, prior to the start of construction activities at Meenaar, Ashton should prepare a plan detailing visual impact and landscaping measures, as part of the EMP, in consultation with the Shire of Northam. The plan should meet the requirements of the EPA (see Recommendation 2).

6.2.3 Risks and hazards

The EPA considers that people should not be exposed to unacceptable levels of risks and hazards from a development. The risk criteria developed by the EPA (EPA Bulletin 611) which are pertinent to this assessment are:

- A risk to individuals in a residential area of one in a million per year is considered so low as to be acceptable to the EPA.
- Risk levels from industrial facilities should not exceed a target of fifty in a million per year at the site boundary for each individual industry.
- A risk level for non-industrial activity located in buffer zones between industrial facilities and residential zones of ten in a million per year or lower, is so small as to be acceptable to the EPA.

The EPA considers that an assessment of risk to the community from a hazardous industrial development should be undertaken as part of the environmental impact assessment. Projects should be planned, designed and controlled so that risks and hazards are minimised and made acceptable. Contingency plans for accidental industrial spillages should be prepared. Facilities and emergency procedures for dealing with accidents should be planned to manage events which could still occur.

Preliminary risk analysis

A preliminary risk assessment of the secondary processing plant has been undertaken on behalf of Ashton. The analysis provides a preliminary assessment of the major hazards associated with the operations of the secondary processing plant that would have the potential to affect public safety beyond the plant site.

The main potential hazards identified were those associated with the storage of 150 tonnes of liquified petroleum gas, or LPG (mainly as propane). The assessment included the storage of 100 tonnes of anhydrous ammonia at Meenaar, which Ashton now propose not to use. Therefore the risk contours developed for the plant, which are shown in Figure 4, can be considered to over-estimate the extent of the risk. The ten in one million a year risk contour is contained within the boundary of the plant site, and the one in one million a year risk contour is contained almost entirely within that boundary. The individual risk level of fifty in one million a year was plotted, but appeared only as a single point over the LPG storage vessel.

The principal hazard associated with the LPG storage vessels is that of fire from an external source that threatens to overheat the vessel and cause flammable vapours to be released. Ashton has made a number of commitments to plant safety and risk minimisation at Meenaar. These include:

Commitment 25	The storage and handling of hazardous materials would be undertaken in accordance with relevant statutes and codes, and Ashton would institute an ongoing worker safety training programme.
Commitment 26	An emergency management plan would be developed by Ashton prior to commissioning, in consultation with the Department of Mines. The plan would include measures to be taken in the event of seismic activity.
Commitment 27	The LPG storage vessel would be designed and operated in accordance with *LP Gas: Storage and Handling* (AS 1596—1989), and would incorporate safety measures such as a fixed water spray (deluge) system as described in that standard.

Heat and fire protection of the LPG storage vessel would be provided through the establishment of a sufficient separation distance from potential heat sources as approved by the Department of Mines. The fixed water spray (deluge) system would be operated in the event of an external fire or heat source near the vessel. This spray system would be operated periodically (weekly) to ensure it was in operating order. Water would be applied to the vessel at a rate of not less than 10 L/min. per square metre of the total surface area of the vessel. Furthermore, the automatic spray system would include provisions for manual initiation and shut-off, and the means of manual initiation would be accessible under all fire conditions. The automatic system would be designed to come into operation in response to a 'fire-detected' signal, but would not be operated by the vapour pressure of the LPG storage vessel. The system would be designed to ensure that runoff water applied to cool the vessel, or from testing the system, did not endanger the foundations of the storage vessel.

The emergency management plan to be developed by Ashton will specify measures to be taken in the event of significant incidents involving hazardous chemicals or LPG stored on site.

The risk contours are based upon the conceptual design and do not incorporate risk mitigation measures such as the proposed fixed water spray (deluge) system for the LPG storage system.

A review of the preliminary risk assessment by the Explosives and Dangerous Goods Division of the Department of Minerals and Energy has indicated that the risk contours are within the limits of uncertainty. Furthermore, the review showed that the storage of 150 tonnes of LPG (and the 100 tonnes of anhydrous ammonia which are no longer required) at Meenaar would meet the EPA criteria established in Bulletin 611, provided all requirements of the Dangerous Goods Regulations 1992 are met.

Seismicity

The 1968 Meckering earthquake had a Richter magnitude of 6.8 and the return period for an earthquake of this magnitude is approximately 110 years. Ashton indicate that the effects of an earthquake with an annual recurrence interval of 500 years and a corresponding Richter magnitude of 7.2 are likely to be as follows:

- horizontal ground movement with a maximum velocity of 160 mm/s;
- horizontal ground movement with a maximum acceleration of 1.6 m/s, oscillating at a high frequency due to the generally shallow nature of the soils in the region;
- poorly graded, saturated and loose fine sands may tend to lose their shear strength and bearing capacity from liquefaction during an earthquake, possibly causing minor landslides;
- embankments may deflect longitudinally in a wave-like fashion, possibly resulting in the shearing of soil wedges from sloping faces; and
- waves may form in dams and ponds, possibly resulting in waves overtopping embankment walls.

Ashton propose that a number of measures would be taken to ensure that the secondary processing plant could withstand seismic events of the magnitudes considered credible. These would include the construction of critical structures, such as the barium precipitation building and chemical storage areas, upon heavy raft foundations to provide support. Additional bracing would also be provided. In terms of other building structures, appropriate sections of *SAA Earthquake Code* (AS 2121—1979) and AS 1170.4 (draft of the revised earthquake code) would be adopted for the design and construction of the secondary processing plant.

It is anticipated that the LPG storage vessel would be supported by a fixed-end column and a sliding-end column to allow for expansion and contraction of the vessel. The vessel would be supported above ground on reinforced concrete foundations. The vessel would be designed and constructed such that it met the requirements of *LP Gas: Storage and Handling* (AS 1596—1989) and the above earthquake codes.

Ashton indicate that the evaporation ponds would be designed to minimise the risk of damage resulting from seismic activity, and to meet performance criteria aimed at achieving low risk in relation to overtopping of embankments from seismically induced wave action; embankment failure, floor cracking, and cut faces slumping and causing excessive waves during a seismic event; leakage of wastewater; high life expectancy; and capacity for embankments to remain stable if subjected to accelerations and/or velocities arising from the estimated 50-year recurrence intervals presented in Gaull and Michael-Leiba (1987).

To design the evaporation ponds for a seismic event, Ashton would undertake the following work:

- assessment of the on-site soil conditions to determine their compaction properties and dispersivity;
- identification of appropriate locations and materials for the construction of the evaporation ponds;

- establishment of design criteria for the embankment construction, including specifications on compaction control for the earth embankments during construction;
- finalisation of the preliminary geometric arrangement of the ponds, taking into account the optimum shape of the ponds and the likely orientation of any seismically induced faults;
- completion of a stability analysis to model a soil profile, simulate the effects of seismic acceleration on the stability of the structure, and assess the factor of safety against failure of cut faces or embankments; and
- selection of a suitable synthetic liner with favourable properties relating to permeability, puncture resistance, shear strength and long-term resistance to the effects of ultraviolet light.

Ashton indicate that the pond embankments would be designed with an impervious core and cut-off to prevent seepage of water through the soil. The selected side slopes would be designed to provide adequate slope stability and to minimise the effects of erosion due to surface runoff. The ultraviolet resistant liner would protect the embankment from the erosive effects of wave action and prevent water from penetrating the embankments. The height of the embankments would be designed to account for 'wave run-up' due to both wind waves and waves generated from seismic shaking.

Ashton will develop an emergency action plan prior to commissioning, to cover the unlikely event of damage to the evaporation ponds following seismic activity. Inspections of the evaporation ponds would be made on a weekly basis.

Management by Ashton of seismic impacts on the secondary processing operation at Meenaar are addressed in Commitments 25, 26, 27 and 32.

The Geological Survey of WA has reviewed Ashton's proposal and considers that suitable undertakings have been made by Ashton concerning the necessary investigation and design activities to complete the designs to construction stage.

The EPA considers, on the basis of the preliminary risk assessment, the commitments by Ashton, and the advice of the Department of Minerals and Energy, that the individual risk levels developed for the secondary processing plant would be acceptable. Ashton's proposal to address potential seismic impacts as outlined in the PER is considered comprehensive and is environmentally acceptable . The EPA considers that, prior to the commissioning of the the secondary processing plant, Ashton should prepare an emergency management plan, as part of the EMP, which should address risk issues associated with storage of dangerous goods and seismic contingency plans at the Meenaar site, in consultation with the Department Minerals and Energy. The plan should meet the requirements of the EPA (see Recommendation 2).

6.2.4 Impacts on local community

Ashton predicts that 75% of the construction workforce would come from the local region. Any imported construction workforce would use temporary accommodation in Northam. There is sufficient vacant space in temporary accommodation to make the accommodation strategy viable. The EPA has been advised that ongoing monitoring of accommodation use would be required to ensure unforeseen difficulties are identified and issues addressed.

Ashton propose that the operational workforce would be recruited locally where possible. The EPA has been advised that Ashton's plans for local recruitment are a vital element of the community's support for the proposal. Local recruitment would address issues of unemployment and the downturn in the area's rural economy.

Ashton has undertaken to consult with the Northam TAFE Centre to ensure adequate workforce training programmes are available. This would increase the capacity of the local community to provide the labour force for the proposal.

Some of the operational workforce, particularly skilled workers, are expected to move to the region. The region has ample capacity in community infrastructure, housing and land availability to support an increase in population.

Ashton has made a commitment to undertake a social monitoring programme in conjunction with the management programme proposed for the Meenaar Industrial Park (Commitment 28).

In response to submissions, Ashton has indicated that local contractors would be given the opportunity to tender for contract to service various requirements of the secondary processing plant. Use of local contractors would further enhance the local benefits of the proposal.

6.3 Transport

6.3.1 Transport of beneficiated ore to Meenaar and residues to Mt Weld

Consideration of options

At present there are no direct rail services to the Mt Weld or Meenaar sites; therefore, the modes of transport considered by Ashton were road only and a road–rail combination.

Comparison by Ashton of road and road–rail transport options for concentrate and residues took into account the following issues:

- risk of spillage resulting from accidents;
- flexibility and security of operation; and
- operating and capital cost.

Spillage risk took account of both the probability of accidents causing spillage during transport, and the potential environmental and health consequences of such spillages.

The comparison of accident risks involves a comparison of a long road section with two short road sections, a long rail section, two shunting operations and two road–rail transfers. No adequate statistics are available that directly address the probability of accidents causing loss of containment from transporters similar to those to be used by Ashton on the relevant routes. Ashton acknowledge that, in general, transport by rail is considered to present a lower risk of accident per kilometre travelled than transport by road. However, the company considered that a comparison based on kilometres travelled alone ignores the risk inherent in the shunting and lifting operations that form part of the road–rail option. While spillages occurring in these latter operations would be largely contained in rail yards, they should be included in a risk assessment.

Neither concentrate nor residue would be classified as dangerous goods under relevant regulations, and Ashton do not believe that spillages and the likely consequences would be sufficiently serious to warrant a precise comparison of accident risk for the two options.

Ashton considered that the road only option provides the greatest operational control and flexibility.

The road–rail option would involve additional capital and operating costs in that three independent transport operations (namely, Mt Weld–Leonora, Leonora–Grass Valley, Grass Valley–Meenaar) must be maintained with their distinct equipment needs.

For the above reasons, Ashton concluded that a road only transport operation direct from Mt Weld to Meenaar is the preferred option. The route approved for B-doubles follows the main roads from Laverton to Leonora to Kalgoorlie and then via Great Eastern Highway to Meenaar.

In response to the many submissions concerned about the impacts of road transport, Ashton has pointed out that significant changes to the cost competitiveness of the road-rail option relative to the road-only option would permit the company to revise the preferred transport option.

Impacts of vehicle movements

12,000 t/a of wet beneficiated ore concentrate from Mt Weld would be transported to Meenaar by road using 40 t capacity B-doubles—trucks comprising a prime-mover pulling two trailers. 28,500 t/a of wet residue would be transported from the secondary processing plant for disposal at Mt Weld. Ashton estimate that there would be about four traffic movements per day associated with the transport of ore and residues. Miscellaneous transport would be at one to two truck movements per week.

Both materials would be moved in specifically designed ISO-type tanktainers, each holding 20t, (less than 10 m^3). Concentrate transport to Meenaar would require 600 tanktainer movements per annum. As the ratio of concentrate to residue would be 2:5, most tanktainers travelling from Mt Weld to Meenaar would be empty. All 750 tanktainers would be full for the return journey from Meenaar to Mt Weld.

The journey of approximately 880 km between Mt Weld and the Meenaar secondary processing plant would take about 12 hours, including a 1 hour allowance for meal stops and vehicle checks.

The proposed transport route is as follows:

- Mt Weld to Laverton via the Leonora–Mt Weld road;
- Laverton to Leonora on Laverton Road;
- Leonora to Kalgoorlie via Menzies and Broad Arrow along the Leonora–Kalgoorlie road;
- along the Eastern bypass, Burt Street and Gatacre Street through Kalgoorlie to Great Eastern Highway;
- Kalgoorlie to Meenaar via Coolgardie, Southern Cross, Bodallin, Burracoppin, Merredin, Kellerberrin, Tammin, Cunderdin and Meckering along Great Eastern Highway.

The traffic on the Laverton–Leonora road has increased by over 11% per annum for the past ten years, in line with the general increase in mining activity in the region. Ashton considers that the proposed future 2% increase in traffic associated with its operation at Mt Weld is within normal operating parameters.

The additional heavy truck traffic associated with the transport of ore residues and other items associated with the project is estimated to add approximately 6.3% to the annual average daily heavy vehicle traffic rates on the Leonora–Laverton road. There would be an increase of some 10–50 movements in the daily light traffic between Laverton and Mt Weld as the workforce commuted. The Mt Weld mine access road would be upgraded and maintained by Ashton to the standard required by the Shire of Laverton. State Government road regulations would apply.

Many submissions to EPA raised concerns about noise, vibration, safety and nuisance impacts on the communities along the transport route for the additional heavy transport passing through built up areas between Meenaar and Mt Weld. In its response, Ashton has pointed out that the estimated increases in traffic are limited to approximately two trucks passing each way along these roads each day, generally representing less than 1% of the recorded annual average daily traffic along the proposed routes. However, Ashton are examining ways of reducing this traffic load further by decreasing the volume of residue (calcium phosphate) requiring transport from Meenaar to Mt Weld. Ashton considers that project related traffic is unlikely to significantly decrease road user safety and communities near the transport routes are unlikely to be significantly inconvenienced by the small increases in traffic associated with the project.

The EPA considers that road-only option chosen by Ashton for the transport of concentrate and residue between Meenaar and Mt Weld would have some environmental impact, particularly on communities along the route. However these impacts are not significant and a requirement for road-rail transport by the company is not warranted, given that the materials are not classified as dangerous goods.

Public exposure to radiation from transport

Ashton has made estimates of the doses from gamma radiation that workers and the public would be exposed to during the transport of concentrate, and the transport and storage of residues. Doses due to inhalation were not considered as the materials would be either wet or in sealed vessels.

The principal sources taken into consideration when estimating doses were tanktainers of ore and residues, ore and residue storage tanks, and the residue ponds at Mt Weld.

Ashton considers that the project's transport operations present minimal risk of radiation exposure for the public. There are very few circumstances conceivable in which members of the public would be sufficiently close to concentrate or residues for long enough that they would absorb doses discernible from background levels.

Most realistic scenarios of the public encountering concentrate or residue trucks suggest an annual exposure to sufficiently few trucks (less than fifty) for such brief times (less than a few minutes) at relevant distances (less than 5 m) that the annual exposure would be less than one-thousandth of the recommended annual dose limit for a member of the public.

Ashton does not propose any radiation monitoring of the public along the transport route, as the company has estimated that doses to the general public would be indistinguishable from background doses.

The levels of radiation associated with trucks would be monitored as part of Ashton's normal occupational radiation monitoring programme.

The EPA was concerned at how Ashton would ensure that the concentrate and residue carried in the trucks does not exceed the radiation limit of 7×10^4 Bq/kg required by the Explosives and Dangerous Goods Act and associated regulations, or alternatively identify those that do exceed this level, thus requiring special labelling and handling. Ashton has responded that the estimate of the radioactivity level of the concentrate to be carried to Meenaar is based on the mean level of radionuclide concentrations within the ore samples assayed by Ashton. This estimate (5.4×10^4 Bq/kg) is 20% below the limit specified by regulations as designating a radioactive substance for the purposes of transport (7.0×10^4 Bq/kg). Variation of radionuclide concentration in the ore samples is sufficient only in a small percentage of cases to produce concentrate which exceeds the limit. However, ore being processed will be mined from a variety of sites within the pit, and concentrate from a number of days production will be constantly blended within a large holding tank before shipment. Thus the radioactivity of concentrate is likely to be close to mean levels. Regular measurement of the activity of concentrate will be undertaken by Ashton to ensure that levels are below statutory limits. Should a high activity occur within the holding tank, activity would be reduced through further blending before transporting the material.

B-doubles would be designed to have a low centre of gravity to reduce the risk of rollover. The tanks would be constructed of boiler quality steel to withstand pressures greater than 170 kPa. All nozzles and openings would be designed to eliminate the possibility of leakage from bottom outlets or damage of bottom pipework. The loading and discharge points would be strengthened and shielded to provide rollover protection.

Ashton has indicated that detailed records of each journey would be kept to ensure compliance with speed limits. Travel during bad weather or flood conditions would be avoided. Adequate emergency residue storage for up to 8 days' production would be provided at Meenaar. The drivers of the road vehicles would be provided with cab-mounted radios to allow regular contact with plant personnel at Mt Weld and Meenaar. This equipment could also be used in the event of an accident.

Emergency response and cleanup procedures

If a tanktainer were to rupture, the amount of contents lost and its immediate behaviour would be governed by its consistency. Concentrate (15% moisture) and residue (30% moisture) would be in the form of a dense paste and, under most rupture scenarios, a large proportion of

the contents would remain within the tanktainer. Ashton has considered the worst case scenarios, involving the consequences of total loss of the contents.

Spilt materials would mostly remain adjacent to the tanktainer and little fluid would enter the underlying soil or, in a built-up area, run off into drains. Under dry conditions, effectively no fluid would leave the paste at this low moisture content. During periods of rain, the paste may be spread by surface water.

Thorium oxide and uranium oxide, the radioactive constituents of the natural ore, are effectively insoluble at a neutral pH and would be transported as particulates in any surface water or rain runoff. Under saline conditions, radium in the concentrate or residues may be quite soluble. Amounts of radium in the concentrate and residues are estimated by Ashton to be very low under most circumstances.

Exposure of the public or emergency crews to radioactivity could occur through gamma radiation or through the inhalation of dust containing radionuclides. Ashton has estimated gamma radiation exposure from a thin layer 20 m in diameter for a person standing 1 m away over 48 hours would amount to about one-thirtieth for concentrate or one-seventieth for residues of the annual limit recommended for public exposure respectively.

Inhalation of long-lived radionuclides in dust could present a greater risk of exposure should clean-up measures be delayed such that the concentrate or residues began to dry or spread. Ashton expects that emergency procedures would be able to avoid this outcome under most scenarios.

Ashton has given a commitment that transport and handling procedures will comply with the requirements of the Commonwealth of Australia's Code of Practice for the Transport of Dangerous Goods by Road and Rail 1987 and the Commonwealth of Australia's Code of Practice for the Safe Transport of Radioactive Substances 1990, together with the Western Australian Dangerous Goods Regulations 1992 and the Radiation Safety (Transport of Radioactive Substances) Regulations 1991 (Commitment 38). The Commonwealth and State dangerous goods codes and regulations require correct labelling, placarding and documentation when consigning dangerous goods. In the event of an accident, this information would help to ensure an appropriate response.

Ashton has given a commitment that emergency procedure guides and emergency contacts would be documented and available in vehicle cabs, and all drivers would be instructed in the actions, as specified under the Western Australian Hazardous Materials Emergency Management Scheme, to be taken in the event of an accident (Commitment 39). The Western Australian Hazardous Materials Emergency Management Scheme involves:

- the control authority (usually the police) responsible for management of the entire incident;
- the combat authority (the fire brigade) responsible for the physical combat of the fire, leak or spill of dangerous goods; and
- support organisations responsible for the provision of resources and specialist advice as needed; for example, the Health Department, the Department of Minerals and Energy and the EPA.

Ashton has indicated that emergency procedures to prevent pollution from transport accidents would be prescribed fully prior to commencement of transport. These procedures would specify that initially:

- the area surrounding the spill be cordoned off—a distance of 25 m from the edge of the spilt material would be sufficient to reduce the rate of public exposure to a negligible level; and
- the spill be sealed with foam spray to avoid drying and dust formation. Trucks would carry 12 L cans of portable foam capable of covering any spilt paste in danger of drying; if these spray extinguishers were destroyed, water, when available, could be sprinkled on to the spill until the fire brigade arrived.

The initial response team should arrive within several hours of the accident, within which time public exposure would be minimal and the material would be unlikely to have dried sufficiently to produce significant quantities of dust. Within 12 hours of notification, the Ashton clean-up team would arrive. Industrial wet–dry vacuum cleaners would be used to transfer paste and the surface layer of soil to another tanktainer. A radiation check of remaining soil would be undertaken to ensure that no radioactive material was left behind. Nutrient and salt pollutants would be removed by this operation with the exception of those dissolved in the small amounts of water that might have left the site.

If the paste were to enter an enclosed waterbody, specialised recovery teams would be used to pump out the undissolved residues, which would contain the majority of the low solubility phosphate and radionuclide components. Paste entering running water would be largely lost, but in such a situation significant acute or chronic effects are unlikely, due to dilution.

In the event of a road accident, time taken to mobilise a response team would be minimised by provision of radio schedules for each truck, clearly marked contact numbers on the vehicle, and training and equipping of rapid response teams (comprising Mt Weld and Meenaar employees).

Ashton has indicated that drivers would be trained in emergency procedures, including the use of foam and clean-up operations. All emergency equipment would be maintained by Ashton to ensure a safe operation.

Ashton has given a commitment to address the monitoring and management of transport issues in the EMP, to be developed in consultation with, and to the satisfaction of, the EPA (Commitment 2).

In response to submissions about the danger that heavy and dangerous goods traffic associated with Ashton's proposal poses to other road users and communities along the route, the company has responded that compliance with the requirements of regulatory authorities and licence/permits issued for vehicles and to drivers would ensure that the established safety standards would be met. These safety standards have been developed to ensure that the risk of accidents is minimised. One of the conditions of contract for transport operators engaged by Ashton would be that these safety standards are met.

Conclusion

The EPA considers that the impacts of transport of concentrate and residues between Mt Weld and Meenaar would be minimal and therefore acceptable. The EPA considers that, prior to the commissioning of the secondary processing plant, Ashton should prepare a transport management plan and a radiation management plan, as part of the EMP in consultation with the Department of Minerals and Energy and the Health Department. The plan should meet the requirements of the EPA (see Recommendation 2).

6.3.2 Transport of dangerous goods and other feedstock chemicals

Consideration of options

The options available to Ashton for the transport of chemicals and dangerous goods from Kwinana or Fremantle to Meenaar are either directly by road; or by road to the Kewdale rail depot, where facilities exist for loading International Standards Organization (ISO) containers on to rail wagons, and then by rail to Grass Valley and by road to Meenaar. The latter option would require an unloading facility for ISO containers to be constructed at Grass Valley.

The routes available for transporting bulk chemicals from Kwinana to Meenaar are limited to those approved by the Main Roads Department (MRD). Ashton's preferred route to Meenaar is via Northam along Great Eastern Highway.

Environmental impacts of transport of chemicals and dangerous goods to Meenaar

Chemicals to be used at the Mt Weld beneficiation plant and the Meenaar secondary processing plant (Table 1) would be transported by road. All chemicals would be sourced in the Kwinana region where possible; oxalic acid and some minor constituents such as solvents may need to be imported via Fremantle.

A total of 600 t of chemicals would be transported to Mt Weld each year; while the Meenaar secondary processing plant would require 38,220 t/a in Stage I, increasing to 49,620 t/a in Stage III. If ammonium bicarbonate were used instead of oxalic acid, tonnages would increase by 3,000 t/a to 52,620 t/a .

Transport of all chemicals between Kwinana and Meenaar would follow roads approved for B-doubles and pass along Cockburn Road, Stock Road, Leach Highway, Tonkin Highway, Roe Highway and Great Eastern Highway. The route from Fremantle would originate in North Quay and cross Stirling Bridge to join Leach Highway; from there, it would follow the B-double route. State and Commonwealth regulations and codes for the transport of dangerous goods would be followed where applicable.

Based on the composition of feedstock chemicals for the Meenaar secondary processing plant, approximately 70% of transported stocks would be classified as dangerous goods and would therefore be carried by B-doubles. Assuming an average 40 t load, this would require approximately 1,000 trips per annum. All chemicals classified as dangerous under the Dangerous Goods Regulations 1992 would be transported in accordance with those regulations.

The 30% of chemicals not classified as dangerous goods would be transported under the MRD's general road traffic regulations and guidelines. These chemicals would be transported by a mix of articulated vehicles such as B-doubles and ordinary rigid trucks. Assuming an average 30 t load, this would require 500 trips per annum.

Ashton has indicated that emergency procedures required to combat chemical spills resulting from accidents occurring during transport would be covered under the Western Australian Hazardous Materials Emergency Management Scheme.

The Explosives and Dangerous Goods Division of the Department of Minerals and Energy has indicated that it would work with Ashton to ensure that its emergency management plan complies with the Dangerous Goods Regulations 1992.

Conclusion

Following its review of the PER, the Explosives and Dangerous Goods Division of the Department of Minerals and Energy has indicated that Ashton's conclusion and preferred options are acceptable.

The EPA considers that the impacts of transport of dangerous goods and process chemicals to the secondary processing plant at Meenaar would be minimal and therefore environmentally acceptable. The EPA recommends that, prior to the commissioning of the the secondary processing plant, Ashton should prepare a transport management plan, as part of the EMP, and in consultation with the Department of Minerals and Energy. The plan should meet the requirements of the EPA (see Recommendation 2).

6.3.3 Transport of rare earths

For cerium and the individual rare earths extracted in Stages II and III, rare earths compounds would be produced in the form of a dry powder and stored in storage bins; powder would be packed inside sealed plastic-lined drums varying in size from 1 kg to 10 kg. Drums would be stacked on pallets and shrink-wrapped in plastic film to ensure the integrity of loads. Rare earths concentrates produced in Stages I and II would be packaged in 900 kg lots in 'bulka bags'. All packaging would be to approved Australian and export standards.

Products would be stored on site pending customer demand. Pallets would be shipped in sea containers; smaller quantities would be shipped as general cargo. Loads transported in sea containers would vary in size according to demand. In general, it is expected that load-out quantities would be in the order of 20 t. In this case, approximately 250 loads per annum would be transported by standard trucks (along Great Eastern Highway and Leach Highway) to the North Quay container terminal in Fremantle for shipping. Demand for small quantities of individual rare earths may increase as Stages II and III of the project produce more refined products, leading to a decrease in load size and an increase in load frequency.

The EPA considers, on the basis that the rare earth products would be non-radioactive, of low toxicity, and would be well packaged and handled, that the transport of rare earth products from Meenaar to Fremantle is environmentally acceptable.

6.4 Radiation

6.4.1 Previous assessments by EPA of proposed rare earth plants

The EPA has previously assessed two other proposals to establish facilities to process rare earths in WA. Neither of these proposals has proceeded to production. A brief summary of the EPA's assessments of these proposals is provided in Appendix 5.

6.4.2 Radiation protection standards

The EPA considers that people need protection from exposure to excessive levels of radiation.

The annual average dose for people living in industrialised countries, from background and artificial sources, has been evaluated to be about 2.4 mSv (United Nations Scientific Committee on the Effects of Atomic Radiation 1988). Radon gas in homes contributes nearly half of this radiation.

The PER identifies the legislative requirements and codes of practice which are used to control radiation in Western Australia, most of which are based on recommendations from the International Commission on Radiological Protection (ICRP) and the National Health and Medical Research Council.

In setting radiation protection standards, the ICRP assumes that there is no threshold dose for the induction of cancer and that the effect of radiation is directly proportional to the dose and is independent of dose rate.

The Australian Ionising Radiation Advisory Council has advised the EPA that the dose limits recommended by the ICRP distinguish between people exposed to radiation in the course of its work and members of the public. In their most recent recommendations, dose limits for occupationally exposed employees are set at a level of dose, above which, for regular and continuous exposure over a working lifetime, the consequences for the individual would be widely regarded as unacceptable. The ICRP recommends a dose limit of 1mSv in a year, excluding exposure from natural background radiation and medical exposure. The ICRP considers that continued exposure at this level from deliberate practices which are a matter of choice would be just short of unacceptable.

The two tiered dose limit system has been introduced in Australia in order to focus monitoring resources and control efforts on the most exposed employees.

6.4.3 Assessment of Ashton's proposal

Management approach

Ashton has committed to the ALARA principle (which requires that exposures to radiation be kept as low as reasonably achievable, taking into account social and economic factors) for all components of the project (Commitment 12).

Ashton has committed to comply with all formal regulatory radiation protection requirements. Commitment 13 states that Ashton would meet the Commonwealth requirements for radiation control outlined in the Commonwealth of Australia publications, the Code of Practice on Radiation Protection in the Mining and Milling of Radioactive Ores 1987 and the Code of Practice on the Management of Radioactive Wastes from the Mining and Milling of Radioactive Ores 1982. Both of these codes have been adopted under the Mines Regulations Act Regulations. Similarly, the Western Australian requirements for radiation control outlined in the Radiation Safety (General) Regulations 1983 would be met.

Commitment 14 states that under Ashton's commitment to the ALARA principle, radiation protection design targets to be adopted for all employees would be less than 2 mSv/a and would not require designation of employees as radiation workers.

Prior to commissioning facilities at Mt Weld and Meenaar, Ashton is required to prepare and submit a Radiation Management Plan that would address the management and monitoring of occupational and environmental radiation issues associated with:

- mining and milling
- transport
- residue disposal

to the satisfaction of the Department of Minerals and Energy and of the Radiological Council, with advice from the EPA (Commitment 4).

In its proposal, Ashton has indicated that the design criteria for the rare earths project would include the following measures:

- establishment of a controlled-access area for the barium–radium precipitation stage;
- physical separation of controlled areas from other sections of the rare earths processing operation by use of barriers;
- design of the above areas to resist earthquake damage;
- reduction of air contamination by avoiding the handling of dry material; for example, the wet milling of ore and the disposal of residue in wet form;
- remote operation of process equipment located in the controlled area, to reduce potential exposure times;
- full containment of the process to minimise potential for spillages;
- shielding, where necessary, of equipment and storage areas containing bulk quantities of radioactive material, to reduce exposure rates;
- selection and design of equipment in the controlled area for reliable operation and ease of maintenance;
- use of non-absorbent, easy-to-clean floor surfaces, bunded to contain spills for return to the process;
- provision of facilities for easy and regular washing of floors and equipment. All washings would be returned to the process via floor sumps; and
- provision of operator access via a change room to controlled areas (i.e. the monazite milling and residue filtering facilities).

The proposed radiation protection design criteria for the project are listed in Table 4. Ashton indicates that radiation exposures would be continually reviewed during the operation of the mining and processing operation to identify opportunities to improve practices and procedures.

Table 4. Radiation protection design targets proposed by Ashton - based on PER

Personnel category	Design criteria proposed by Ashton	Relationship to radiation protection standards
Employees	<2 mSv/a	Less than 1/10 the annual dose limit for designated employees
Members of the public	<0.05 mSv/a	Less than 5% of annual dose limit

Sources and management of radiation emissions

The amounts of radioactive thorium and uranium involved in Ashton's proposal are summarised in Table 5.

Table 5. Concentrations and annual tonnages of radionuclides in mine and residue streams (from PER)

Material	Total dry weight	Thorium		Uranium	
	(t/a)	(%)	(t/a)	(%)	(t/a)
Mined ore	50,000	0.07	34.4	0.002	1.25
Beneficiation residue	40,000	0.05	20.4	0.002	0.95
Meenaar plant residue	20,000	0.07	14.0	0.001	0.30

Possible radiation exposure pathways associated with the proposed development comprise:

- External:
  - Exposure to gamma radiation from materials outside the human body.
- Internal:
  - Inhalation of particulate thoron and radon progeny, which form in the atmosphere by the decay of thoron and radon gas escaping from solid materials.
  - Inhalation of airborne particulate matter containing inspirable particles of long-lived alpha-emitting radionuclides.

All three pathways may be of consequence in the handling of members of the Th-232 and U-238 decay chains, which result from the decay of the monazite minerals present in the rare earths ore.

Release of radon and thoron gases may be expected upon exposure of the ore during mining, or during processing of the ore. Thoron (Rn-220) has a very short half-life of only 55 seconds and thus poses minimal risk at any distance away from its source. Ashton considers that both thoron and radon would contribute negligible radioactivity to the total dose exposure of employees in the operation.

The Health Department considers that, as the thorium/uranium content of the ore is only about 1/50 that of beach sands monazite, the radiological impact of the project would be minimal.

Transport of beneficiated ore concentrate to Meenaar

The beneficiated ore concentrate from Mt Weld would have an estimated specific activity of 5.4 x 10^4 at 15% moisture. The activity estimate is based on a concentration of 0.14% thorium and 0.004% uranium on a dry weight basis, as estimated in concentrate from the AMDEL pilot plant (or 0.115% thorium and 0.003% uranium in the paste).

Levels of radiation would be sufficiently low that beneficiated concentrate would not be classified as a radioactive substance under the WA Radiation Safety (Transport of Radioactive Substances) Regulations 1991, the Commonwealth of Australia's Code of Practice for the Safe Transport of Radioactive Substances 1990, or the State and Commonwealth dangerous goods regulations and codes. These specify that radioactive substances are those emitting in excess of 7.0 x 10^4 Bq/kg. For the level of radioactivity in a batch of the concentrate to exceed this statutory limit, a 30% increase above the average would be required. In response to submissions, Ashton considers that such an increase is highly unlikely, given the low variability of radioactivity throughout the orebody and the blending of ores that would occur in stockpiling, beneficiation and storage.

As a result of Ashton's commitment to the ALARA principle in handling this low specific activity substance, many of the practices specified under the above codes and regulations, although not formally required, would be adopted in the transport plan.

The Department of Minerals and Energy has indicated that the concentrate would not be defined as a radioactive substance for the purposes of transport.

Ore beneficiation at Mt Weld and secondary processing at Meenaar

Chemical treatment of ores may increase the radon and thoron emanation by opening up additional release pathways. Chemical attack would be strongest during processing of the beneficiated ore. Estimates by Ashton show that release of both gases during the various phases of processing would be negligible. Potential release rates would be highest for the barium–radium precipitation step. However, Ashton anticipate that actual releases would be low due to the small quantities of residue present at any one time. Enhanced ventilation in this area would ensure that gases did not accumulate to significant concentrations.

Ore beneficiation and processing contain mainly wet stages. Ashton expect that air quality within these operations would be controlled such that the concentration of airborne ore and beneficiated ore would not exceed 0.1 mg/m^3. Uncontrolled venting of material from the calciner might result in an elevation in the internal component of occupational dose. Emission control requirements would be determined according to the results of radionuclide deportment tests currently being conducted by ANSTO as part of a pilot plant study.

No specific radon or thoron control measures are planned by Ashton, as thoron and radon release are predicted to be sufficiently small not to be a problem.

The Australian Ionising Radiation Advisory Council and the Australian Radiation Laboratory has indicated in its submissions to the EPA that it is unlikely that the project would present a serious occupational or public radiation exposure problem. The Department of Minerals and Energy also indicated that radiation is not expected to be a significant hazard at the various stages of the project.

The Department of Minerals and Energy has indicated that the processing of the concentrate will require some level of radiological surveillance.

The Health Department considers that, as the thorium/uranium content of the ore is only about 1/50 that of beach sands monazite, the radiological impact of the project would be minimal. This would require ongoing verification. The Health Department also considers that positional monitoring of radon gases should be used to establish a background level, and that significant increases did not occur.

As discussed in Section 6.2.2, EPA will require Ashton to provide an analysis of the plant product, to assist in the determination of the potential for types of pollution from the calciner

stack. Stack monitoring of particulates and their composition, including heavy metals and radionuclides, would be also be required.

Transport of secondary processing residues to Mt Weld

The 28,500 t/a of secondary processing residue would have a specific activity of 2.3 x 10^4 B/kg at 15% moisture, after blending of all residue streams within the plant. The material would be in the form of a paste able to be pumped following reslurrying. Based on effectively all radionuclides leaving the Meenaar secondary processing plant in the residue , the concentration of radionuclides would be 0.048% thorium and 0.001% uranium in the residue paste.

Should calcium phosphate be separated from the residue at Meenaar, this would increase the level of radiation in this residue to be returned to Mt Weld by approximately one third. At that increased level, radioactivity would be still be less than half that of the transport limit requiring designation as a radioactive substance under the Explosives and Dangerous Goods Act.

At Meenaar, the residue would be stored in a 350 m^3 tank. In accordance with the ALARA principle, this tank would be shielded by a 2 m high earthen wall, approximately 1 m thick, to reduce the potential for exposure of plant employees and of truck drivers to gamma rays.

Following delivery of concentrate to the secondary processing plant at Meenaar, the empty containers would be refilled with residue for transport back to Mt Weld via the same route. Upon arrival at the mine site, the residue would be pumped into below-ground residue ponds. Each pond would be approximately 75 m x 75 m and would hold about 2 years' production of residue. After filling, these ponds would be sealed and capped.

The Department of Minerals and Energy has pointed out that the residues returned to Mt Weld would have less radioactivity than the original deposit, and that the concentrations of thorium and uranium would be below the radioactive waste criteria specified in the relevant Code of Practice. At decommissioning of the residue ponds, the cover would attenuate radon emissions by more than 90% and gamma emissions by more than 99%.

Solid residues and wastewater

The deposition of radioactive waste from the project would be governed by the Commonwealth of Australia's Code of Practice on the Management of Radioactive Wastes from the Mining and Milling of Radioactive Ores 1982. The two waste streams which may come into the scope of the Code would be the residue from the beneficiation plant at Mt Weld and the residue from the secondary processing plant at Meenaar. Wastewater from the Meenaar plant would contain concentrations of radionuclides similar to those found in water supplies around metropolitan Perth (e.g. 10–90 mBq/L of Ra-226 and 15–150 mBq/L of Ra-228) and would not be classified as radioactive.

Precipitation and filtration treatments of neutralised wastewater from the Meenaar plant are expected to remove effectively 100% of the thorium and 99.8% of the uranium as solids in the main residue for return to Mt Weld. The minimal amounts of radionuclides entering ponds with wastewater would not accumulate to higher concentrations, as approximately 7,000 t/a of solids would be deposited with them on evaporation.

Of concern to the EPA is the potential for radionuclides to leach into groundwater from the deposition of solid residue from the secondary processing plant. Within the solid residue streams, radionuclides would occur as high surface area hydrous oxides and hydroxides. Although both thorium and uranium would be largely insoluble under most conditions likely to be encountered, radium would be fairly soluble in saline groundwaters.

Ashton expect that all radionuclides passing to the cerium circuit would be precipitated out during neutralisation of the wastewater. Radium in the liquor stream passing to the rare earth solvent extraction process would be removed by precipitation with sulphate. Should this process be shown to remove unacceptably high levels of rare earths, Ashton has indicated that a different, equally efficient method of radium removal would be undertaken. The radionuclides in solid waste resulting from neutralisation of wastewater and precipitation of radium would be returned to Mt Weld in the general residue stream.

Ashton predicts that the lead component (Pb-210) in the rare earth liquor would be effectively removed by precipitation with sulphate. This process would also occur in the impurity removal stage in the isolated section of the processing plant. The residue would then be blended into the major waste stream. As Pb-210 is part of the uranium chain that occurs at very low concentrations, amounts of lead residue would be small.

As the orebody within the carbonatite pipe at Mt Weld contains levels of radionuclides above those to be deposited in residue structures, pollution of soils and waters by radionuclides from wastes is unlikely to have a significant impact. Baseline measurements of groundwater radioactivity at Mt Weld show that levels of alpha and beta radioactivity are presently about twice the action levels specified by the Department of Health for drinking water (action levels for gross alpha or gross beta are 0.1 Bq/L; values in excess of these do not necessarily mean that the water is unfit for drinking). Measured values in groundwater at Mt Weld are 0.14 Bq/L and 0.11 Bq/L for gross alpha, and 0.38 Bq/L and 0.25 Bq/L for gross beta. Ashton's containment measures of residues within ponds appear to be largely aimed at the salts from by-products of the beneficiation and caustic cracking processes. Nevertheless, the compacted clay liner of the ponds would retard any large movement of radionuclides.

Prior to commissioning residue disposal facilities for these streams, Ashton would obtain approval for a management plan covering operations at the facilities from the Department of Minerals and Energy, the Radiological Council, the EPA and other relevant authorities. The management plan would cover the design of the facility, its operation and final rehabilitation.

The Australian Radiation Laboratory has indicated that, given the chemical state of radium and the particle size of the residues, it is possible that radon emissions in the residues will be significantly greater than in the ore. In response to this issue, Ashton considers that radon emissions from residues would be inconsequential given the projected levels of radon emissions from process materials during mining, beneficiation and processing. The Health Department considers that radon levels should be measured for verification purposes.

It is considered that, whilst radon emissions may be higher in the residues as compared to the ore, the concentration of uranium (the parent of radon) in both residue and ore is very low, and within the range of background values. Covering of the residue ponds would result in negligible radon emissions from the residue.

The EPA has recommended previously in this report (Section 6.1.3) that Ashton should prepare a plan for residue disposal and wastewater management at Mt Weld, as part of the Environmental Management Programme (EMP), and in consultation with the Water Authority of Western Australia, the Health Department of Western Australia, and the Department of Minerals and Energy of Western Australia. The plan should meet the requirements of the EPA.

Public exposure

With the exception of the transport component, pathways of exposure for the public not directly entering Ashton premises at Mt Weld or Meenaar would be as follows:

- Gamma radiation: Ashton considers that sources are of such low specific activity that doses at the boundaries of the plants would be indistinguishable from background levels.
- Radon and thoron: Ashton predicts that emissions within the plants and mine would be sufficiently low as to be indistinguishable from background levels at the plant boundary.
- Inhalation of radionuclides: Strict management of concentrate and residues by Ashton at Meenaar would prevent occurrence of any significant concentration of dust containing radionuclides; small amounts of dust containing radionuclides may escape from the mine and stockpile at Mt Weld but would be unlikely to come into contact with people in the vicinity in quantities that would result in measurable doses.

Visitors to the mine and plants would be regulated such that there was little chance of their receiving a discernible portion of the 1 mSv/a dose recommended as the maximum increment allowable above background levels. Under Ashton's commitment to the ALARA principle, radiation protection design targets to be adopted for members of the public would reduce the

statutory 1 mSv/a required by the Commonwealth of Australia's Code of Practice on Radiation Protection in the Mining and Milling of Radioactive Ores 1987 to 0.05 mSv/a (Commitment 15).

Monitoring

Radiation monitoring is required under the relevant codes and regulations adopted under the Mines Regulations Act. Ashton's proposed environmental monitoring plan is shown in Table 8. The details of the actual programmes would be determined as part of the Radiation Management Plan developed in consultation with the Department of Minerals and Energy and the Health Department. An intensive monitoring programme would be initially undertaken by Ashton to confirm predictions and to identify areas requiring attention (in particular levels in barium–radium precipitation and at the plant boundary).

Ashton would monitor the health of employees in accordance with the *Radiation Safety Act 1975* and other requirements of the Health Department. The final programme and reporting requirements would be determined within the Radiation Management Plan, in consultation with the Radiological Council and the Department of Minerals and Energy, before the commencement of operations.

The Health Department considers it important that there be on-going verification that the radionuclide content of the ore and concentrate remains low throughout the operation, to ensure that radiation exposure is not significantly greater than that predicted in the PER.

Table 6. Environmental radiation monitoring programme

Radiation parameter	Location monitored	Frequency of measurement
Absorbed gamma dose	Mine and plant perimeter	Biannual surveys
Radionuclides in air	Sites around mine or plant	Biannual surveys
Radon and thoron progeny	Sites around mine or plant	Biannual surveys
Radionuclides in water	Bores around evaporation ponds and disposal dams	Monthly

Conclusion

The EPA received submissions from the Department of Minerals and Energy, the Department of Health, the Australian Radiological Laboratory and the Australian Ionising Radiation Advisory Council about radiation aspects of the Ashton proposal. The EPA considers that Ashton's response has adequately addressed the issues raised in these submissions.

The submission by the Department of Minerals and Energy considers that radiation is not expected to be a significant hazard in the Ashton proposal. As a result of earlier discussions with Ashton, and an analysis of the PER, the Department concluded that the facility, including associated waste management systems, could be designed, constructed and operated in such a manner that radiological impacts to the community would be well below national and international limits, and that commitments by Ashton would be sufficient to ensure this would be the case.

The Health Department considers that, as the thorium/uranium content of the ore is only about 1/50 that of beach sands monazite, the radiological impact of the project would be minimal.

The EPA considers that effective removal of radionuclides from the wastewater is a key component to the environmental acceptability of the plant. This issue was also raised by the

Australian Radiation Laboratory. Ashton will be required to provide further details on the alternative radium removal process should this be necessary, prior to commissioning of the secondary processing plant. Efficient removal of radionuclides in the plant liquor stream will need to be demonstrated by Ashton before a Licence to operate the plant will be granted by EPA. Such details of radiological significance will be submitted to the Department of Minerals and Energy and the Radiological Council for assessment.

The EPA considers that the environmental impacts of radiation associated with the proposal are manageable and therefore acceptable. The EPA considers that, prior to the commissioning of the beneficiation and secondary processing plants, Ashton should prepare a radiation management plan, as part of the EMP, and in consultation with the Department of Minerals and Energy and the Department of Health. The plan should meet the requirements of the EPA (see Recommendation 2).

7. Conclusions and recommendations

The EPA has identified a number of environmental impacts associated with the proposal by Ashton. Based on its assessment of the proposal and additional information provided by the proponent in response to questions raised as a result of the assessment process, the EPA makes the following conclusions and recommendations:

Recommendation 1

The Environmental Protection Authority has concluded that the proposal by Ashton Rare Earths Ltd is acceptable and all impacts are manageable, either by the environmental management commitments given by the proponent, or by the Environmental Protection Authority's recommendations in this report.

In reaching this conclusion, the Environmental Protection Authority 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.**

Accordingly, the Environmental Protection Authority recommends that the proposal could proceed, subject to the proponent's commitments to environmental management (Appendix 1) and the Environmental Protection Authority's recommendations in this report.

The EPA believes that any approval for the proposal based on this assessment should be limited to five years. Accordingly, if the proposal has not been substantially commenced within five years of the date of this report, then such approval should lapse. After that time, further consideration of the proposal should occur only following a new referral to the EPA.

The EPA notes that during the detailed implementation of proposals, it is often necessary to make minor and non-substantial changes to the designs and specification which have been examined as part of the EPA's assessment. The EPA considers that subsequent statutory approvals for this proposal could make provision for such changes, where it can be shown that the changes are not likely to have a significant effect on the environment.

Recommendation 2

The Environmental Protection Authority recommends that the proponent should prepare and implement an Environmental Management Programme to meet the requirements of the Minister for the Environment, describing plans for, but not necessarily be limited to:

- **conservation of native flora and fauna at Mt Weld;**
- **rehabilitation of disturbed sites, overburden dumps and residue ponds at Mt Weld;**
- **contingency plans for major seismic events at Meenaar;**
- **radiation management;**
- **solid and liquid waste management at Mt Weld and at Meenaar;**
- **visual impacts and landscaping at Mt Weld and Meenaar; and**
- **periodic reporting of monitoring results and consequential changes to environmental management.**

The timing of the preparation and review of the implementation of these plans should meet the requirements of the Environmental Protection Authority.

The Environmental Protection Authority concludes that the emission and monitoring of noise, atmospheric contaminants, and solid and liquid waste disposal associated with the construction and operations of the beneficiation plant and minesite at Mt Weld and secondary processing plant at Meenaar, should be controlled through conditions imposed by Works Approvals and subsequently, Licences, under the Environmental Protection Act.

The EPA points out that the proponent's compliance with Environmental Conditions and the conditions of Works Approvals and Licences will be periodically audited. Pollution control limits and other conditions will be periodically reviewed and may be modified by the EPA in the light of operating experience.

Appendix 1

List of environmental management commitments by Ashton Rare Earths Ltd

1 GENERAL

1.1 PROJECT AMENDMENT

Commitment 1 Details of any plan to significantly alter the processing or operation of the project from that proposed in this PER would be referred to the EPA for environmental assessment.

1.2 LEGISLATIVE COMPLIANCE

Commitment 2 The construction and operation of the project would be undertaken in accordance with the requirements of relevant Commonwealth, State and local authority legislation, regulations and codes of practice.

1.3 MANAGEMENT PROGRAMME

Commitment 3 Prior to commissioning of facilities at Mt Weld and Meenaar, Ashton would prepare and submit an Environmental Management Programme that would address, where appropriate, the monitoring and management of the following:

- atmospheric emissions (Commitments 10, 20, 29)
- noise emissions (Commitments 11, 35, 36)
- water management at Mt Weld (Commitments 21, 23)
- chemical handling and storage (Commitment 25, 27)
- solid and liquid residues (Commitments 22, 30, 31, 33, 34)
- transport (Commitments 38, 40)
- workforce management (Commitment 16)
- rehabilitation and decommissioning (Commitments 17, 18, 19, 37)
- social impacts (Commitment 28).

The Environmental Management Programme would be developed in consultation with, and to the satisfaction of, the EPA.

Commitment 4 Prior to commissioning facilities at Mt Weld and Meenaar, Ashton would prepare and submit a Radiation Management Plan that would address the management and monitoring of occupational and environmental radiation issues associated with:

- mining and milling
- transport
- residue disposal

to the satisfaction of the Department of Mines and the Health Department, with advice from the EPA.

1.4 ANNUAL REPORTING

Commitment 5 Annual reports that described the actions undertaken to comply with these environmental management and monitoring commitments would be prepared by Ashton and submitted to the appropriate authority.

2 CONSTRUCTION

2.1 GENERAL

Commitment 6 Ashton would not commence construction of the secondary processing plant until the design and status of the Meenaar Industrial Park buffer zone had been resolved to the satisfaction of the Minister for the Environment.

Commitment 7 All construction materials and practices would comply with relevant Australian standards and codes of practice.

Commitment 8 Solid refuse and material wastes would be removed from construction sites and disposed of in accordance with the requirements of the Shire of Laverton (for the Mt Weld site) and the Shire of Northam (for the Meenaar site).

2.2 REHABILITATION

Commitment 9 Where practicable, vegetation and topsoil cleared during Mt Weld site preparations would be used to rehabilitate disturbed areas.

2.3 POLLUTION CONTROL

Air

Commitment 10 Dust suppression measures, including application of water from tankers, would be implemented at Mt Weld and Meenaar to minimize dust generation during site preparation and construction activities.

Noise

Commitment 11 Construction activities at Mt Weld and Meenaar would be carried out in accordance with statutory requirements relating to noise, and would incorporate appropriate management techniques to ensure that occupational and ambient noise levels were within acceptable limits set by the EPA and the Department of Occupational Health, Safety and Welfare.

3 RADIATION

3.1 GENERAL

Commitment 12 The ALARA principle (which requires that exposures to radiation be kept as low as reasonably achievable, taking into account social and economic factors) would be adopted for all components of the project.

3.2 LEGISLATIVE COMPLIANCE

Commitment 13 The Commonwealth requirements for radiation control outlined in the Code of Practice on Radiation Protection in the Mining and Milling of Radioactive Ores 1987 and the Code of Practice on the Management of Radioactive Wastes from the Mining and Milling of Radioactive Ores 1982 would be met. Similarly, the Western Australian requirements for radiation control outlined in the Radiation Safety (General) Regulations 1983 would be met.

3.3 RADIATION PROTECTION DESIGN TARGETS

Commitment 14 Under Ashton's commitment to the ALARA principle, radiation protection design targets to be adopted for all employees would be less than 2 mSv/a and would not require designation of employees as radiation workers, which would allow a 20 mSv/a dose limit under the International Commission on Radiological Protection draft recommendations (1990).

Commitment 15 Under Ashton's commitment to the ALARA principle, radiation protection design targets to be adopted for members of the public would reduce the statutory 1 mSv/a required by the Commonwealth of Australia's Code of Practice on Radiation Protection in the Mining and Milling of Radioactive Ores 1987 to 0.05 mSv/a.

4 MT WELD OPERATIONS

4.1 CONSERVATION

Commitment 16 An education programme for all employees would be implemented to outline the purpose of imposing restrictions on domestic pets, firearms and recreational use of motor vehicles.

4.2 REHABILITATION AND DECOMMISSIONING

Commitment 17 Ashton would participate in an appropriate programme to control feral animals (goats and rabbits), in consultation with the Agricultural Protection Board and pastoral owners, prior to the commencement of rehabilitation measures.

Commitment 18 Rehabilitation at Mt Weld would be progressively undertaken in accordance with EPA and Department of Mines' guidelines. Rehabilitation activities would be reported annually to the Department of Mines.

Commitment 19 A plan outlining the decommissioning of the Mt Weld facilities would be prepared by Ashton before commencement of operational mining and commissioning of the beneficiation plant. The decommissioning plan would be prepared in consultation with the EPA and the Department of Mines. The decommissioning strategy would follow the guidelines of the Commonwealth of Australia's Code of Practice on the Management of Radioactive Wastes from the Mining and Milling of Radioactive Ores 1982.

4.3 POLLUTION CONTROL

Air

Commitment 20 Dust control measures would be implemented to comply with Department of Mines' regulations.

Water

Commitment 21 A water management plan, including water conservation, would be prepared by Ashton to detail appropriate measures to manage the groundwater resources in the carbonatite pipe area. The plan would be prepared prior to the commencement of mining operations, in consultation with the EPA and the Water Authority.

Commitment 22 A management plan for the disposal of residues from the Meenaar secondary processing plant at Mt Weld would be prepared by Ashton prior to commissioning of the project. The plan would be prepared in consultation with the EPA and the Department of Mines.

Commitment 23 A groundwater monitoring programme would be prepared in consultation with the Water Authority.

5 MEENAAR OPERATIONS

.5.1 GENERAL

Commitment 24 Ashton would co-operate with other occupants of the Meenaar Industrial Park in the development of a comprehensive safety and environmental protection programme for the park.

5.2 SAFETY

Commitment 25 The storage and handling of hazardous materials would be undertaken in accordance with relevant statutes and codes, and Ashton would institute an ongoing worker safety training programme.

Commitment 26 An emergency management plan would be developed by Ashton prior to commissioning, in consultation with the Department of Mines. The plan would include measures to be taken in the event of seismic activity.

Commitment 27 The LPG storage vessel would be designed and operated in accordance with *LP Gas: Storage and Handling* (AS 1596—1989), and would incorporate safety measures such as a fixed water spray (deluge) system as described in that standard.

5.3 SOCIAL

Commitment 28 Social impact monitoring would be undertaken to address local issues.

5.4 POLLUTION CONTROL

Air

Commitment 29 A programme would be established upon commissioning to monitor the following parameters:

- concentration and mass emission rate of sulphur dioxide
- concentration of oxides of nitrogen
- volume flow rate
- temperature
- boiler fuel feed rate over the duration of the test.

Water

Commitment 30 A total containment policy would be adopted for wastewater and surface runoff from the plant area.

Commitment 31 Studies would be undertaken by Ashton during the design phase of Stages II and III to identify an economic means of removing the nitrate from the wastewater before it entered the evaporation ponds.

Commitment 32 Plans and associated documentation for the design of the Meenaar facility and evaporation ponds to withstand predicted seismic events would be prepared by Ashton prior to construction, in consultation with the EPA and the Water Authority.

Commitment 33 A groundwater monitoring programme would be implemented. The results of this monitoring would be issued annually to the Water Authority and the EPA.

Solids

Commitment 34 Ashton would continue to investigate the feasibility of selling the calcium phosphate material produced from regeneration of caustic soda or otherwise making it available to others (for possible use as fertilizer feedstock).

Noise

Commitment 35 All potential noise-generating equipment would incorporate effective sound-proofing measures such that, during the operation of the plant at full capacity, noise at the nearest residence would not exceed those limits set by the EPA.

Commitment 36 A noise monitoring programme would be implemented.

5.5 DECOMMISSIONING

Commitment 37 A plan outlining the decommissioning of the secondary processing plant would be prepared by Ashton before commissioning the plant, in consultation with the EPA. This decommissioning strategy would follow the guidelines of the Commonwealth of Australia's Code of Practice on the Management of Radioactive Wastes from the Mining and Milling of Radioactive Ores 1982.

6 TRANSPORT OPERATIONS

6.1 LEGISLATIVE COMPLIANCE

Commitment 38 Transport and handling procedures would comply with the requirements of the Commonwealth of Australia's Code of Practice for the Transport of Dangerous Goods by Road and Rail 1987 and the Commonwealth of Australia's Code of Practice for the Safe Transport of Radioactive Substances 1990, together with the Western Australian Dangerous Goods (Road Transport) Regulations 1983 and the Radiation Safety (Transport of Radioactive Substances) Regulations 1991.

6.2 EMERGENCY PROCEDURES

Commitment 39 Emergency procedure guides and emergency contacts would be documented and available in vehicle cabs, and all drivers would be instructed in the actions, as specified under the Western Australian Hazardous Materials Emergency Management Scheme, to be taken in the event of an accident.

6.3 MONITORING

Commitment 40 A programme of occupational health and safety monitoring of transport drivers would be developed by Ashton prior to commissioning, in consultation with the Health Department.

Appendix 2

Response by Ashton Rare Earths Ltd to issues raised in public submissions on the Public Environmental Review.

ASHTON RARE EARTHS LTD

RESPONSE TO ISSUES RAISED IN SUBMISSIONS ON THE PUBLIC ENVIRONMENTAL REVIEW FOR THE MT WELD RARE EARTHS PROJECT

Document No. PE1016-31-04-041

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PE1016/300

MINE SITE ISSUES

1 GROUNDWATER

1.1 How much dewatering would occur from the unconfined aquifer?

Coffey Partners International Pty Ltd (Coffey) determined in their geotechnical studies (Coffey 1991) that 'the shallow aquifer would be expected to contribute about one third of the total quantity pumped'. Thus some 4,000–5,000 ML (of the total 13,000–14,000 ML dewater) would come from the unconfined (shallow) aquifer.

1.2 The amount of dewatering (14 MM^3) from the confined aquifer is substantial. How has this been calculated?

Using the results of previous hydrogeological and bore log studies from Granny Smith Gold Mine Water Supply Field, Coffey (1992) undertook modelling studies to analyse a multi-layered plan model operating with time varying conditions using a finite element mesh and seepage analysis programme (CAPMESH and CAPSEEP). Due to conservative assumptions, especially the specific yield of the confined aquifer, the actual amount of dewatering eventually required may be lower. On the basis of ongoing studies of hydrogeology at Mt Weld, Ashton presently estimate that total dewatering may be able to be reduced to 9,000–10,000 ML. Further testing would be undertaken as part of the final feasibility studies, to confirm these results.

1.3 What measures could be taken to minimize the amount of dewatering of the confined aquifer?

As indicated in Section 8.2.2 of the PER, the amount of dewatering of the confined aquifer is being minimized by the following:

- Granny Smith mine modifying their bore field to ensure drawdown occurs in the mine pit region rather than elsewhere in the carbonatite pipe.

- The production bore field for the Mt Weld Project will also be located to assist with dewatering.

A number of other options to minimize the amount of dewatering have been investigated, including the use of a grout curtain. All were found to be uneconomic and did not significantly reduce the amount of dewatering over the proposed method.

1.4 Has it been established that there would not be substantial leakage of water stored in the pit at the Granny Smith mine?

Hydrogeological studies undertaken for Ashton confirm that pits at Granny Smith are the only practical surface reservoirs available to receive dewatering. Was this water to be disposed at other sites, adverse environmental impacts could result. Storage at Goanna Pit offers a good change to conserve much of the dewatering for future use; however, if losses were substantial, they are predicted to occur without adverse impacts.

1.5 A high density residue slurry would appear to reduce water usage, accelerate drying and reduce the risk and rate of seepage in the ponds. Why is the solids content of the residue (8%) so low and what options are available to the company to increase this?

Ashton have undertaken feasibility studies to investigate the use of slurries of various density. The low density slurry is the most economic for this process. It does not alter the production requirement from the Mt Weld water supply bore field.

It should be noted that the low density slurry residual disposal system incorporates recycling of water as detailed in Section 4.2.3 of the PER.

1.6 More information should be provided on the proposed groundwater monitoring programme (to the same degree of detail as given for Meenaar).

The location of the ponds at Mt Weld has yet to be finalized. Further geotechnical studies are required to determine suitable pond locations away from commercial ore bodies. Detailed information of the proposed groundwater monitoring would be provided in the Environmental Management Programme (EMP) and Works Approval application once the location of the ponds are finalized.

1.7 What monitoring would be undertaken in relation to the proposed groundwater disposal practices?

In addition to bore log monitoring, as currently undertaken in the Mt Weld Water Supply Bore Field, and groundwater monitoring (as would be detailed in the EMP for the residue ponds) water stored at Granny Smith would also be monitored.

It is anticipated that the level and salinity of water in the Goanna Pit would be regularly monitored and, as outlined in the draft Water Supply Agreement, the 'Mt Weld/Granny Smith pipeline' would be monitored. This would be in accordance with the Department of Mines and the Water Authority regulations. The pipeline would be either visually inspected at least every twelve hours or an approved telemetric system would be installed.

1.8 When would the proposed water management plan be prepared?

The Water Management Plan would form part of the Water Supply Agreement between Placer (Granny Smith) Pty Ltd, Ashton Rare Earths and CSBP & Farmers Ltd which is currently under discussion. The Water Management Plan would also form part of the EMP and be in accordance with the requirements of the Water Authority and the EPA. A Water Management Strategy has recently been completed and submitted to the Water Authority.

2 MINING AND BENEFICIATION

2.1 How variable is the radionuclide content of the ore and would this need to be managed?

The concentration of uranium and thorium in the Mt Weld orebody has been estimated from a set of 498 samples taken from series of cores located within the 5-year pit, in the annulus of the 5-year pit and outside the 5-year pit. The radionuclide level used to characterise the radioactivity of ore in the PER was the mean of all samples. Variation of individual samples around the mean was not large: for the most abundant radionuclide, thorium, no sample was over twice the concentration of the mean and most samples were within 20% of the mean. Variation was more extensive for uranium although this element was present in minor quantities only (less than 10%).

As the ore processed each year will represent a mixture of several sites within the pit, annual averages of radionuclide content should be close to the mean value used to calculate annual occupational dosage. Although this suggests that no additional measures will be necessary to manage radionuclide content of processed ore, the concentration of radionuclides in mined ore will be measured regularly.

2.2 Would there be on-going monitoring of the ore to ensure that the radionuclide content remains low throughout the operation?

Refer to Response 2.1.

2.3 Would the design of the earthen wall be sufficient to retain a large spillage of concentrate paste from the storage tank?

The purpose of the earthen wall around the tank storing concentrate at Mt Weld would be to act as a shield to reduce the gamma radiation emissions to employees working in this area. As the concentrate will be stored as a paste with only limited mobility without being pumped, large spillages are very unlikely and would have little propensity to move. Thus the earthen wall could effectively contain any spillage. The contents of the tank are effectively those of the ore with the rare earths component doubled. Thus spillage would be unlikely to cause a significant pollution hazard and spills could be readily cleaned up.

2.4 Would there be a detection system below the earthen wall to detect leakage?

No in situ detection equipment would be installed around concentrate storage areas. As the concentrate would have a low moisture content, there would be little chance of leakage of fluid. Walls surrounding storage areas would have at least one entry point for access to visually assess condition of equipment or loss of concentrate paste. See comment in 2.3 on tank contents.

2.5 What is the ultimate fate of the sodium sulphide reagent in the process and would hydrogen sulphide be generated?

The great majority of sulphides within the beneficiation process would eventually be discharged to the residue ponds. At the pH value likely to occur during sodium sulphide addition (approx pH 11) very little sulphide would be in solution as the volatile form, H_2S. Nonetheless, this section of the building would be provided with enhanced ventilation to ensure that build-up of H_2S does not occur.

3 RESIDUE STORAGE

3.1 What are the chemical and mineralogical compositions of the beneficiated residue and the Meenaar residue?

The chemical and mineralogical composition of the residue are:

- Meenaar residue – refer Table 6.2 of the PER.

- Beneficiated residue – ground ore depleted of 50% of the rare earths. The residue has a high iron content mainly in the form of goethite and ilmenite. Major solid contituents of the residue would be goethite (60%), rare earths minerals (11%), ilmenite (6%) and clay/quartz (6%).

3.2 Would radionuclides in residues be in different chemical and physical form to that in the ore, such that this could influence their long term environmental behaviour?

The residue returned to Mt Weld would contain radionuclides at levels below those occurring in the ore given the diluting effects of the process chemicals. Even though the residues would be in forms different from that in the ore, the absolutely low levels and the low solubility of radionuclides would inhibit the migration of radionuclides from the residue bodies. The possible movement of radionuclides would be studied as part of the Radiation Management Plan.

3.3 Would radon emanation from residues be significantly greater than from the ore?

Radon emissions from residues would be inconsequential given the projected levels of radon emissions from process materials during mining, beneficiation and processing.

3.4 What would be the pH, ionic composition and concentration of the 50 mL/annum of water which is predicted to leak from the beneficiated residue ponds?

The water in the beneficiated residue ponds would have a pH 8–8.5. Due to evaporation, the salinity of the pond water would become greater than process water. Under the water balance conditions specified in Section 8.2.3 of the PER, the principal component of the leachate is likely to be sodium bicarbonate at concentrations around 3,000 ppm.

Added to the 'background' salinity of process water, this would yield an eventual salinity of 5,000–7,000 ppm for leachate. Such levels are within measured salinities of the unconfined aquifer (5,000–8,000 ppm) and thus unlikely to have detectable impacts on the groundwater.

The high geothite content in the beneficiated residue would aid with the sealing of the ponds by 'clogging' the pores of the liner. After the first year of operation, leakage rates are estimated to be less than 10 ML/a. This phenomenon would counteract the tendency for ponds to increase in salinity over some years of operation.

3.5 To what extent would the covering of the ponds on the Meenaar residue attenuate radon emissions? At what level would these emissions continue after rehabilitation?

Refer to Response 3.3.

3.6 What are the potential exposure pathways from the radioactive components of the residues, particularly after operations cease at mt weld?

The potential exposure pathways for residue at Mt Weld are:

- gamma radiation above the residues
- inhalation of dust entrained from the residue body
- migration of radionuclides from the residue body into groundwater.

Gamma radiation levels would fall within the spread of common natural background values in view of the 2 m soil and rock cover to be placed over the residue. The soil/rock cover would also prevent dusting and therefore any elevation in the background of atmospheric radionuclides. The movement of radionuclides from the orebody would not be of consequence as discussed in Section 5.3.2 of the PER.

3.7 More information should be provided on the beneficiation residue ponds, such as depth of free-board, expected drying times, methods to minimise seepage, and rehabilitation of the structures.

As defined in the Department of Mines interim guidelines on tailings storage, the beneficiated residue ponds are a significant storage dam. All residue storage areas would comply with Department of Mines regulations.

The conceptual design of the beneficiation residue ponds is shown in Figure 4.6 of the PER. The final design would comply with the Mines Department's guidelines.

Each pond would have a capacity to store 5 to 7 years of beneficiated residue. As indicated in Section 8.2.3 of the PER, preliminary investigations have determined that the permeability of the duricrust is 10^{-6}–10^{-5} cm/s. If detailed investigation failed to confirm this, then a clay liner, using lake clay similar to the Meenaar residue storage area, would be installed.

Rehabilitation of the beneficiation pond would be similar to the Meenaar residue storage areas, as detailed in Section 8.2.12 of the PER. However, as the beneficiation residue would only have radioactivity at background levels, a high clay content layer would not be required.

3.8 To what extent do the residue storage areas comply with the interim guidelines recently issued by the department of mines?

The conceptual design is in agreement with the Department of Mines guidelines and as stated in Response 3.7, the final design and construction would comply with the Department of Mines guidelines.

4 NATIVE FLORA AND FAUNA

4.1 What are the likely differences between the flora survey conducted under the drought conditions of April 1991 and a survey done after significant rainfall (such as exists in winter 1992)?

Flora surveys undertaken after significant rains would be expected to show an increased abundance and diversity of vegetation.

The flora of the carbonatite area is similar to the widespread mulga woodlands of the Goldfields region. As the alluvium cover over the pipe is some 20 m thick and is typical of the surrounding area flora over the pipe would be unlikely to respond to rain differently to the surrounding flora. The description of the biological environment provided in Section 8.1.6 of the PER would still be valid.

Botanists have been engaged to undertake another flora and vegetation survey in spring 1992 when species diversity should be at its greatest. The survey is expected to confirm the results of the previous survey and to increase the number of species recorded in the Mt Weld area.

5 REHABILITATION

5.1 What are the envisaged end uses for the land and the various components of the project? Has this factor been taken into account in the rehabilitation objectives?

Rehabilitation objectives and methods are detailed in Section 8.2.12 of the PER (for the Mt Weld site) and in Section 9.2.14 of the PER (for the Meenaar site).

It is envisaged that Mt Weld will return to grazing land and that other mining may be carried out in the carbonatite pipe. The end use for Meenaar is envisaged to be industrial use. These factors and various end uses have been taken into consideration in determining the methods of rehabilitation to be used.

The rehabilitation method, trials and monitoring programmes would be further detailed in the EMP in accordance with Commitments 17, 18, 19 and 37 of the PER.

Rehabilitation would be undertaken to ensure that it is successful through the use of the most practicable rehabilitation methods. Rehabilitation would meet the requirements of the regulatory authorities.

5.2 Would Ashton undertake further research, such as re-vegetation trials and waste characterization, to ensure that the rehabilitation is successful?

Refer to Response 5.1.

5.3 Would the sequencing of overburden placement ensure that saline material does not bury non-saline waste?

Refer to Response 5.1.

5.4 To what extent would the project impact on the local landscape, particularly the waste dumps? Upon decommissioning of the mine, would these dumps remain, or would they be used to backfill the open pit?

The waste dumps would not be used as backfill in the open pit due to:

- the real potential for future mining in the pit area;
- the low impact that the rehabilitated waste dump would have on the local landscape;

- the high cost of backfilling which would adversely affect the viability of the project.

As indicated in Section 4.2.4 of the PER, the waste dumps would cover an area of 17 ha and be 10 m in height. Rehabilitation of these dumps would commence at the end of the earthwork construction stage and would be undertaken in the manner described in Section 8.2.12 of the PER.

The waste dumps would form part of the local landscape and would be visible from outside the lease area. Due to the distance of the Mt Weld mine site from populated areas and the presence of similar features in the region, the impact on the local landscape of the waste dumps would be minimal.

TRANSPORT ISSUES

6 TRANSPORT

6.1 Many submissions raised concerns about the impact of additional heavy transport passing through built up areas between Meenaar and Mt Weld, carrying chemicals, low-level radioactive concentrate and residue. how has Ashton taken into account the noise, vibration, safety and nuisance impacts on the communities along the transport route?

The relative increase in traffic and the associated potential environmental impacts expected to result from the construction and operational phases of the project have been outlined in Sections 8.2.1, 8.2.8, 9.2.1 and 9.2.7 of the PER. The estimated increases in traffic are limited to approximately two trucks passing either way along these roads each day: generally representing less than 1% of the recorded annual average daily traffic along the proposed routes. As indicated in the PER, the small increases in heavy haulage traffic would result in more frequent short-term increases in noise levels and possibly vibrations typically associated with the current volume of heavy traffic using the proposed transport routes. However, Ashton are examining ways of reducing this traffic load further by decreasing the volume of residue requiring transport to Mt Weld.

Project related traffic is unlikely to significantly decrease road user safety (refer Response 6.3). Communities near the transport routes are unlikely to be significantly inconvenienced by the small increases in traffic associated with the project.

6.2 Many submissions advocated the use of rail instead of road, for the transport of material to and from Mt Weld and Meenaar, and also from the large quantity of dangerous goods transported from Kwinana to Meenaar. Under what circumstances would Ashton consider using rail instead of road transport for the movement of these materials?

A summary of a detailed evaluation of alternative transport options (mode of transport and routes) was provided in Section 3.3 of the PER. The rationale for the preferred option for the transport of concentrate and residues (Section 3.3.1), feedstock chemicals (Section 3.3.2) and rare earth product (Section 3.3.3) was also provided.

The main advantages of road transport over the road-rail option for the Mt Weld project included:

- lower operating and capital cost
- greater operational control and scheduling flexibility
- no significant differences in risk of spillage resulting from accidents.

Of these, significant changes to the cost competetiveness of the road-rail option relative to the road-only option would permit Ashton to revise the preferred transport option (refer Response 12.4 and 14.2). Any improvement in the cost competetiveness of the road-rail option would need to be sufficiently large so as to compensate for the lower operational control and flexibility associated with this option. Alternatively, the road-rail option would need to be amended such that operational control and flexibility are significantly improved.

6.3 To what extent has Ashton taken into account the danger its heavy and dangerous goods traffic poses to other road users and communities along the route?

Compliance with the requirements of regulatory authorities and licence/permits issued for vehicles and to drivers would ensure that the established safety standards would be met. These safety standards have been developed to ensure that the risk of accidents is minimized. One of the conditions of contract for transport operators engaged by Ashton would be that these safety standards are met.

6.4 How would Ashton ensure that the concentrate and residue carried in the trucks does not exceed the radiation limit of 7 x 10^4 Bq/kg, or alternatively identify those that do exceed this level (which would require special labelling and handling, as specified under the explosives and dangerous goods act and associated regulations)?

The estimate of the radioactivity level of the concentrate to be carried to Meenaar is based on the mean level of radionuclide concentrations within the ore samples assayed by Ashton (see response to 2.1). This estimate (5.4 x 10^4 Bq/kg) is 20% below the limit specified by regulations as designating a radioactive substance for the purposes of transport (7.0 x 10^4 Bq/kg). Variation of radionuclide concentration in the ore samples is sufficient only in a small percentage of cases to produce concentrate which exceeds the limit. However, ore being processed will be mined from a variety of sites within the pit and concentrate from a number of days production will be constantly blended within a large holding tank before shipment. Thus the radioactivity of concentrate is likely to be close to mean levels. Regular measurement of the activity of concentrate will be undertaken to ensure that levels are below statutory limits. Should a high activity occur within the holding tank, transport will await reduction of activity through further blending.

6.5 What plans does Ashton have to monitor radiation levels in built-up areas through which their trucks would pass?

The assessment of radiation risks associated with transport, presented within the PER (Section 6.5), shows clearly that there is no conceivable scenario under which normal transport operations could present a public radiation hazard. Monitoring of radiation within built-up areas (which would include existing background levels) is not warranted given the brief passage of trucks through these areas. The levels of radiation associated with trucks will be monitored as part of Ashton's normal occupational radiation monitoring programme. Using these values and estimates of the time spent by trucks in

built-up areas, calculations of the minimal levels of radiation contributed by transport could be made.

6.6 Has Ashton considered worst case scenarios for accidents involving the transport of dangerous goods? What options are available to Ashton to minimize potential disasters in areas of high population?

The transport of dangerous goods associated with the project is restricted to the movement of LPG and some process chemicals used at Meenaar. Trucks carrying similar loads already travel along this route. Such transport is regulated by the Explosives and Dangerous Goods Act 1961 and its Regulations, and emergency responses to accident scenarios have been developed under the Western Australian Hazardous Materials Emergency Management Scheme (WAHMEMS). For these reasons, consideration of worst case scenarios for accidents involving these goods and their management was not treated in the PER. Ashton would meet all regulatory requirements and will liaise with regulatory authorities to ensure appropriate management for emergency responses is in place.

6.7 What emergency procedures would be required of this Police, Fire Bridgade and State Emergency Service in the event of an accident involving plant residue, concentrate and chemicals?

An indication of the probable response required by emergency services and Ashton personnel in the event of a major spillage of concentrate or residue is outlined in Section 6.6 of the PER. The final form of this response would be negotiated between Ashton and emergency services under WAHMEMS before transport operations commence.

6.8 Would there be any modifications and upgrading to the Great Eastern Highway to accommodate additional traffic for the Ashton project, particularly in the vicinity of the Meenaar plant and between Meenaar and Cunderdin?

The CER for the Meenaar Industrial Park (prepared by the Industrial Land Development Authority and the Department of State Development) states that the intersections of the Great Eastern Highway and the Meenaar access roads would be designed to Austroads Intersection Type C standard. It is expected that the intersections would have off-set turning lanes to allow vehicles to turn off the highway and to join the highway with maximum safety. It is also expected that the intersections would have suitable lighting. The modification of the intersections is the responsibility of the proponents for the Meenaar Industrial Park, not Ashton.

Maintenance and upgrading of sections of the Great Eastern Highway would be undertaken by the MRD as part of their normal rural road maintenance programme.

MEENAAR ISSUES

7 GROUNDWATER AND SURFACE WATER

7.1 Where are the nearest sources of valuable or high quality groundwater referred to in the PER (Section 9.2.2)?

The statement made in Section 9.2.2 of the PER was 'The soils (at the site of the secondary processing plant) have low permeabilities and the groundwater is saline and contains high levels of nitrate and sulphate. These factors would assist the retention of any leachates from the evaporation ponds within the plant site and would not contaminate any existing high quality or valuable groundwater in the region'. The intent of this statement was to indicate that because the immediate area does not contain high quality groundwater, potential leachates could not affect high quality groundwater.

The absence of high quality groundwater in the region is suggested in Section 9.1.4 of the PER, which refers to a number of bores and wells which have mostly been abandoned, possibly due to low yield or high salinity. Hydrogeological studies confirm this suggestion for the immediate area of the Ashton plant (see response 7.2.)

7.2 More information should be provided on the quality, quantity and distribution of groundwater in the Meenaar area. How does this quality compare to accepted standards for various uses?

The hydrogeological studies were commissioned to determine the nature of the conditions at the site of the secondary processing plant. The purpose of these studies was to enable an assessment of the suitability of the site for establishing evaporation ponds and to evaluate the potential environmental impact of a loss of containment from such ponds. The PER contains sufficient information on the groundwater in the area of the secondary processing plant to permit an assessment of environmental impacts. Additional information on the quality, quantity and distribution of groundwater in the Meenaar area and any comparative water quality analysis with 'acceptable standards for various uses' would be of limited value to the consideration of possible environmental impacts of Ashton's plant. Full technical reports on the hydrogeology studies have been provided to the EPA and were made available to the public during the eight-week public review of the PER.

7.3 What evidence is used to conclude that isolated bodies of groundwater and seepages rather than a single body of groundwater underlie the site?

The drilling programme of the hydrogeological studies found significant variations in water levels and salinity, and a lack of groundwater in some boreholes. These findings

provided evidence that there are isolated bodies of groundwater and seepages with different heads and of different quality beneath the site of the secondary processing plant. Should a single body of groundwater lie beneath the site, then the water quality of groundwater samples from the boreholes and the water levels recorded in each borehole would have been similar over the site.

7.4 How would surface water be contained on site? what are the likely impacts, of total on-site containment of surface runoff water i.e. groundwater recharge rates, downstream impacts, particularly on adjacent properties, e.g. mounding of saline groundwater? How would these impacts be monitored and (if significant) managed?

Section 4.3.8 of the PER states that stormwater runoff would be directed (via a system of open channels) to a centralized drainage sump and that stormwater runoff would be contained entirely within the plant site. Figure 4.8 provides a conceptual site plan of the secondary processing plant, including the location of the main drainage sump. This drainage sump would be designed to have sufficient capacity to accommodate an extreme rainfall event.

The potential impacts of on-site containment of surface runoff would be comparable to the effects on the hydrology resulting from the establishment of a farm dam with an equivalent catchment area. Groundwater and downstream impacts are considered likely to be minimal and not require additional monitoring to that associated with residue ponds.

7.5 What data have been assessed to indicate what geological controls might be present to influence groundwater distribution?

As indicated in Response 7.1, Section 9.1.4 of the PER contains a summary of the findings of hydrogeological studies undertaken at Meenaar by Rockwater (1992). These findings were largely based on the information provided by an on-site drilling programme. Drilling involved the establishment of fifteen bores (up to a depth of 29 m) to determine lithology and depth to bedrock beneath the site.

Specific information was obtained on the following:

- depth and quality of groundwater
- directions of groundwater flow and flow rates
- hydraulic connection with the Mortlock River
- presence of permeable or impermeable layers
- in situ and compacted hydraulic conductivities of the soils
- phosphorus retention indices of the soils.

In addition to the drilling programme, the records of the Geological Survey of Western Australia were also reviewed to provide information on the general area of Meenaar.

8 WASTES, PLANT RESIDUES AND EVAPORATION PONDS

8.1 What arrangement does Ashton have for the disposal of septic waste?

Section 4.3.8 of the PER states that sewage would be treated in a septic tank disposal system approved by the Health Department. Contractors would be engaged to maintain and remove sludge from the septic tank for disposal in accordance with the Shire of Northam. Options for the disposal of septic waste would be determined following consultation with the Shire of Northam.

8.2 In addition to nitrates and phosphates, would there be any other waste components from the plant that could have a potential beneficial use?

Other than nitrates and phosphates, no additional component of the waste streams currently has the potential to have a beneficial use. Should any components of the waste stream in the future have a potential beneficial use, Ashton would consider making the component available if it is economic to do so.

8.3 Would the water in the evaporation ponds constitute a hazard for bird-life?

The water in the evaporation ponds would not be hazardous to birdlife upon contact. Section 9.2.8 of the PER states that the only constituents of the wastewater in the evaporation ponds which can be toxic to wildlife (including birds) are aluminium and barium; however at the concentrations expected, the wastewater would not be toxic or harmful if consumed by birdlife in the volumes normally expected. The radionuclides present in the wastewater would be at levels similar to those in existing Western Australian water supplies and would therefore not affect birdlife.

8.4 How would the pond design prevent overflow in a major rainfall event?

The evaporation ponds would only collect rainfall which falls directly into the open area of the ponds or on the inside slopes of the embankments. No runoff from upslope areas would be permitted to collect in the ponds. For this reason, the catchment of each pond would be limited to the area of that pond (refer Figure 4.8 of the PER).

The evaporation ponds would be designed in consultation with the Water Authority and the Department of Mines with a freeboard which has sufficient capacity to contain the highest twenty-four hour rainfall event recorded to date (i.e. 109 mm on 9 March 1934) or if greater, the 1 in 50 year storm event.

8.5 How has the siting of the ponds taken into account local geological conditions, soil types and depth to groundwater?

During the preparation of the PER, Ashton commissioned two separate specialist consultant hydrogeologists to evaluate conditions at the site of the secondary processing plant. The Rockwater studies (refer Section 9.1.4 of the PER) provided a detailed assessment of the hydrogeology of the site. Ashton also obtained advice from a consultant engineer who specializes in building design in seismic areas, with particular

advice being sought on evaporation pond design. The final design and siting of the evaporation ponds would take into account the data from these sources.

8.6 What are the most common environmental problems associated with the operation of evaporation ponds and how would Ashton ensure that these would not occur at Meenaar?

If properly designed, constructed and operated, evaporation ponds do not cause environmental problems. The evaporation ponds to be established at Meenaar would be properly designed, constructed and operated and would comply with the current standards required for such structures. Commitment 32 of the PER indicates that plans and associated documentation for the design of the ponds to withstand predicted seismic events would be prepared by Ashton prior to construction, in consultation with the EPA and the Water Authority. Section 4.3.7 and 9.2.5 of the PER outline the proposed measures to ensure that the evaporation ponds are well designed and constructed.

8.7 Would the design and construction of the ponds be supervised by a competent geotechnical engineer?

Yes.

8.8 What are the concentrations of, and how soluble are, radium, lead, thorium and uranium in the residues that would be disposed of in the evaporation ponds on site, and the residues destined for Mt Weld?

The concentrations of radionuclides in Meenaar wastewater and residue and their solubilities are detailed in Section 5.3.2 of the PER. The concentration of radionuclides in wastewater entering evaporation ponds at Meenaar was calculated to be so low (less than 1 kg in 7,000 t of solids each year) that it was effectively zero for the mass balance shown in Figure 5.3 of the PER. As noted in Section 5.3.2, the only radionuclide with an appreciable solubility under conditions likely to be encountered by the solid Meenaar residue was radium which would be stored at Mt Weld at concentrations below those of the nearby orebody.

8.9 Would inputs into the ponds be monitored, particularly radionuclides?

Regular monitoring of wastewater entering the Meenaar evaporation ponds would be developed under the EMP. Parameters to be monitored would include radionuclides.

8.10 Would the predicted 7,000 t/a of solids in the ponds remain at Meenaar or would they be returned to mt weld?

The suspended and dissolved solids contained in wastewater from the secondary processing plant would be contained in the evaporation ponds and not returned to Mt Weld. As stated in Section 9.2.3 of the PER, the wastewater directed to the evaporation ponds during Stage II and III would contain nitrates but would have negligible levels of radioactivity. Commitment 31 of the PER indicates that studies would be undertaken by Ashton during the design phase of Stages II and III to identify an economic means of

removing the nitrate from the wastewater before it enters the evaporation ponds. Any effective and economic means of removing the nitrate would therefore reduce the volume of solids to be stored in the evaporation ponds. Furthermore, Ashton is continuing to investigate means of reducing the volume of solids in the wastewater stream.

8.11 What plans does the company have for the decommissioning and rehabilitation of the evaporation ponds, particularly in terms of a 'walk away' solution?

The issue of decommissioning and rehabilitation of the secondary processing plant has been addressed in Section 9.2.14 of the PER. In addition, Commitment 3 indicates that the EMP would address decommissioning and rehabilitation. The EMP would specifically address the issue of decommissioning and rehabilitation of the evaporation ponds at Meenaar.

The objectives of decommissioning and rehabilitation are presented in the PER. The objectives are to:

- minimize any short-term or long-term health risks;
- restore the site to a condition suitable for industrial use or other uses, as may be appropriate at the time of decommissioning;
- ensure that no ongoing additional liability for the project is incurred by the State Government.

These objectives would apply to the decommissioning and rehabilitation of the evaporation ponds.

9 NOISE, DUST, ODOURS AND VISUAL IMPACTS AT MEENAAR

9.1 On what basis does Ashton consider that wind data in the PER (from Northam) is representative of the Meenaar area?

Wind data are available from the Bureau of Meteorology for Northam, York and Cunderdin. No wind data are available for Meenaar or Grass Valley. Advice was provided by the Bureau of Meteorology that the data for Northam are likely to be representative of wind conditions at Meenaar. The data provided in the PER are sufficient for the purposes of environmental assessment.

9.2 Would atmospheric emissions vary significantly during operation, particularly under startup and shutdown conditions? if so, what plans does Ashton have to monitor emissions and control excessive emissions?

During normal operation, atmospheric emissions would remain constant at the levels shown in Table 4.4 of the PER. As with most industrial processing plants, emissions

may vary during startup and shutdown conditions. Details of the monitoring of atmospheric emissions would be provided to the EPA in the EMP.

9.3 What is the likely composition of the particulates that would be emitted to the atmosphere from the plant?

The process of calcination, using LPG to burn off residual reagents and organic matter would generate small emissions of particulate matter. Particulates emitted to the atmosphere would mostly consist of small particles of ore which become attached to water vapour. As indicated in Section 4.3.6 of the PER, wet scrubbers would be installed to treat air discharges from the calciner and heaters prior to being vented to the atmosphere. The wet scrubbers would capture almost all of the particulates generated.

9.4 What are the predicted radionuclide concentrations in the emitted material and what would be the likely environmental impact?

Particulate matter emitted from the stack would have negligible concentrations of radionuclides which would not differ from normal background levels. This would be confirmed by the monitoring programme for atmospheric emissions.

9.5 What assurances can Ashton provide to nearby farmers that noise and atmospheric emissions from the plant will not harm their health and livestock, nor contaminate their produce?

The maximum noise limits likely to be set by the EPA are provided in Section 9.2.1 of the PER, while the air quality standards likely to be set by the EPA are provided in Table 9.5 of the PER. These levels have been established by the regulatory authorities to ensure that human health and public amenity are protected. Ashton would ensure that noise and atmospheric emissions from the secondary processing plant comply with these levels. As indicated in Section 9.3.2 and 9.3.3 of the PER, monitoring would be undertaken to ensure compliance with these emission levels.

9.6 Would there be any independent monitoring or auditing of Ashton's monitoring activities

The issue of monitoring and auditing would be addressed in the EMP. Monitoring and auditing can be undertaken either by the proponent or by suitably qualified and experienced independent consultants. Ashton would determine who would undertake monitoring and auditing prior to plant commissioning. In addition, the EPA has a statutory role to undertake audits to ensure operators comply with their environmental commitments and conditions; the EPA would therefore be expected to conduct audits to ensure Ashton comply with its environmental commitments and conditions.

9.7 What is the height of a 'typical wheat silo' referred to in Figure 9.9 of the PER?

The height of the 'typical wheat silo' shown in Figure 9.9 of the PER is about 22.5 m above ground level.

9.8 What would be the height of the emissions stack?

The height of the stack shown in Figure 9.9 of the PER is about 28.5 m above ground level.

9.9 One residence, located about one kilometre east of the plant site appears to have been over-looked in the PER. How did Ashton identify residences in the vicinity of the proposed plant site?

Figure 9.7 of the PER should have shown an additional residence located 1 km east of the Meenaar Industrial Park. The location of residences was determined on the advice from proponents of the Meenaar Industrial Park and from observations made during visits to the site.

10 RISKS AND HAZARDS

10.1 Advice to the authority is that the LPG storage vessel should be mounded, in order to avoid avoidable risk (recent studies have shown that the automatic water sprays as proposed in the PER do not provide sufficient protection to prevent bleve in all credible cases of jet impingement). Would the LPG tank be mounded?

The preliminary risk contours (shown in Figure 9.8 of the PER) indicate that the individual risk levels for the secondary processing plant (without mounding of the LPG storage vessels or provision of automatic sprays) are well within those levels which are considered acceptable to the EPA for a new industrial installation. Addition of an automatic water spray system was considered by Ashton's risk management consultants to provide an adequate further reduction of risk level under EPA criteria. In discussions with the EPA and the Department of Mines, Ashton has already reduced the original level of LPG storage to one which ensured that these risk guidelines would be met.

Recent studies examining the merits of mounding large (over 1,000 m^3) LPG tanks suggest that mounding of smaller units (such as that at Meenaar) would incur a 10% cost penalty and there might be a greater risk of tank corrosion. Thus mounding of the LPG storage vessels is not proposed at this time.

10.2 How much ammonia would be used and stored at the site? Would ammonia be used in the stripping section of the solvent extraction plant?

Table 4.3 of the PER indicates the process chemicals required and the volumes to be stored at the secondary processing plant. No ammonia is to be used or stored at Meenaar.

As indicated in Section 1.3 of the PER, any significant alteration in processing or operation (including the use and storage of large volumes of ammonia) would be referred to the EPA for possible separate environmental assessment.

10.3 What contribution would Ashton make to public safety and rescue support for emergences in the area around Meenaar?

Regional emergency facilities and services would be expected to be primarily responsible for appropriate action in the event of emergencies in the Meenaar area. If required, and if such an action does not in any way jeopardize the safe operation of the plant, Ashton would assist in responding to identified emergencies. The principal facilities which could be made available by Ashton are the first-aid station and communications system.

10.4 Is Meenaar in a zone 1 or zone 2 seismic region?

Section 9.1.5 of the PER describes the earthquake zone classification for the Meenaar area from two sources. As stated, the SAA Earthquake Code (AS 2121-1979) classifies the area within which Meenaar lies as a Zone 2 category. Gaull and Michael-Leiba (1987) ascribe a Zone 1 to an area which includes Meenaar. The difference in classifications is due to the different methodologies used; the two classifications are not directly comparable.

10.5 The height and length of the Meckering fault line quoted in the PER is at variance with other sources of information i.e. 'souvenir booklet, 1988– meckering earthquake - October 14, 1988' – Meckering agricultural society (inc). What are Ashton's references on this subject?

The information on the length and uplift of the Meckering fault line in Section 9.1.5 of the PER was provided verbally by the Bureau of Mineral Resources. However, the summary for the Meckering earthquake (Geological Survey of Western Australia, Bulletin 126) states that 'the maximum displacement of the Meckering Fault was 2 m vertical, 1.5 m dextral slip and 2.4 m heave measured at the centre of the arc'. At the end of the arc, uplift was significantly lower: about 76 mm at each end. These data on uplift associated with the Meckering earthquake should replace those stated in the PER.

10.6 What information has been used to ensure that the plant and dangerous goods storage facilities would not be located over unstable geological rock-types or structures?

The same sources of information as those described in Response 8.5 have been used to determine whether unstable geological rock-type or structures occur at the site of the secondary processing plant. Further geotechnical work may be undertaken during the final design phase.

11 RADIATION

11.1 What plans does Ashton have to contain and manage an on-site spillage of radioactive material, particularly as a result of a major seismic event? How would contaminated soil, groundwater and other materials be cleaned up or disposed of?

The measures outlined in Section 9.2.5 of the PER would ensure that the secondary processing plant could withstand seismic events of the magnitudes considered credible and that on-site spillage of radioactive material is prevented. Ashton does not expect any spillage of material or contamination of soil or groundwater to occur at the Meenaar site. In the unlikely event that a spillage does occur, the spilt material would be recovered and either reprocessed or stored. Any contaminated soils would be transported to Mt Weld for disposal.

Groundwater monitoring would be undertaken which would detect any contamination. As the level of radionuclides present in the wastewater to be stored in the lined evaporation ponds would be similar to those in existing Western Australian water supplies and because any spillages would be rapidly recovered or removed from site, contamination of groundwater is most unlikely.

11.2 What quantitative detail is used to substantiate claims that radiation doses would be small for workers and negligible for the public?

Section 5.2 of the PER provides a detailed treatment of the formulae and assumptions used to estimate radiation doses likely to be received by the worst effected members of the employees and public. This treatment follows recommendations of the United Nations Scientific Committee on the Effects of Nuclear Radiation. The radionuclide concentrations on which calculations are based are given in Section 6.1.1 (concentrate) and Section 6.2.1 (residue) of the PER.

11.3 Is it valid to regard the potential for exposure from internal sources of radiation to be negligible when there is a calcination stage in the process?

Uncontrolled venting of material from the calciner might result in an elevation in the internal component of occupational dose. Emission control requirements would be determined according to the results of radionuclide deportment tests currently being conducted by ANSTO as part of a pilot plant study.

11.4 What is the basis for the target dose of 2 mSv/a for non-designated employees in table 5.3 of the PER?

As described in Section 5.1.3 of the PER, the 'Planned' limits of Table 5.3 (including those of non-designated employees) are drawn from the latest recommendations of the International Commission on Radiological Protection.

11.5 What employees in the barium-radium precipitation unit need to be classified as 'designated' or 'non-designated' employees?

Table 5.6 of the PER shows radiation protection targets for all Ashton employees as less than 2mSv/a which would place them below existing and proposed criteria for 'designated employees'. The section on Beneficiated Ore Processing in Section 5.2.1 of the PER describes how the operations of the barium-radium precipitation unit would be managed to ensure minimal doses to workers.

11.6 It may be too simplistic to extrapolate occupational doses from the proposed Port Pirie plant by only taking into account the relative activities of the two feedstocks. What are the differences and similarities between the two processes that might influence occupational doses?

This procedure was used to estimate only the gamma component of occupational dose. It is important to note that the protocol indicates that this component represents less than 10% of the estimated total dose. If, for example, the method has resulted in the gamma component being underestimated by a factor of, say, x3, the total value remains substantially less than the design figure of 2 mSv/year. It is intended to perform a gamma modelling exercise at the engineering design stage similar to that described in the Port Pirie proposal. In the current project, the modelling procedure would be refined by using the results to ensure that the layout of plant vessels is consistent with the ALARA principle.

11.7 Would barium chloride and sulphuric acid need to be added to produce a radium-barium sulphate precipitate, considering the low level of barium in the ore?

The present procedure for precipitating radium in the barium-radium precipitation step does not require the addition of barium chloride or sulphuric acid.

11.8 What levels of radionuclides would be precipitated prior to blending with other residue destined for Mt Weld?

The disposition of radionuclides within the secondary processing plant is shown in Figure 5.2 of the PER.

11.9 If phosphate is separated from the residue, does the resultant higher level of radiation in the transported residue then require labelling of the residue under the Explosives and Dangerous Goods Act and associated regulations?

Separation of calcium phosphate from the residue to be returned to Mt Weld would increase the level of radiation in this residue by approximately one third. At that increased level, radioactivity would be less than half that of the transport limit requiring designation as a radioactive substance under the Explosives and Dangerous Goods Act.

11.10 Would the company give consideration to the separation and disposal of radioactive components from the process at the Mt Walton facility, instead of at Mt Weld?

Ashton has considered this option and rejected it on the following grounds: The separation of radionuclides during secondary processing with subsequent disposal at Mt Walton would create a component of the project dealing with high level radioactive waste. This would require some employees to be designated as radiation workers and necessitate the transport of a highly radioactive substance. Blending of radionuclides back to the main residue stream and disposal at their site of origin at levels occurring naturally at that site is the most environmentally responsible option.

11.11 Some submissions expressed concern about the role of ansto in the pilot plant trials for Ashton, bearing in mind the recent press coverage of an alleged lack of safety procedures at the lucas heights facility discovered by NSW EPA. would Ashton like to comment on this?

Safety procedures at the ANSTO facility at Lucas Heights are not relevant to the Mt Weld Project.

12 SITE SELECTION

12.1 How do factors such as the necessity for a larger buffer zone and the exclusion of rail and gas infrastructure affect the selection of Meenaar as the preferred site over other areas?

The establishment of a buffer zone around the Meenaar Industrial Park is a matter for the proponents of the Meenaar Industrial Park, not Ashton. It would be expected that a buffer zone would be required around any new industrial setting in which the secondary processing plant was to be located.

As indicated in Table B.2 of the PER, of the six sites considered in the detailed sites evaluation study, only East Rockingham, Kemerton and Geraldton (Narngulu) have existing access to natural gas; all other sites (Collie, Kalgoorlie and Northam) require LPG to be transported from Perth. Although it may be more economic to connect directly into existing natural gas distribution lines (where it is available), the cost of transporting LPG to Meenaar makes it a viable option.

The most important criterion in the selection of an appropriate transport option is cost. As the project is a commercial venture, and if all other factors are equal, the most economic option would be preferred. Taking into account the need to transport concentrate and residue, feedstock chemicals, LPG and rare earth product, the absence of an existing rail access is not considered a disadvantage for the Meenaar site.

12.2 On what basis is the Meenaar site considered by Ashton to be less constrained than Kalgoorlie from a public health point of view?

The sites evaluation study defined public health as the potential for off-site effects on adjacent workers and residential areas resulting from radiation or other exposure under an accident scenario. Table B.6 of the PER indicates that the degree of management required to avoid impact in terms of public health at the Northam (Meenaar) site was minor, compared with moderate for the Kalgoorlie (Gidgi) site. However, based on the criteria for public health outlined in Table B.3 of the PER, the degree of management required to avoid impact at both Kalgoorlie and Meenaar should be assessed as moderate. This does not in any way affect the overall findings and conclusion of the sites evaluation study; public health was not a major or overriding constraint or a significant constraint at either Kalgoorlie or Meenaar.

12.3 On what basis is the utilization of land for a site near Kalgoorlie considered by Ashton to be similar to utilization of productive agricultural land at Meenaar?

The sites evaluation study defined utilization of land as the availability and effectiveness of utilizing the land for the required area of evaporation ponds. Table B.4 of the PER indicates the rationale for the assessment of utilization of land for Kalgoorlie (Gidgi) and Northam (Meenaar). Both Kalgoorlie and Meenaar have sufficient capacity to accommodate the area required for evaporation ponds (areas indicated in Table B.2 of the PER) and the degree of management required to avoid impact was assessed as being minor for both sites. Additional factors which made the assessment of Kalgoorlie and Meenaar the same in terms of utilization of land included:

- the Meenaar site is poor agricultural land which has low productivity (refer Section 7.8 of the CER for the Meenaar Industrial Park);
- there was some uncertainty with the proposed Gidgi site as the area was considered by the Department of Mines to have potential for potential future mining.

12.4 What factors would need to change for Ashton to have considered Kalgoorlie or Mt Weld as the optimum site for the secondary processing plant? If these changes could occur in the near future, is it too late for Ashton to relocate their proposal?

As indicated in Section B.2.4 of the PER, the capital and operating costs associated with the Kalgoorlie site were assessed to have major or overriding constraints. The principal reasons for the high capital and operating costs for the Kalgoorlie site relative to the base case (Kwinana) and Meenaar, were the costs associated with the transport of feedstock chemicals and LPG, provision of water and construction costs. The additional costs associated with transporting chemicals and LPG the longer distance from Perth to Kalgoorlie (instead of Meenaar) are significantly higher than the cost savings associated with transporting concentrates and residues the shorter distance from Mt Weld to Kalgoorlie (instead of Meenaar).

Although Ashton is not scheduled to make a development decision on the project until December 1992, at this stage of the environmental assessment process, Ashton is committed to the proposed site of the secondary processing plant at Meenaar. Any proposal to relocate the plant would be subject to a new environmental approval process for the secondary processing plant which would necessitate a substantial delay in the project schedule. For the Kalgoorlie site to become more attractive, substantial subsidies for both the capital works and the ongoing operations would be required.

13 SOCIAL ISSUES

13.1 How would the proponent ensure that local residents of the Avon Valley community have the opportunity to be employed?

Employment opportunities for local residents in the Avon region would be created in the construction and operation phase of the project for those with appropriate skills (refer Section 4.3.10 of the PER). Employment positions would be advertised in local and statewide newspapers, with local residents encouraged to apply. The most important criterion for employment would be appropriate skills. Local recruitment is considered to be economically attractive to Ashton and beneficial to the local community.

13.2 How would job training be provided for local people who have insufficient skills to be employed on the project?

Existing education and training facilities and services would be available for local residents with insufficient skills to gain appropriate training for possible employment at the Meenaar plant. The Northam TAFE centre runs full-time courses in basic industrial skills, business study programmes, office and secretarial studies and community skills programmes. The TAFE extension service also runs short vocational training courses and a number of part-time certificate courses. TAFE has the capacity to provide flexible training programmes to the workforces of any new industries establishing in the region. When a decision is taken to proceed with the project, Ashton would consult with the Northam TAFE centre on the matter of training needs. It is anticipated that additional training courses in chemistry and engineering would need to become available.

13.3 How would local contractors be given maximum opportunity to service the project?

Local companies will be invited to tender for contracts to service various requirements of the secondary processing plant. Depending on the competetiveness of these contract tenders, local contractors would be engaged. It is expected that most service contracts would be awarded to local companies.

13.4 How would the local community be involved in monitoring the projects impacts on an ongoing basis?

Specific details of monitoring would be provided in the EMP to be submitted to the EPA. Monitoring is expected to be undertaken by Ashton or by appropriate suitably qualified consultants. The results of monitoring would be provided to the Meenaar Industrial Park Management Committee (refer Section 8.15 of the CER for the Meenaar Industrial Park) and a summary of the findings made available to the local community.

13.5 What procedures would be used to assess any claim for damages to property or health arising from the project's operations?

Any claims for damages would be required to follow normal judicial procedures. No special procedures would be developed to assess such claims outside of the normal legal system. In the unlikely event of any grievance, it would be expected that issues of concern could be resolved through consultation and negotiation with the affected parties.

14 CHANGES TO THE PROPOSAL

14.1 What changes to the proposal does the company propose or are likely to occur since the PER was released to the public for comment?

No aspect of the project, as outlined in the PER, has been revised since the document was made available for public comment. Further investigations of dewatering operations have suggested that it may be possible to reduce the amount of dewatering required at Mt Weld (see Responses 1.1 and 1.2), but this is yet to be confirmed. At present, no other aspect of the project is proposed to be revised. Ashton will continue to pursue the use of 'best available technology' for environmental protection and where possible alter the project to meet this objective.

14.2 What commitments would be added or changed to reflect public submissions?

As no aspect of the project has been revised (refer Response 14.1). The only revision to the list of commitments provided in Chapter 10 of the PER has been the amendment of the version of the Dangerous Goods (Road Transport) Regulations from 1983 to 1992 in commitment 38. Should public submissions have warranted it, then Ashton would consider revising these commitments. The EPA summary of issues arising from submissions does not contain any issue which would warrant further revision to the existing commitments.

As a result of concerns expressed in some public submissions received by the EPA in relation to transport options, Ashton have offered an additional commitment to the existing list of commitments. The proposed additional commitment is as follows:

Commitment 41 Ashton would undertake a further comparative review of the practicability of the transport options (road-rail versus road only) for the Mt Weld project prior to the commencement of construction of transport-related facilities at Mt Weld and Meenaar. The results would be made available to the EPA.

Appendix 3

List of people and organisations who made submissions.

Appendix 4

Conceptual environmental monitoring programme, as proposed by Ashton Rare Earths Ltd in the Public Environmental Review (excluding radiation monitoring)

Parameter	Equipment	Location	Frequency	Data	Frequency of reporting	Reporting to
Groundwater	Slotted bores and electro-submersible pumps	To be determined	Monthly; to be reviewed after 2 years	Refer to text, but subject to Water Authority licence conditions	Annually, but subject to Water Authority licence conditions	Water Authority and EPA (subject to licence conditions)
Stack gases	Lear Siegler GS80	Stack or ducting to stack	Quarterly; to be reviewed after 1 year	Refer to text, but subject to EPA approvals and licences	Six monthly	EPA (subject to licence conditions)
Noise	Sound level meter and possibly data logger	Adjacent to nearest residences and possibly Grass Valley	Quarterly; to be reviewed after 1 year	Sound power levels	Annually (subject to EPA requirements)	EPA (subject to licence conditions)

Appendix 5

Previous assessments by EPA of proposed rare earth plants

PJ Rodgers

Mr A Cooke

Mr J Dixon

NJ Alcock, Shire Clerk, Cunderdin Shire Council,

Mr A Thomas, Secretary Australian Ionising Radiation Advisory Council

Mr I Thornton, Water Authority of Western Australia

Mr G Cooke

Dr MB Cooper, Australian Radiation Laboratory

LP Strugnell, Town Clerk, City of Kalgoorlie-Boulder

Mr A Bradley, Department of Mines

PW & AM Laird

M Wylie, Explosive And Dangerous Goods Division , Dept of Mines

Ms J Hammond

Mr PA Collin

RE Turner, Shire Clerk, Shire of Laverton

RA & J Cooke

BH Wittber, Town Clerk, Town of Northam

Mr I Buchhorn

Mr B P Wall, Director, Environmental Health Health Department of Western Australia

Mr P Dempster

Ms L Hockey

Ms R Siewart, Co-ordinator, Conservation Council of Western Australia

R Heyhoe

Mr L Gentle

AJ Middleton, Secretary, Avon Community Development Foundation

Mr C Howrie

Mr H Gallagher, Kalgoorlie-Boulder Chamber of Commerce

Ms S Brandenburg, Chairman, Central Regions Development Advisory Committee

JB Horner

Mr D Popham

MW & LJ Scale

Narngulu - Allied Eneabba Ltd

Allied Eneabba Ltd proposed to establish a plant at Narngulu near Geraldton in 1985, using 12,000 t/a of monazite and 100 t/a of zenotime feedstock, which were residual phosphate minerals derived from local mineral sands production. A number of chemical processes would have been involved, using caustic and acid dissolution, precipitation, solvent extraction and ion exchange stages to produce a heavy rare earths concentrate. About 18,000 t/a of dissolved and suspended solids in 580 ML/a of wastewater would have been collected in evaporation ponds at the plant and 6,000 t/a of low level radioactive thorium residue would have been disposed of in shallow, clay-lined pits at either the plant site or the company's mine site at Eneabba.

The major environmental issues included consideration of thorium residue disposal, evaporation pond management and radiation safety. The EPA recommended against disposal of thorium residue at Eneabba due to the difficulties in modelling movements in the good quality groundwater that existed there, and determined that the company should investigate disposal sites at Narngulu. The EPA concluded that the project would be environmentally acceptable and construction could commence prior to finalising residue disposal and evaporation pond details, provided the company abided by its environmental management commitments and a number of recommendations by the EPA, including the development of detailed design of the waste management system by the company in accordance with the Code of Practice, establishment of a specialist committee by the State to review these designs and to assess environmental effects and monitoring programmes, the State's investigation for a Government radioactive site to be guided by the specialist group, a thorium residue study programme, details on radioactive materials transport, and the preparation of reports to the State on environmental management, triennial reports of which would be public documents.

Pinjarra - Rhone Poulenc Chimie Australia Ltd

Rhone Poulenc Chimie Australia Ltd proposed to establish a rare earths treatment plant at Pinjarra in 1988. The proposal had two stages. At full production, the first stage proposed to treat 15,000 t/a of monazite derived from local mineral sands producers. The process involved wet grinding and hot caustic dissolution, to produce an intermediate product containing rare earths hydroxides. Dissolved trisodium phosphate would be neutralised with lime to produce 8,000 t/a of calcium phosphate residue, which was to be disposed with wastewater in evaporation ponds at the Pinjarra plant site. The second stage involved treating half the intermediate product with nitric acid and ammonia to produce soluble rare earth nitrates, and a filter cake of thorium hydroxide, impurities and water, which would be transported to a remote site for disposal. The rare earth nitrates, after purification and solvent extraction, would be converted to rare earth salts. The second stage would produce ammonium nitrate and other wastes, such as ammonium chloride, rare earths nitrates and radium 226 and 228, which would be disposed of in the evaporation ponds.

The EPA's assessment of the Environmental Review and Management Programme identified that potential radiological impacts were the main environmental issue of concern with Stage I. The main areas of potential radiation exposure were transport of monazite feedstock, transfer of feed to the mill, milling of monazite, and transport of the intermediate product. Ground and surface water impacts associated with the storage of highly insoluble calcium phosphate residue in the evaporation ponds were considered manageable, and unlikely to pose a major risk to the Peel-Harvey inlet, which has a severe nutrient enrichment problem, in a worst case situation.

The EPA concluded that Stage I of the proposal was environmentally acceptable and recommended that it could proceed, subject to the the proponent abiding by the environmental management commitments, and the EPA's recommendations. Of major importance to the EPA was the proponent's commitments to management of principal sources of radiation exposure, the ALARA principle (as low as reasonably achievable) to minimising radiation doses, and management of the closure and rehabilitation of the evaporation ponds. The EPA further recommended that the proponent prepare a groundwater monitoring plan prior to commissioning, problem rectification and modification of future ponds if pond leakage was

detected, restrictions to rail only transport of rare earths product from Pinjarra to Fremantle, and preparation of a decommissioning plan.

The EPA considered, that for Stage II of the proposal to be acceptable, it should:

- demonstrate that the environmental impacts during the operational phases are manageable;
- require a "walk-away" option after completion of the project and so be environmentally acceptable in the long term; and
- not create any occupational health problems.

Approximately 16,000 t/a of ammonium nitrate would have been disposed of in evaporation ponds at Pinjarra. The EPA was concerned about the potential for the highly soluble ammonium nitrate to seep through the clay lined evaporation ponds, and to contaminate the groundwater and the Peel-Harvey Inlet, either during operations or after their cessation. The EPA concluded that it would be necessary to remove the ammonium nitrate from the evaporation ponds to make the ponds environmentally manageable in the long term. It was determined that 12,000 t/a of the ammonium nitrate would be low enough in contaminants to be commercially saleable. The balance of 4,000 t/a would be contaminated with 7 g/t of radium, and could not be sold unless the radium was removed. Disposal of this material (in solution) at the Health Department's Integrated Waste Disposal Facility at Mt Walton was suggested, however no environmentally acceptable transport proposal was put forward. An alternative proposal by the company was deep well injection of the radium-contaminated ammonium nitrate. In comparable plants in America and France, a radium removal circuit cleans the ammonium nitrate, which enables all this material to be sold. A radium removal circuit can cause high levels of gamma radiation in that section of the plant, and it was accepted by the proponent that such a circuit would probably not meet the standards set in this state.

The EPA considered that transport of thorium hydroxide residue to the Health Department's Integrated Waste Disposal Facility by road and rail in iso-containers would meet the requirements of the Code of Practice for the Safe Transport of Radioactive Substances. The proposal to dispose of low level radioactive thorium residue was considered to be acceptable to the EPA.

Prior to the EPA reporting on Stage II, the proponent withdrew from the project, citing changed economic circumstances as the reason.