Sodium Cyanide Plant Extension

Australian Gold Reagents Pty Ltd

Report and Recommendations of the Environmental Protection Authority

Environmental Protection Authority
Perth, Western Australia
Bulletin 387 May 1989

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ISBN 0-7309 1958-7

ISSN 1030-0120

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i. SUMMARY AND RECOMMENDATIONS

The Environmental Protection Authority (EPA) has assessed the proposal by Australian Gold Reagents Pty Ltd to double the size of its existing sodium cyanide plant at Kwinana to a capacity of 30,000 tonnes of sodium cyanide per annum and to use existing rail/road routes to transport it as a 30% solution to gold mines in the State. While the proponent has identified that such a plant could be modified to have a capacity of 40,000 tonnes sodium cyanide per annum, this has not been assessed and if proposed would require further assessment by EPA.

Australian Gold Reagents Pty Ltd (AGR) prepared a Public Environmental Report (PER) which was released for public review for eight weeks. Three submissions were received from Government agencies and the public. During its assessment, EPA visited the existing plant and found that it was operating satisfactorily.

The EPA identified three main issues regarding the expansion proposal:

- risks and hazards associated with the manufacture and storage of sodium cyanide and the implications for the Kwinana area;
- releases of gases during start-up and production; and
- potential environmental consequences of transportation.

EPA examined the risks and hazards and concluded that the total risks and hazards for the present plant and proposed extension fall well within the individual risk level of the Authority's published guidelines and are therefore acceptable to EPA.

EPA has previously found that the transport of sodium cyanide solution by particular rail and road configurations is environmentally acceptable. If different road routes are proposed for transport of sodium cyanide solution, they must be assessed by EPA.

In its assessment, EPA has also considered environmental impacts associated with the construction and operation of the plant. In this respect EPA noted the extensive list of commitments given by the proponent covering these aspects and also recognised the proponent's satisfactory performance during construction and operation of the present plant.

The Authority considers the project to be environmentally acceptable subject to the commitments given by the proponent in the PER and in its responses to subsequent questions from the Authority and to the Authority's recommendation in this report. These commitments cover issues such as:

- safety, risks and hazards, and modifications to existing plant;
- construction and commissioning procedures;
- gas emissions, wastewater management and environmental monitoring;
- storage and transport of increased volume of product; and
- fire protection and emergency plans.

RECOMMENDATION 1

The Environmental Protection Authority concludes that the proposal, as described in the Public Environmental Report to manufacture and distribute a total of 30,000 tonnes per annum sodium cyanide solution, is environmentally acceptable, and recommends that the proposal could proceed subject to the Authority's recommendations in this report and the management commitments made by the proponent in the PER (Appendix 1 of this report), the assumptions made in the risk assessment, and in responses to questions raised during assessment (Appendix 2 of this report).

RECOMMENDATION 2

The Environmental Protection Authority recommends that the proponent should prepare, in stages, a comprehensive hazard identification and risk management programme, to the satisfaction of the Environmental Protection Authority and on advice from the Department of Mines.

The programme should include the following:

. hazard and operability studies (HAZOP) of the process units, to be completed and submitted before mechanical construction commences;

. safety engineering design;

. quantified risk assessment;

. implementation systems; and

. safety reviews during the life of the plant at intervals to be determined by the Authority.

The results should be forwarded to the Environmental Protection Authority and the Department of Mines.

RECOMMENDATION 3

The Environmental Protection Authority recommends that the proponent should:

. maintain the process equipment, instrumentation and alarm systems consistent with the safety and reliability assessment of the plant; and

. install very high integrity instrumentation for the control of the plant and for the detection of and response to any unplanned releases;

to the satisfaction of the Environmental Protection Authority.

RECOMMENDATION 4

The Environmental Protection Authority recommends that the proponent revise the present site emergency plan to cover the proposed extension. The revised plan should be submitted to, and be to the satisfaction of the Environmental Protection Authority prior to construction of the extension. The plan should meet the requirements of the Kwinana Integrated Emergency Management System.

RECOMMENDATION 5

The Environmental Protection Authority recommends that the proponent revise the previous construction and operational stage management plans to cover the proposed extension. Each revised plan should be submitted to, and be to the satisfaction of, the Environmental Protection Authority before that stage of the development commences. The plans should include the following:

. management of stormwater runoff from the site;

. emergency response for site workers in the case of present plant failure;

. storage and bunding requirements for additional sodium cyanide storage; and

. storage requirements for additional ammonia.

RECOMMENDATION 6

The Environmental Protection Authority recommends that the proponent revise the present wastewater and solid waste management plan to take into account the additional effluent resulting from expansion from the plant. This revised plan should be submitted to, and be to the satisfaction of, the Environmental Protection Authority before commissioning the extended plant.

RECOMMENDATION 7

The Environmental Protection Authority recommends that the proponent installs in the ammonia pipeline, remotely operated fast action safety valves which can isolate each plant from the pipeline and the other plant.

RECOMMENDATION 8

The Environmental Protection Authority recommends that the proponent should be responsible for decommissioning the plant and surrounds, and that 6 months before decommissioning the proponent should submit decommissioning plans to the satisfaction of the Environmental Protection Authority.

1. INTRODUCTION

The joint partners - CSBP and Farmers Ltd, Coogee Chemicals Pty Ltd and the Australian Industry Development Corporation have formed a joint venture, Australian Gold Reagents Pty Ltd (the proponent) to produce sodium cyanide. Australian Gold Reagents Pty Ltd. (AGR) already have a 15,000 tonnes per annum (tpa) plant in operation at Kwinana (Figure 1) which could be modified to have a capacity of 20,000 tpa. The plant produces sodium cyanide solution (30%) from natural gas, ammonia and caustic soda. AGR proposes to double the production capacity to 30,000 tpa.

The proponent has submitted information about its proposal to the Environmental Protection Authority (EPA) in the form of a Public Environmental Report (PER). The PER had an eight-week public review period commencing 10 December 1988 and finishing 3 February 1989.

The EPA received three submissions on this project, two from Government agencies and one from a private individual. Relevant issues raised in submissions were summarised and forwarded to the proponent for comment. The questions raised and the proponent's responses are given in Appendix 2. In addition, the proponent provided additional information which has been incorporated in the assessment of this proposal.

The EPA assessed the environmental aspects of the project from information provided in the PER, submissions to the Authority, the proponent's responses to issues raised in the submissions and information gathered through the Authority's own investigations including a site inspection. The Authority notes the extensive list of management commitments the proponent has made regarding all aspects of the proposal.

In its assessment of the proposal, EPA found that the major issue was the risks and hazards associated with the manufacture of sodium cyanide and the implications for the Kwinana area. In addition, the transport of the sodium cyanide was considered.

2. DESCRIPTION OF THE PROPOSAL AND SITE

2.1 THE PROPOSAL

The PER states that sodium cyanide is an essential part of the gold extraction process. Currently 50 000-60 000 tpa of sodium cyanide is consumed in WA and is expected to continue to increase in the future. The expanded plant would provide the bulk of the State's sodium cyanide needs in the future.

The proponent has an existing sodium cyanide plant at Kwinana. The plant has a present capacity of 10,000 tonnes sodium cyanide per annum. When fully commissioned it will produce 15,000 tonnes per annum of sodium cyanide. The existing plant, however, has the potential to produce 20,000 tonnes per annum of sodium cyanide after some modification of equipment downstream of the reactor producing intermediate hydrogen cyanide.

The proposal in the PER is to duplicate the present sodium cyanide plant so together they could produce up to 30,000 tpa sodium cyanide in a 30% solution form. The final integrated plant will have four reactors. It will use the Andrussow process for manufacture which uses natural gas, ammonia and caustic soda as raw products. The present plant consists of two gas reactors, a cooler, an absorber, a distillation column and an incinerator (Figure 2). The process consists of mixing ammonia with natural gas and

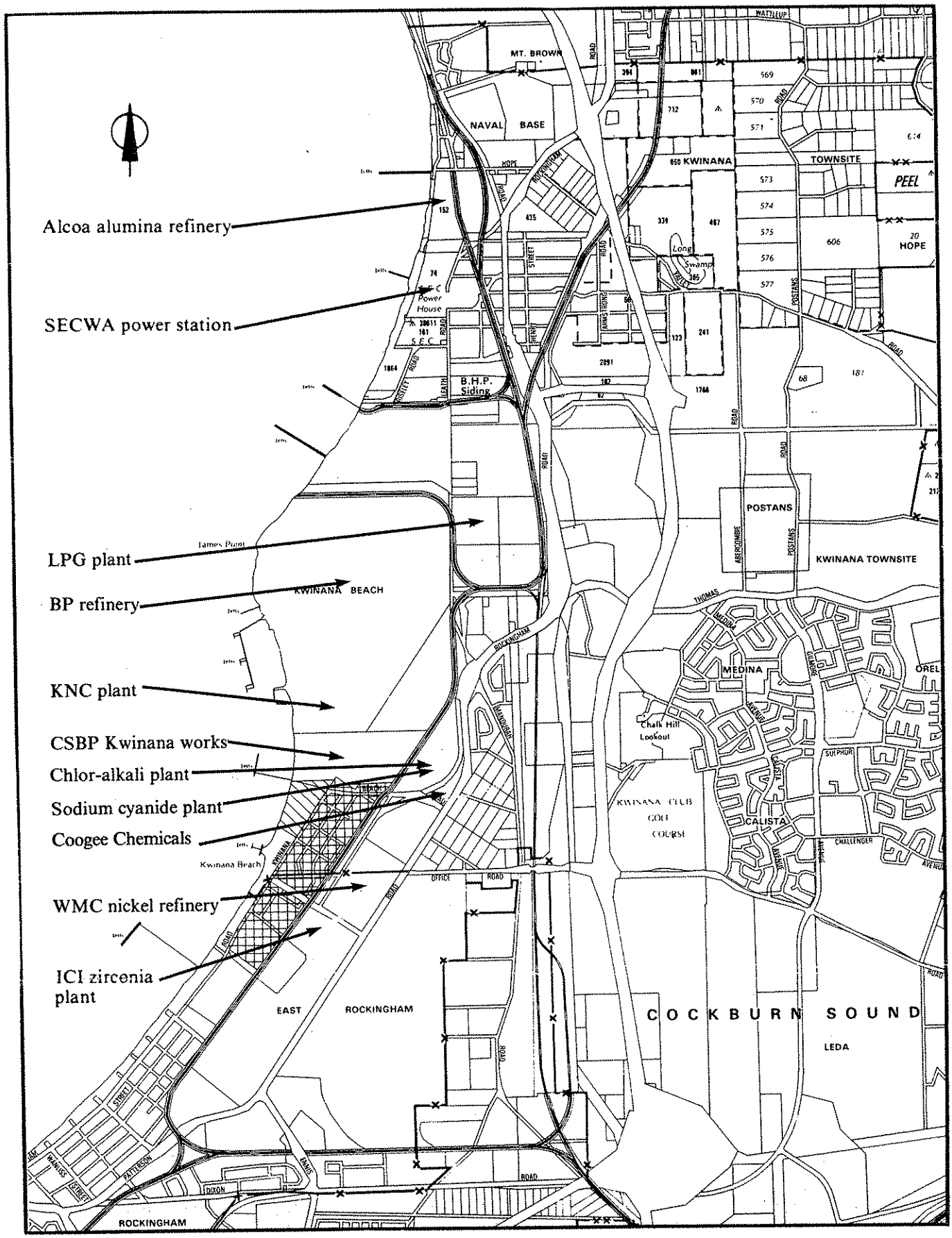

Figure 1. Locality Plan. (After PER.)

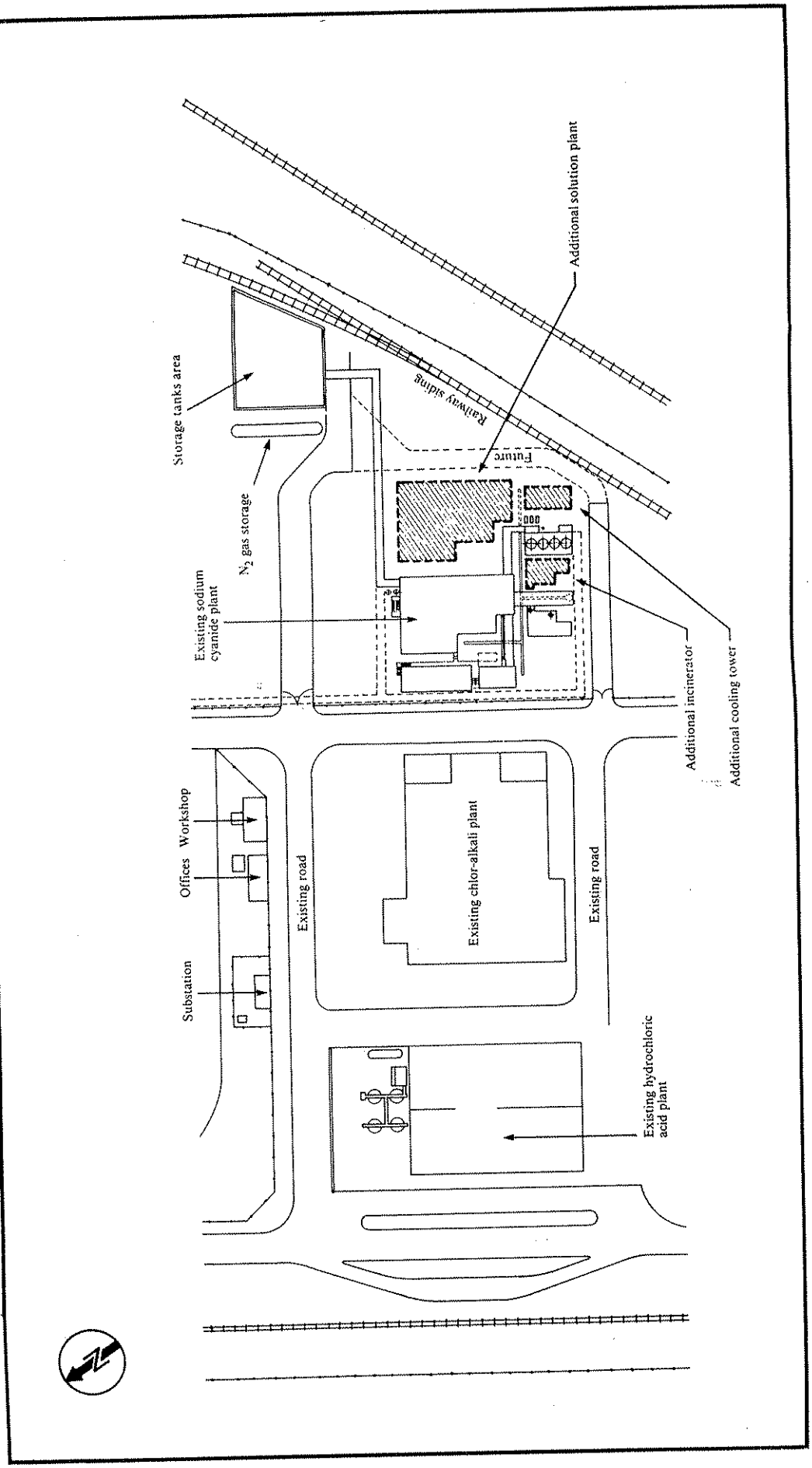

Figure 2. Plant Layout. (After PER.)

heating to 1100°C on a platinum/rhodium gauze whereupon hydrogen cyanide gas is evolved. The gas is then scrubbed with sodium hydroxide, producing sodium cyanide solution. The process works under negative pressure and gas in the reaction vessels is unlikely to leak to the atmosphere.

The sodium cyanide solution would be stored in existing 1300 tonne capacity steel tanks. On-site product storage would probably be increased from the present 2600 tonnes to approximately 4000 tonnes of 30% by weight sodium cyanide solution. The latter figure is slightly less than the 4166 tonnes of product storage assumed in the risks and hazards analysis for the existing plant (Cremer and Warner, 1986).

The additional storage tank would be sited on concrete supports surrounded by impermeable bunds as are the existing tanks. This would not significantly affect the risks and hazards of the plant because the solution is alkaline and stable and will not give off gaseous emissions.

The product is presently being transported by rail and road in dedicated containers to various gold mines, within the eastern and northern goldfields in accordance with the requirements of all decision making authorities. The proponent also expects to transport the product to markets in the southwest should a suitable routes be approved. This will be the subject of a separate submission to the EPA.

2.2 THE SITE

The site is a 1.7 ha triangular block, located towards the northern end of the Becher-Rockingham beach ridge in the Kwinana industrial area. It is close to Kwinana Beach Road and Patterson Road (Figure 1). The nearest major residential area is approximately 2km inland to the south-east.

2.3 THE ENVIRONMENT

The winds at the site consist of sea breeze/land breeze phenomena reinforced by a katabatic wind from the Darling Scarp. The area experiences strong westerly winter winds while strong easterly winds predominate in summer.

The proposed sodium cyanide plant extension site has generally been cleared of native vegetation. The site has recently been planted at the edges with a variety of plant species including Agonis flexuosa, Acacia rostellifara, Allocasuarina obesa, Eucalyptus platypus, Melaleuca pubescaris and Myoporum insulare by CSBP as part of the landscaping for its existing works.

3. POTENTIAL ENVIRONMENTAL IMPACTS IDENTIFIED IN PER

The potential environmental impacts associated with the extension are similar to those described in the PER for the original sodium cyanide plant and which were addressed extensively in the EPA's assessment report on the proposal (EPA Bulletin 274). They include:

- hazards associated with sodium cyanide plant and transport;
- occupational health and safety;
- waste disposal; air, liquid and solids, spillage; and
- odour, noise, traffic, dust, aesthetics, and public amenity.

All these potential environmental impacts are addressed by the proponent in the extensive list of commitments made in the PER and in response to questions submitted during the public review period (Appendix 1 and Appendix 2).

4. REVIEW OF SUBMISSIONS

The PER was released to the public and Government departments on 10 December 1988 for an eight week review period, which ended on 3 February 1988.

A total of three submissions were received: two from Government agencies and one from the public (Appendix 3). All submissions have been analysed and the main issues raised were:

- staffing levels
- ammonia pipeline safety;
- storage and transportation of product;
- incinerator operations and gaseous emissions;
- sulphur removal from natural gas and disposal; and
- water usage.

The proponent's response to questions raised are given in Appendix 2. In summary, the proponent indicates that:

- an additional ten full time personnel are likely to be required;
- the ammonia pipeline is fitted with an excess flow valve at Kwinana Nitrogen Company and a remotely operated emergency shut-off valve at the plant. It is proposed to install another excess flow valve in the supply pipeline near the plant;
- storage will not be a problem as another properly bunded storage tank will be erected. The solution will be stable as it will be kept alkaline using excess sodium hydroxide;
- the likelihood of significant impacts from gas emissions during incinerator breakdown is very low. During servicing of the incinerator, production cut back will depend on the wind conditions;
- sulphur removal will not be a problem as the levels of sulphur in the gas are very low; and
- the water usage will consist of small volumes of groundwater and scheme water.

Information and comments provided in submissions, and the proponent's answers to questions raised, have been used to assist in the evaluation of this proposal.

5. ENVIRONMENTAL ASSESSMENT

5.1 GENERAL INTRODUCTION

The Authority has identified the following aspects as those with potential to cause impacts:

. risks and hazards associated with plant failure;

. transport of product;

. noise, dust and stormwater runoff during construction;

. gaseous, solid and liquid wastes;

. amenity, and

. occupational safety.

The selection of this site has been reviewed previously by EPA in the PER for the original sodium cyanide plant (EPA, 1987a). In its present assessment, EPA considered the proposal in a regional and local context, acceptability to the local community and compatibility with other industries in the area. The major part of the assessment related to risks and hazards. In its assessment of the original proposal, EPA found the site to be acceptable using conservative analytical criteria. In assessing the proposed extension, the Authority found that there will be no significant public risk associated with the location of the proposal.

The Authority considers the project to be environmentally acceptable and that it could proceed subject to the commitments given by the proponent in the PER (Appendix 1) and in response to subsequent questions (Appendix 2), and to the Authority's recommendations in this report. These commitments cover issues such as:

. safety, risks and hazards, and modifications to existing plant;

. construction and commissioning procedures;

. gas emissions, wastewater management and environmental monitoring;

. storage and transport of increased volume of product; and

. fire protection and emergency plans;

RECOMMENDATION 1

The Environmental Protection Authority concludes that the proposal, as described in the Public Environmental Report to manufacture and distribute a total of 30,000 tonnes per annum sodium cyanide solution, is environmentally acceptable, and recommends that the proposal could proceed subject to the Authority's recommendations in this report and the management commitments made by the proponent in the PER (Appendix 1 of this report), the assumptions made in the risk assessment, and in responses to questions raised during assessment (Appendix 2 of this report).

5.2 RISKS AND HAZARDS

5.2.1 INTRODUCTION

EPA issued the proponent with risk assessment guidelines (PER, Appendix A) based on the premise that there was no need to duplicate work in the previous report for the original sodium cyanide plant. The document had to be a stand-alone report, however, and detailed analysis and descriptions were required where the proposed plant differed from the existing development, and where there could be significant differences in the consequences or individual risk levels.

Issues relating to risks and hazards were addressed during the assessment of the proposal for the original sodium cyanide plant (EPA Bulletin 274). The quantitative assessment of risk to individuals in the community is an important part of the environmental impact assessment procedure for major proposals. Industrial accidents do occur, and technical safeguards do have limitations. With proper controls at all stages of plant design, development and operations, however, risks and hazards can be reduced to an acceptable level.

As detailed in EPA Bulletin 278, the Authority has set criteria for assessing the risk acceptability of new industrial projects. A small level of risk in residential areas, set at less than one in a million fatalities per year, is acceptable to the Authority. A high risk level in a residential area, taken as greater than ten in one million per year, is unacceptable to the Authority and warrants rejection of the proposal. A level of risk which is between these two values require further evaluation and safeguards, and may then be considered acceptable by the Authority.

There has been a quantitative and qualitative assessment of risk of the proposed sodium cyanide plant's raw material inputs, processes, products and operations by risk consultants engaged by the proponent (Appendix B of PER). In addition, a cumulative risk analysis of the Kwinana area has been updated to include the expansion of the sodium cyanide plant by risk consultants engaged by the Department of Resources Development.

Based on the assumptions given in the PER (Appendix B), the risk consultants concluded that even with the doubling of the capacity of the present sodium cyanide plant adjacent to the original plant, the risk to the surrounding area rapidly falls below the one in a million per year contour of individual risk of fatality (Figure 3). In general, the new one in a million per year risk contour generated for the new expanded plant (ie the existing plant and the expansion) falls within land owned by the project partners (Figure 3).

The risk consultants also concluded that if in the future the production rate of each plant increases to 20,000 tonnes per annum, it can be achieved by increasing the on-stream factor of each plant (ie the number of days the plant will operate each year) which is intended to be 300 days per year at present. It will also be necessary to modify equipment downstream of the reactors at their maximum design rate equivalent to 10,000 tpa of sodium cyanide per reactor. The risk consultants have predicted that these changes would not significantly affect the risk contours which have so far been generated.

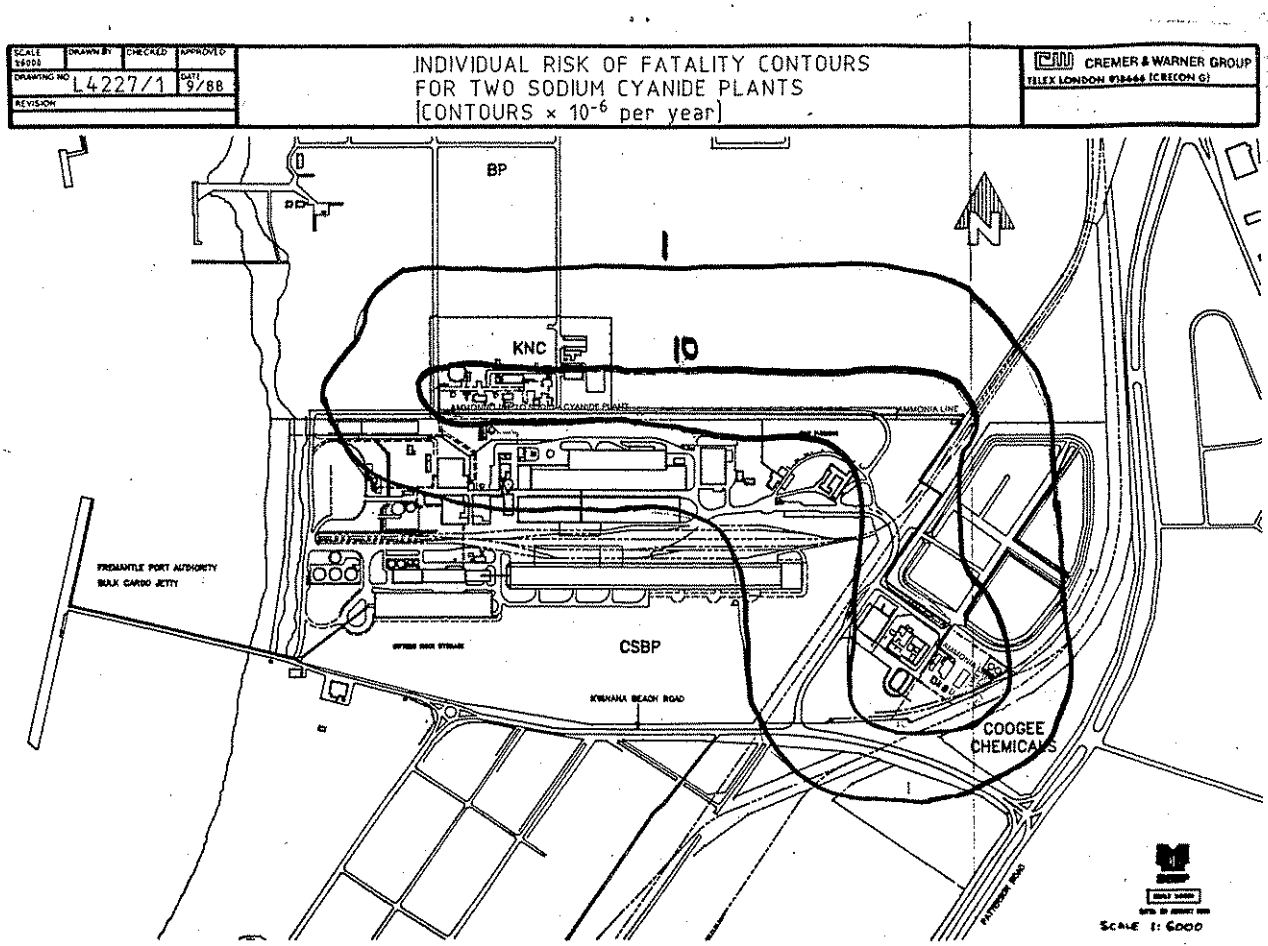

Figure 3. Risk Contours. (After PER.)

The Authority has reviewed both reports and accepts the analyses as a comprehensive and appropriate assessment of the risks and hazards associated with the proposal to produce up to 30,000 tpa sodium cyanide. In addition, the Authority considers that the risks and hazards fall well below the acceptable level of risk. During its assessment, the Authority noted the extensive list of appropriate commitments the proponent has given to ensure that all due care will be taken so that the potential for impact will be minimised (Appendix 1).

5.2.2 APPROACH TO RISK AND HAZARD ASSESSMENT

Assessment of risks and hazards has a recognised place in the assessment of industrial projects with potential to cause major environmental impacts. Hence, the proponent must calculate the risk from the proposal to the community so that the EPA can assess fully the acceptability of a project. This has been done in the PER (Appendix B). The method is called Preliminary Risk Assessment (PRA) and consists of the following steps:

- PROJECT DESCRIPTION - to give an inventory of hazardous materials and processes;
- INCIDENT IDENTIFICATION - detailing potential unwanted events that could lead to injury or death;
- FREQUENCY ESTIMATION - determining the likely frequency of each event;
- CONSEQUENCE PREDICTION - determination of the likely severity of the effects of each unwanted event; and
- RISK ESTIMATION - comparison with established criteria

A Preliminary Risk Assessment report has been prepared for this project (Appendix 4). The Authority accepts that the report adequately assesses the maximum likely individual risk level due to the proposed plant.

5.2.3 INCIDENT IDENTIFICATION

The proposed sodium cyanide plant extension generates risks and hazards due to:

- potential for loss of containment of toxic gases; and
- potential for loss of containment of sodium cyanide solution while being handled or stored.

There is also the potential for interaction between this proposal and surrounding industries to create increased risks through so- called 'domino' effects.

5.2.4 RISK ESTIMATION

The next step in the assessment is to estimate the risk due to each of the failure incidents. This is a combination of the consequence (which is the damage resulting from an incident outcome) with the likelihood (which is a measure of the expected frequency of occurrence of an event). Risk is then a measure of loss in terms of both the incident likelihood and the magnitude of the loss.

The Authority agreed, for consistency and comparability, that the frequencies used for the failure incidents of this proposal should generally be the same as those used in the 'Kwinana Cumulative Risk Study'.

5.2.5 RISK MANAGEMENT STRATEGY

It is normal practice for a Hazard and Operability Study (HAZOP) to be commissioned for major industrial plants. Significant reductions in hazards are possible as a result of such studies.

It is also usual to update the quantified risk study after the HAZOP has been carried out. This Quantitative Risk Assessment (QRA) considers all possible failure incidents which could cause injury on the site, and for a project of this size and complexity a large number of incidents would be considered. The iterative process of QRA and detail design results in off-site risk levels better than those estimated from the smaller number of cases used for the Preliminary Risk Analysis.

RECOMMENDATION 2

The Environmental Protection Authority recommends that the proponent should prepare, in stages, a comprehensive hazard identification and risk management programme, to the satisfaction of the Environmental Protection Authority and on advice from the Department of Mines.

The programme should include the following:

- **hazard and operability studies (HAZOP) of the process units, to be completed and submitted before mechanical construction commences;**
- **safety engineering design;**
- **quantified risk assessment;**
- **implementation systems; and**
- **safety reviews during the life of the plant at intervals to be determined by the Authority.**

The results should be forwarded to the Environmental Protection Authority and the Department of Mines.

The proponent should follow good engineering and management practices and employ suitably qualified personnel as part of the total safety package for the design, construction and operation of the proposed plant. Rigorous operator and maintenance personal training for the plant is also required.

The proponent should develop detailed written procedures covering all process work, including start-up, shutdown, plant testing, plant modification, inspection and emergency action. These shall be made available on request for inspection by relevant government agencies.

In ensuring the safe operation of the plant, the proponent should liaise with the Safety Coordinator in the Mines Department.

In addition to "software" issues such as training, it is essential to ensure the reliability and safety of process equipment, instrumentation and alarm systems.

RECOMMENDATION 3

The Environmental Protection Authority recommends that the proponent should:

- **maintain the process equipment, instrumentation and alarm systems consistent with the safety and reliability assessment of the plant; and**

- **install very high integrity instrumentation for the control of the plant and for the detection of and response to any unplanned releases;**

to the satisfaction of the Environmental Protection Authority.

5.2.6 EMERGENCY PLANNING AND RESPONSE

CSBP and Farmers Ltd, the operators of the AGR plant, already have an on-site emergency plan and equipment in place. There is, however, a need to ensure that existing plans meet the requirements outlined below.

The potential emergency situations that could arise during construction would be the accidental release of feed gases (natural gas and ammonia) and product gases (nitrous oxide and hydrogen cyanide) from the existing plant. In addition, gases will be released during start-up and shut-down. Such releases, although of very small probability, must be allowed for in emergency planning for the industrial area. Data to date indicate that these incidents do not have any credible effects in the areas beyond the industrial area. Emergency response planning is also an essential part of the operation of the plant.

The EPA considers that a site specific emergency management plan should cover:

- the types of emergencies which could occur;

- alarm initiation;

- communication; and

- equipment requirements.

The communication systems should be tested prior to commencement of construction and at regular intervals thereafter. The plan should also delineate roles and responsibilities of designated individuals. The plan should also integrate with site infrastructure ensuring that sufficient points of egress from the site are in place, in case of emergencies which require evacuation. Provision for access by emergency services is also required. The plan should be developed to the standard required by the relevant government agencies. The site emergency plan is to be compatible with regional off-site emergency planning requirements and should be completed prior to commencement of construction.

RECOMMENDATION 4

The Environmental Protection Authority recommends that the proponent revise the present site emergency plan to cover the proposed extension. The revised plan should be submitted to, and be to the satisfaction of the Environmental Protection Authority prior to construction of the extension. The plan should meet the requirements of the Kwinana Integrated Emergency Management System.

5.2.7 OFF-SITE EMERGENCY PLANNING AND RESPONSE

Off-site emergency planning and response arrangements are to be developed by the Kwinana Integrated Emergency Management System (KIEMS). KIEMS has been established by the Government as a result of recognition by the Authority, in the assessment of the ammonia-urea proposal (EPA Bulletin 309), that a Kwinana regional emergency plan was required. KIEMS will interact with companies (who are responsible for the development of their own on-site plans) to ensure the optimum level of coordination for managing total area responses to emergencies. This regional planning and response system is to meet the standards required by the agencies represented on KIEMS. The system is expected to be in place within two years.

5.3 TRANSPORT

The sodium cyanide solution will be transported by the following rail/road based system which has already been assessed and found to be acceptable by the EPA for the existing plant:

- sodium cyanide solution will be loaded by a loading arm and coupling into isotainers secured onto specially modified and dedicated railway wagons at the siding at the plant site in Kwinana;

- the railway wagons will be moved in scheduled Westrail freight services to appropriate railway terminals near intended markets;

- at the railway terminal, the isotainers will be released from the railway wagons and lifted on to road vehicles and locked into position ready for delivery to the mine site;

- after road delivery to the mine site, the sodium cyanide solution will be discharged into the customer's storage tank by pressurizing the isotainers with compressed air; and

- the empty isotainers will then be sent back to the railway terminal for return to Kwinana.

An isotainer is a specially constructed vessel for the transport of sodium cyanide solution, which complies with all the relevant Western Australian, Australian and International Standards Organization standards.

It is currently planned to use about thirty isotainers; this number could be increased to about sixty if production increased to a total of 40,000 tonnes per annum, depending on the location of markets and the turnaround of isotainers by the rail/road distribution system.

The proponent is currently considering transport options for delivery of product to goldfields near Boddington.

The road delivery routes generally follow the shortest practicable route (in most cases, the only route) from the rail terminal to the mine sites. Exceptions to this are:

- diversions around areas of sensitivity (note: it is not always possible to avoid these areas); and

- use of a longer route because of better road conditions.

Discussions have been undertaken by the proponent with the various Shires which could be affected if product were transported to Boddington.

In the event of spillage, the proponent's existing Emergency Response Plan and management procedures will be employed. This procedure requires that stocks of neutralizing agent will be available at strategic locations along the existing transport routes.

Liaison by the proponent with Local Shires, the EPA, the Department of Mines, Westrail and counter-disaster groups will occur as appropriate in regards to proposed changes to agreed transport routes or the addition of new market areas.

EPA considers that the routes presently used for transport to the northern and eastern goldfields are acceptable as they comply with the Authority's strict guidelines for transport by rail and road. In its assessment, EPA noted the proponent's commitment to stockpile neutralizing agent (ferrous sulphate) along the transport routes at agreed locations and that these stockpiles will be inspected regularly to ensure that they are in in good condition. It also recognised that doubling the size of the plant would increase the risk of accident during transport. However, the overall risk due to transport as outlined in the PER is so low that it is considered acceptable. In this regard it should be noted that rail transport has been calculated as being about 5000 times safer than road transport.

The Authority would still be concerned however about any future proposals to transport liquid sodium cyanide by road within the defined area of concern. The Authority reiterates its position as outlined in its assessment report for the original sodium cyanide proposal 'that transportation of sodium cyanide solution by road through the Authority's defined area of concern is environmentally unacceptable' (EPA Bulletin 274). The defined area of concern constitutes that part of the State within 50 km of the Perth GPO plus designated surface and groundwater catchment areas. If areas outside those indicated in the proponent's transport plan are to be serviced, and EPA will assess the environmental acceptability of transport operations proposed in any new areas.

The Department of Mines and Occupational Health, Safety and Welfare of Western Australia have established an approval system for isotainers and the Department of Mines has established a data bank to monitor the use and transport of each isotainer. EPA considers that all additional isotainers required for transport of product as a result of expansion of the plant should be included in this approval system.

It is clear that a result of this proposal proceeding will be increased rail traffic of sodium cyanide solution. Westrail will need to ensure that the increased traffic will not lead to delays in rail/road transfer operations or other infrastructure difficulties. The Authority is concerned to ensure that potential exposures of sodium cyanide containers to the public are absolutely minimised.

5.4 ENVIRONMENTAL IMPACTS

The issues of environmental impacts associated with construction, operation, risks and hazards, waste discharge, amenity and worker safety are discussed in the proposal for the establishment of the original sodium cyanide plant (EPA, 1987A). The proponent has covered these issues with an extensive

management programme which has been accepted by EPA for the original plant and have been carried out to the satisfaction of EPA. Also, the proponent has given an extensive list of commitments to ensure minimal impact during construction and operation of the extended plant.

5.4.1 CONSTRUCTION, COMMISSIONING AND OPERATIONAL IMPACTS

Construction could have the following associated impacts:

. generation of dust and noise; and

. discharge of contaminated stormwater.

The proponent's commitments on these matters are given in Appendix 1. These commitments also applied to the original proposal and were found to be carried out in a satisfactory manner. The Authority finds the proponent's commitments are sufficient to ensure proper environmental management.

Whilst commissioning, start-up and shut-down and on going operations should not normally have environmental impact, the potential remains for impacts to occur. Hence, the environmental management plan should be extended to cover such eventuality.

RECOMMENDATION 5

The Environmental Protection Authority recommends that the proponent revise the previous construction and operational stage management plans to cover the proposed extension. Each revised plan should be submitted to, and be to the satisfaction of, the Environmental Protection Authority before that stage of the development commences. The plans should include the following:

. **management of stormwater runoff from the site;**

. **emergency response for site workers in the case of present plant failure;**

. **storage and bunding requirements for additional sodium cyanide storage; and**

. **storage requirements for additional ammonia.**

The proponent has covered the issue of effluent disposal in its extensive list of commitments and in the management plan for the original plant. The Authority however considers that this plan will have to be updated to take into account the extra effluent which will be generated as a consequence of expansion.

With regards to solid waste, the PER states that the plant would not be producing any solid industrial waste except in the case that it had extract sulphur from its natural gas. That has been found not to be necessary with the existing plant. The Authority, in its assessment, has taken into account the proponent's commitment to manage solid waste if sulphur removal becomes necessary.

Odour should not be a problem as the raw material will not be exposed to the atmosphere and the product is in an odourless solution form.

RECOMMENDATION 6

The Environmental Protection Authority recommends that the proponent revise the present wastewater and solid waste management plan to take into account the additional effluent resulting from expansion from the plant. This revised plan should be submitted to, and be to the satisfaction of, the Environmental Protection Authority before commissioning the extended plant.

Gaseous emissions will be the same as for the present sodium cyanide plant which has been assessed previously and has been found to be environmentally acceptable. Under normal conditions, the proponent commits itself to managing emissions to comply with Victorian EPA guidelines and NHMRC guidelines, and to the satisfaction of EPA.

Gaseous emissions will occur, however, during start-up and shut-down, the volume and concentration of gases should be so low that they will cause no impact on the surrounding environment. Emissions may also occur in the unlikely case of plant failure. Such emissions would be very small because the plant operates under partial vacuum. If leakage occurred, it would be small and would become diluted quickly in air making it highly unlikely that it would cause an environmental impact.

5.5 AMMONIA SUPPLY

In the event of the failure of the pipeline adjacent to the plant the full inventory of the pipeline could be discharged onto the plant. A failure of the pipework also could lead to the inventory leading to and including the vaporisor discharging onto the adjacent plant. To prevent this impact, the following recommendation is made:

RECOMMENDATION 7

The Environmental Protection Authority recommends that the proponent installs in the ammonia pipeline, remotely operated fast action safety valves which can isolate each plant from the pipeline and the other plant.

5.6 OCCUPATIONAL HEALTH, TRAFFIC, VISUAL AND AMENITY IMPACTS

Matters which could affect the health or safety of personnel in the sodium cyanide plant or in the adjacent industrial installations in the surroundings are the responsibility of the Commissioner of Occupational Health, Safety and Welfare.

The issue of traffic has been discussed at length in the original assessment report. Traffic related to the construction phase will be subject to the same requirements as those imposed during the construction phase of the original plant. The proponent has made a commitment to this effect.

As roads around the proposed plant will not be used for transport of raw materials and product, traffic due to the expansion should not be a problem.

With respect to amenity, the proponent has pointed out that the present sodium cyanide plant is very small in the context of the Kwinana industrial area. The proposed expansion will also be small and have no significant additional visual impact.

5.7 DECOMMISSIONING

The Environmental Protection Authority considers that when the plant ceases operation permanently the decommissioning and site cleanup should be the responsibility of the proponent.

RECOMMENDATION 8

The Environmental Protection Authority recommends that the proponent should be responsible for decommissioning the plant and surrounds, and that 6 months before decommissioning the proponent should submit decommissioning plans to the satisfaction of the Environmental Protection Authority.

6. ENVIRONMENTAL MANAGEMENT AND MONITORING

The environmental assessment process in Western Australia places a high priority on the management of environmental impacts and the monitoring of both the management programme and the impacts to ensure that appropriate steps are taken to ameliorate and minimise impacts.

The proponent gave an extensive list of management and monitoring commitments when the original sodium cyanide plant was assessed by EPA (EPA Bulletin 274). The proponent has extended these commitments to cover the expanded plant. In addition, EPA has approved the existing management and monitoring plan for the existing plant and this will be extended to cover the expanded plant to the satisfaction of EPA. The Environmental Management Plan and commitments cover issues of design and construction, commissioning, emergency procedures and contingency planning, monitoring and reporting, auditing, and hazards control plans. These issues have been dealt with in section 5.

7. CONCLUSION

During its assessment, the Authority noted the extensive list of commitments given by the proponent to ensure minimal risk to the workforce, local residents and the environment.

EPA has examined the risk analysis for the proposal (PER, Appendix B) and has concluded that the parts of the proposal associated with construction and operation of the plant extension to produce a total of 30,000 tpa of sodium cyanide are environmentally acceptable, as individual risk levels are such that the one in a million contour does not impact on residential areas. This is also true of the cumulative risk analysis for the Kwinana area which was updated for this proposal (Appendix 4). Although there is a slight increase in the overall cumulative risk due to the risk contribution of the proposed sodium cyanide plant extension, this risk level as it pertains to residential areas is well below the guidelines adopted by the EPA and is acceptable to the Authority.

In its consideration of the proposal, the Environmental Protection Authority also found that the transport routes presently used by the proponent for the transport of sodium cyanide solution are acceptable for future use.

8. REFERENCES

Cremer & Warner Ltd (198). Proposed Sodium Cyanide Plant. Public Environmental Report, Volume 2. Risk Assessment Report. Prepared for CSBP & Farmers Ltd, Coogee Chemicals Pty Ltd and the Australian Industrial Development Corporation.

DCE, (1981). Water Quality Criteria for Marine and Estuarine Waters of Western Australia. Bulletin 103.

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Technica, (1988). Cumulative Risk Analysis of Kwinana Industrial Area: Revision of Ammonia-Urea Plant and Expansion of Sodium Cyanide Plant. Technica, London.

APPENDIX 1

SUMMARY OF MANAGEMENT COMMITMENTS

The commitments that the proponent has made to environmental management during the design, construction and operation of the expanded facilities are as follows:

- Prior to implementing any modifications to the design of the existing plant, the following safety checks will be undertaken:
  - referral of the proposed modification to the process licensor, Roehm GmbH;
  - liaison with the risk consultant on the proposed changes if they are likely to affect the risk analysis.
  - HAZOP analysis of the proposed modifications to the plant design.
- Construction of the proposed expansion will be undertaken in accordance with a Construction Stage Management Report similar to that prepared for the existing plant but recognising the potential hazards of the existing plant, together with relevant conditions imposed by the EPA.
- All construction materials and practices will be in accordance with the relevant Australian codes and international standards where appropriate.
- The plant design will ensure that emissions of nitrogen oxides during normal operating conditions will be within the NH&MRC recommended guidelines and will also comply with guidelines adopted by the Victorian EPA.
- Safety features incorporated into the existing plant will be incorporated into the expanded facilities.
- Wastewater from the plant will be managed according to the wastewater management strategy approved by the EPA for the existing plant.
- The process and storage areas will be sealed and bunded so that any washings, contaminated stormwater runoff or spills will be collected and directed to the wastewater treatment plant sump, and analysed and treated prior to disposal. Any discharge of treated wastewater into Cockburn Sound will comply with the criteria specified in Bulletin No. 103 or the terms of the EPA licence for the existing plant.
- Any additional storage of sodium cyanide will be approved by the Chief Inspector of Explosives and Dangerous Goods.
- A fire protection system will be incorporated into the expanded facilities in accordance with the requirements of the plant design and the Western Australian Fire Brigade Board. CSBP works' personnel will be trained in the appropriate fire-fighting techniques. In addition to the fire-fighting capability of CSBP's Kwinana works, the fire-fighting co-operative established by the industrial operators in the Kwinana district will be available for emergency assistance. CSBP has been participating in the development of the Western Australian Hazardous Materials Emergency Management Scheme.

- All employees will be trained in the safe work practices and emergency procedures appropriate to the operation of the plant and handling of all associated materials. The management structure for the expanded facilities will incorporate at least two tiers of personnel technically qualified to manage hazardous chemical operations.

- On-site emergency facilities at CSBP's Kwinana works will continue to include a dedicated emergency response vehicle, fire tender and an ambulance at all times, and an occupational health sister during normal working hours.

- A detailed operating manual has been prepared for the existing plant from information supplied by the licensor, covering all process work, including start-up, and shut-down, plant testing, inspection and emergency action. The procedures manual will be amended as necessary to include the expanded facilities.

- The proponent will arrange for observers from the licensor to be at the plant during commissioning of the duplicate plant if it is deemed necessary by the licensor and the proponent.

- The duplicate plant and any interconnections to the existing plant will be subject to a full HAZOP study and follow-up prior to commissioning.

- Stocks of neutralizing agent (ferrous sulphate) are located along the transport routes at agreed locations. The will be inspected regularly to ensure that they are in good order.

- Emergency response practice sessions will take place on a basis agreed with the relevant authorities.

- CSBP as the plant operator will maintain a dedicated emergency response vehicle at the Kwinana works and this will be available to service any off-site incident involving the transport of sodium cyanide.

- Upon commissioning, monitoring of the existing plant will be undertaken in accordance with a comprehensive EMMP, and the proposed expansion will be incorporated into this EMMP to the satisfaction of the EPA.

- Liaison with local Shires, the EPA, the Department of Mines, Westrail and counter-disaster groups will occur as appropriate in regards to proposed changes to the agreed transport routes or the addition of new market areas.

- Subject to final regulations becoming law, AGR will prepare a Total Hazard Control Plan to the satisfaction of the Safety Coordinator, Explosives and Dangerous Goods Division of the Department of Mines, for the existing sodium cyanide plant at Kwinana. The plan will be extended to cover the operation of the duplicate solution plant.

APPENDIX 2

EPA'S QUESTIONS TO THE PROPONENT AND PROPONENT'S RESPONSES

AUSTRALIAN GOLD REAGENTS PTY. LTD.

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Telex AA93971. Phone (09) 3274343. Fax (09) 3274391

19 April 1989

Director
Evaluation Division
Environmental Protection Authority
1 Mount Street
PERTH WA 6000

ATTENTION: DR VICTOR TALBOT

Dear Sir,

Proposed Sodium Cyanide Plant Expansion

Thank you for a summary of the questions to the proponent arising out of public submissions on the above proposal. Our response to these and some other issues is as follows:

1. Sulphur Removal

Q. What types and quantities of sulphur waste will be disposed of?

Has the Health Department been consulted about managing the disposal sites?

A. If sulphur removal was found necessary in the expanded facility, then it could be designed to remove both mercaptans and natural sulphur compounds, although it is assumed that the major component would be natural sulphur compounds. A zinc oxide based system would remove the natural sulphur as zinc sulphide. Mercaptans would have to be removed by a separate system but there is such a small concentration of mercaptans in the natural gas that it is unlikely we would contemplate their removal.

At the present time, the operation of the existing plant has not been affected by the sulphur content of the natural gas and therefore we are not contemplating the requirement for sulphur removal in the expanded facility.

If this situation changes then the details of a sulphur removal system would be advised to the EPA before proceeding.

Furthermore if solid waste disposal sites were required then the Health Department, EPA and relevant local authority would be consulted for approval beforehand. The other possible scenario as discussed in Sections 4.4 and 4.7 of the PER is that the solid wastes could be sold for metal recovery where the zinc would be recovered. The Kwinana Nitrogen Company have done this in the past when using feedstocks with high sulphur content.

2. Incinerator Operation

Q. . What is the degree of "slow down" as an emergency measure in terms of production?

. How and when is such procedure implemented?

. What are the expected quantities of absorber off-gases and any other gases (including NOx) that will escape during incinerator failure at 100%, 20% and 10% of production?

. Over what period will the gaseous discharge be allowed to escape prior to further action being taken such as:

i) further reduction in production?
ii) plant shut-down?
iii) restoration to full production?
iv) notification to EPA?

. On what basis will decisions be made?

. What are the expected gaseous discharges resulting from incomplete combustion during start-up and shut-down operations? Will reduced production reduce the period of gaseous discharge and on what basis?

. What safeguards are installed or given to avoid accidental or deliberate gas discharge on incinerator failure?

A. In the event that the incinerator trips out during the normal operation of the plant, the normal operating procedure is that the rest of the plant continues to operate depending on the prevailing weather conditions and the nature of the incinerator failure.

If the incinerator failure is likely to be extended then the plant production may be reduced.

The degree of "slow down" is 50% of the design rate of the plant. This procedure is implemented only if it appears the incinerator will be shutdown for an extended period of time to carry out repairs and the decision is made by the senior staff in charge of the plant.

Operating experience to date has shown that the incinerator has been easily restarted when it tripped out and only on one occasion has the incinerator been shut down for more than 2 hours, at which point the EPA were advised.

The expected quantities of absorber off-gases that will be vented during an incinerator failure have been advised to the EPA previously together with the results of the WHAZAN modelling. In this instance we modelled the emissions from the plant at the design production rate of the plant and found that even under worst case dispersion conditions there would be no health effects at ground level. The emissions were not modelled at rates of 10% or 20% of production as the plant cannot operate at these rates.

The gases consist mostly of nitrogen (more than 50%), hydrogen, ammonia, carbon dioxide, water vapour and less than 50ppm of hydrogen cyanide.

There are no oxides of nitrogen emitted from the shut-down stack in an incinerator failure situation or a normal shut-down. The dispersion of the ammonia and hydrogen cyanide emissions was modelled on the WHAZAN model and confirmed by Cremer and Warner as presenting no problem at ground level under worst case conditions as discussed in Section 4.4.4 of the PER.

Decisions on whether to continue operating the plant in the event of incinerator failure are made on the basis of the estimated time to restart the incinerator and weather conditions at the time of the incident. We also liaise with the local EPA as necessary.

The gaseous discharges during start-up of the plant consist mostly of oxides of nitrogen together with some ammonia and a small quantity of hydrogen cyanide in the last few minutes of the start-up sequence. Start-up emissions and ground level effects are monitored and results have been reported to the EPA.

The gaseous discharges during shutdown of the plant consist mostly of nitrogen, carbon dioxide and water vapour together with lesser amounts of ammonia, natural gas, hydrogen, carbon monoxide and a trace of hydrogen cyanide. The gaseous discharge on plant-shutdown is independent of the plant production rate.

On incinerator failure there will always be an emission of absorber off-gas. If the production plant continues to operate then the emission will be the normal off-gas from the absorber. If the reactors are also shutdown, then the emission will be of short duration and consist of the absorber off-gas diluted by nitrogen purge. The nitrogen purge is a safety measure to flush the plant of flammable gases in the event of a total plant shut down, whether it is an emergency shutdown or a planned shutdown. The gases are scrubbed in the absorber column to remove hydrogen cyanide before discharge to atmosphere.

In the situation where the incinerator has failed and the rest of the plant continues to operate, if the absorption system then failed, the reactors would immediately shutdown by means of safety interlocks and there would be a nitrogen purge through the reactors and absorption system as discussed above. The emergency shutdown system is of very high integrity and the emergency shutdown will occur within 1 to 2 seconds of a trip.

3. Raw materials

Q. . **What is the source of the increased water requirement?**
. **What are the quantities of water required?**

A. The source of the increased water requirement is a combination of ground water from the CSBP bore system on its Kwinana works, together with scheme water and treated scheme water (boiler feedwater) from the sulphuric acid plant water treatment plant.

Quantities required are estimated as follows:

Groundwater for cooling	10 - 15 m^3/h.
Scheme water (for potable water, toilets, process water)	3 - 6 m^3/h
Treated water (for steam raising)	1 - 2 m^3/h

4. Storage

Q. **What will be the requirement for additional tanks and bunding to allow for the increased production of sodium cyanide solution.**

A. As discussed in Section 4.6.2 of the PER, on-site storage will probably be increased from the present 2,600 tonnes of 30% solution to approximately 4,000 tonnes of 30% solution. This would be achieved by extending the existing bunded area to provide room for one additional storage tank of 1,400 tonnes capacity.

As stated in the PER, the additional tank will be subject to the approval of the Chief Inspector of the Explosives and Dangerous Goods Branch of the Mines Department. All tanks will be appropriately placarded advising the contents of the tank together with relevant emergency information.

The requirement for the additional storage tank will depend on the projected turnaround time for isotainers together with the production rate necessary to achieve required sales and allow for plant shutdown for maintenance and catalyst replacement.

It should be noted as detailed by Cremer and Warner in their Preliminary Risk Analysis report of December 1986 on the existing plant, that in terms of quantification of the risk from the plant, sodium cyanide solution storage is not considered a potential area for offsite harm, and is therefore not a contributor to the individual fatality risk contours. Nevertheless the storage hazards are recognised and the necessary preventative measures were taken during design, construction and operation of the storage facility.

5. Transport

Q. . **If the Boddington minesites are to be supplied from Narrogin, what steps are being taken to provide the Narrogin rail terminal with the required rail/truck shipment facilities as well as ferrous sulphate stockpiling?**

. **How will the increased transport of hazardous goods affect the hazard to which the public is exposed?**

A. It is still our intention to supply the Boddington gold mines with sodium cyanide solution. Our preference is for a more direct route than the one previously proposed which consisted of rail from Kwinana to Narrogin via the Great Southern railway line and then road from Narrogin via Williams to Boddington. This and a range of other possible options is being evaluated and once we have finalised our studies, our proposal will be discussed in detail with the local authorities before being presented to EPA for approval.

If a more direct route is not approved then we would re-appraise the route via or near Narrogin and if approved by EPA and the local authority we would instal a rail siding to the specification required by EPA and the Mines Department including the provision of stocks of neutralising agent as previously done at Kalgoorlie, Leonora and Southern Cross.

The transport of sodium cyanide solution will not add to the overall hazard to which the public is exposed. AGR's supply to Boddington gold mines would simply replace the existing supply of solid sodium cyanide to Boddington so the total quantity of sodium cyanide into the Boddington mines will not alter except in accordance with the production rate of the mine.

The transport of sodium cyanide solution to Boddington will be in accordance with the conditions of approvals and our commitments already in place for existing product transport and will include:

- use of dedicated isotainers subject to regular and frequent inspection;
- use of special rail wagons for rail transport;
- use of dedicated and specially designed low bed trailers for road transport;
- road vehicles and drivers licenced for the transport of our product;
- drivers to have been trained and accredited by CSBP for transporting this product;
- stocks of neutralising agent placed at strategic locations along the route - likely to be at the rail siding chosen together with the Boddington townsite;
- CSBP's Emergency Response Plan will be amended to include this route.
- A public information programme to inform local emergency services, shires and interested groups of the details of our proposal.

These measures mean that transport of sodium cyanide solution to Boddington will be a well managed and accountable operation.

6. Gaseous Release

Q. What is the probability of prompt fatalities?

What would be the consequence of a failure of any other component during the failure of the incinerator?

What is done to guard against failure in the protection system?

A. Assuming that this question refers to an escape of hydrogen cyanide gas from the plant, the probability of any fatalities from such an incident is negligible.

The preliminary risk analysis by Cremer & Warner (1986) showed that potential releases of hydrogen cyanide present negligible risk of fatality beyond the plant boundary and that in the proposed expansion of the plant, there are no changes in the design or operation of the plant which will cause a significantly greater consequence from such releases. (Section 4.3 of Appendix B of PER).

The design of the plant is such that the areas of the plant where hydrogen cyanide is present in appreciable concentrations are under vacuum and therefore the gas cannot escape. In the unlikely event of a major vessel or pipework failure the quantity of hydrogen cyanide which could be released is very small (less than 1 kilogram for a 15,000 tpa plant) and the consequence of such an event is referred to by Cremer and Warner as presenting negligible risk of fatality beyond the plant boundary.

The likelihood of an on-site fatality from such a release is low given the safety consideration to the design, operation and maintenance of the plant.

These considerations include:

- basic design and safety philosophy of the process as licensed from Roehm;
- safety interlocking in the process control system;
- checking procedure prior to start-up of the plant ensures all safety conditions are satisfied before proceeding;
- training of operators, maintenance and support staff;
- operating and maintenance procedures;
- first aid and emergency response capability of CSBP to deal with on-site and off-site incidents;
- HAZOP of the final plant design and any subsequent changes.

The interlocking system referred to above ensures that in the event of an incinerator failure, if any other critical component fails, then the plant will shut down safely.

The interlocking or protection system has built-in redundancy and is backed up by an independent hard wired system to guard against failure of the primary system. The interlocking system was thoroughly checked before the plant commissioning last year by the process licensors.

Any changes to the system required as a result of subsequent operation are only done through a works authorisation and clearance system.

7. Staffing

Q. What are the expected manning levels of the plant after expansion?

A. The PER refers to the need for ten additional full time personnel to staff the duplicate plant. This is likely to be the upper limit of additional manning requirements and would allow for additional plant operators, isotainer loading personnel and production and maintenance staff.

8 Ammonia Pipeline

Q. How will the proponent prevent the escape of gas in the event of guillotine failures of the pipeline?

A. The ammonia supply pipeline from KNC is fitted with an excess flow valve at KNC and there is a remotely operated emergency shut-off valve at the plant battery limits. It is also proposed to install another excess flow valve in the supply pipeline near the plant battery limits once the plant operability problems associated with this are resolved. There is a protective barrier alongside the pipeline where it is above ground to prevent external impact, and we have standard clearance and authorisation procedure if any digging is required on-site.

In the event of a guillotine failure of the ammonia pipeline between the protective devices, action would be taken to mitigate the effects of an ammonia release. This would include:

- isolation of both end of the pipeline;
- initiation of the emergency plan on the works;
- notification of emergency and local authorities and surrounding industries;
- use of CSBP's emergency response team and resources and the WA Fire Brigade's resources (if necessary) to knock-down the fumes by use of water spray and foam and effect a repair to the pipeline to stop the leak;
- evacuation of works personnel and/or nearby population if necessary to avoid adverse effects of an ammonia cloud.
- a copy of Works Instruction 409 - "Toxic Gas Release Procedure" is attached for reference. This would be followed together with other related emergency procedures on the works.

Additional Information

On the question of whether the risk analysis performed by Cremer and Warner is valid for a debottlenecked plant (i.e. combined facility of 40,000 tpa), we have further advice from our consultants and attach a copy of their letter for your consideration.

In summary they confirm their previous advice that the risk fatality contours would not be materially affected by an increase in the output of each of the two plants to 20,000 tonnes per annum.

We trust this response is helpful in assisting your evaluation of our proposal. If you require any further advice please contact the undersigned.

Yours faithfully
Australian Gold Reagents Pty Ltd

SR Fitzpatrick
Principal Executive Officer

SRF109:GK23

Appendix 2 (Cont'd)

CSBP & Farmers Ltd

KWINANA WORKS INSTRUCTION NO.409

Title: TOXIC GAS RELEASE PROCEDURE

Issued by: Works Manager Signed:

Date Issued: 12 August 1987 Date Amended: 13 April 1988

1. PURPOSE

This instruction sets down the procedure to be followed in the event of an accidental release of toxic gas on the works.

2. REPORTING

The report of any toxic gas release is first to:

- the switchboard - dial 9 during normal hours OR
- the sulphuric acid plant - dial 743 during out of hours

The involved plant will be made aware of the emergency.

3. SEVERITY OF RELEASE

The plant supervisor or in absence the leading operator must determine the size and rate of the release as quickly as possible.

Assess the severity of the release by whether people and property beyond CSBP boundaries will be affected.

Toxic Gas releases having extended influence beyond CSBP boundaries have been classified as:

(i) small - e.g. discharge from a partial line failure
(ii) medium - e.g. discharge from a ruptured liquid pipeline
(iii) large - e.g. discharge from a ruptured storage tank

If it is not clear what rate of release of chlorine is then assume it is "large".

If it is not clear what the rate of release of other toxic gases is, then assume it is "medium".

4. DISC/MAP SYSTEM

Obtain the toxic gas dispersion discs and map. Discs and maps are located in the following:-

- main emergency control centre (Works Managers office)
- sulphuric acid plant control room
- emergency response centre
- police communications centre

Note the division of the disc into day (red figures) and night (blue figures) sections, and that each section has three segments, "small", "medium" and "large" corresponding to the severity of toxic gas release.

.../2

4. DISC/MAP SYSTEM (cont'd)

Place the correct toxic gas disc on the map.

Estimate the wind direction and speed (km/h).

Rotate the disc so that the centre-line of the appropriate segment (small, medium or large) in the appropriate day or night section is pointing in the direction that the wind is blowing. Day is from 1 hour after sunrise to 1 hour before sunset.

Note the number (1 to 36) on the map nearest to the reference arrow on the disc.

Enter the data in the appropriate spaces in the emission report form.

5. WORKS MANAGER

Contact the Works Manager or deputy and advise of the toxic gas escape.

The Works Manager will decide whether to:

(i) alert Police Emergency Communications via 000 (dial 0)
(ii) shutdown and evacuate plants

If within three minutes the Works Manager or deputy cannot be contacted alert Police Emergency Communications.

6. POLICE EMERGENCY COMMUNICATIONS

The Works Manager, deputy, or, if instructed, the plant supervisor or leading hand sulphuric acid plant operator is to telephone Police Emergency Communications and advise them of the toxic gas release.

Check for correct understanding of the emission report sheet data by having it read back.

If an emission report sheet is not available, the following information is required by Police Emergency Communications:

(i) company name and works, supervisor's name and position

(ii) statement that "there has been a release of toxic gas which will affect people outside CSBP boundaries and that their toxic gas dispersion estimate discs and map will be required"

(iii) toxic gas disc for (name of toxic gas) is required

(iv) (1) the disc arrow reference number is (1 to 36).
(2) day or night condition is (day/night)
(3) rate of release is (small, medium or large)
(4) wind speed is (km/h)
(5) initial time of release is (hours/mins; AM/PM)

3/.

7. EMERGENCY CONTROL

The Emergency Co-ordinator or Emergency Co-ordinator O.O.H. carries out the instructions of Works Controller regarding evacuation of plants on the works site.

8. EMERGENCY ACTIONS

If an inspection of the area where the toxic gas release has occurred is required, two men equipped with self contained breathing apparatus and full protection equipment should be used. The flow of toxic gas should be shut off if possible.

9. FOLLOW UP

As more information as to the rate and duration of the release of toxic gas is obtained, the Works Controller or Emergency Co-ordinator O.O.H. should keep Police Emergency Communications informed.

CREMER & WARNER
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Our Ref: L4227/1/VH/RPK
Your Ref:
Date: 11th April 1989

Mr. S.R. Fitzpatrick,
CSBP and Farmers Limited,
40 The Esplanade,
GPO Box D148,
Perth,
Western Australia, 6001.

Dear Steve,

Re: Increase in Sodium Cyanide Plants Output to 20,000 Tonnes Per Annum Each

An increase in the output of each of the two plants to 20,000 tonnes per annum by increasing plant capacity and the plant on-line factor will not materially effect the individual risk of fatality contours previously calculated for the following reasons:-

(a) Allowance for an on-line factor of less than 100 per cent is usually only made for failure frequencies when pipelines, equipment, etc. are thoroughly cleaned and decommissioned on shutdown and then fully pressure tested and recommissioned prior to every start-up. This was assumed not be done in this case particularly for the pipelines which are most significant in terms of the calculated risk, hence, no allowance was made in the analysis.

(b) The pipelines are pressurised, hence, the flowrate or mass released during a failure was much greater than the plant throughput. These scenarios are not affected by the increased throughput and on-line factor, hence, no increases in risk will occur from these release scenarios.

(c) The majority of failures of the vaporiser and connecting lines, and the ammonia recovery unit and connecting lines were also assumed during the analysis to be pressure or inventory limited rather than flowrate limited, the former producing the greater consequences. Even with the increased flowrate for 20,000 tonnes per annum would still lead to lower consequences that those previously calculated, hence, no increased risk will occur from these failures.

Continued.....

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Robertson Group
LABORATORY & CHEMICAL ENGINEERING DIVISION

(d) Only minor release cases such as emission from the vaporiser due to continued brine flow after shutdown or failure of the ammonia vapour line to the gas mixer downstream of the pressure reducing valve will have greater consequences due to the increased flowrate. However, these cases have low consequences in comparison to other scenarios and/or low frequencies and did not contribute significantly to the overall calculated risks. The increase in flowrate will still not cause a significant if any impact on the location of the one in a million per year individual risk contour if the risks are recalculated.

Yours sincerely,

VIC HARKER

APPENDIX 3

GOVERNMENT AGENCIES AND PUBLIC WHO MADE SUBMISSIONS

Mines Department of Western Australia.
Department of Resources Development.
Mr M Derry, Wembley Downs, WA.

APPENDIX 4

TECHNICA'S REPORT ON CUMULATIVE RISK ANALYSIS OF THE KWINANA AREA

Technica
CONSULTING SCIENTISTS & ENGINEERS

Lynton House, 7/12 Tavistock Square, London WC1H 9LT
Tel: 01-388 2684 Telex: 22810 TECNIC G Fax: 01-387 3550

CUMULATIVE RISK ANALYSIS OF KWINANA INDUSTRIAL AREA:

REVISION OF AMMONIA/UREA PLANT AND EXPANSION OF SODIUM CYANIDE PLANT

C1628/AHJ

November 1988

CUMULATIVE RISK ANALYSIS OF KWINANA INDUSTRIAL AREA:

REVISION OF AMMONIA/UREA PLANT AND EXPANSION OF SODIUM CYANIDE PLANT

CONTENTS

1. INTRODUCTION

The Department of Resources Development, Western Australia, has asked Technica to revise the estimate of the cumulative individual risk for the Kwinana area, in the light of proposed changes to two facilities.

CSBP intend to construct an ammonia/urea plant at Kwinana which will export ammonia when operational. CSBP have now submitted plans to relocate the main ammonia pipeline and storage tank in order to use them for ammonia import before the ammonia/urea plant is operational. In addition to this change, CSBP propose to increase the production capacity of the sodium cyanide plant from 15,000 tonnes/year to 40,000 tonnes/year by debottlenecking and duplication of the plant.

Technica have performed risk analyses of both plants in their original proposed forms, as part of the Kwinana Cumulative Risk Analysis (Technica, 1987). The results were presented as supplementary reports on the two plants (Technica, 1986).

The purpose of this report is to show the effects of the proposed changes to the ammonia/urea and sodium cyanide plants on the cumulative individual risk for Kwinana.

2. PROPOSED CHANGES TO CHEMICAL FACILITIES

2.1 Ammonia/Urea Plant

The main 30,000 tonne refrigerated storage tank for ammonia, together with related compressors and transfer pump, would be built on the Kwinana Nitrogen Company site, rather than to the north of the proposed Ammonia/Urea plant site. The main transfer pipeline would run from this new location to the import/export jetty. Thus, the tank would be slightly further away from the residential areas to the east of the Kwinana industrial area, and the pipeline would be shorter by about 500m. In addition the pipe diameter would be increased from 250 to 300mm and a liquid injection at the jetty would be used for cool-down, rather than liquid injection at the tank. This requires an additional 50mm ammonia utility pipeline to the jetty which would be used before each transfer operation.

2.2 Sodium Cyanide Plant

The sodium cyanide plant will be debottlenecked primarily by increasing the onstream factor, or number of production days per year, from the current level of 300. This will increase the production capacity from 15,000 and 20,000 te/yr. An identical processing plant will be constructed directly east of the first plant, duplicating the following items of equipment:

- ammonia vapouriser;
- air, ammonia and methane gas mixer;
- two reactors producing HCN gas;
- HCN/caustic soda absorption tower;
- waste gases incinerator;
- startup/shutdown stacks;
- auxilliaries.

The total production capacity will then be 40,000 te/yr.

3. CUMULATIVE RISK INCORPORATING CHANGES

The individual risk due to each plant has been recalculated using SAFETI. Changes to locations, equipment specification, onstream factors, etc. have been modelled by editing the failure case definitions held in the SAFETI datafiles for each plant.

The cumulative individual risk for the area with no changes to the plants is shown in Figure 3.1. The contours are made up of contributions from the following existing and planned activities:

1. BP Refinery and Kwinana Nitrogen Company Ammonia plant
2. Western Mining Corporation Nickel refinery
3. Nufarm Industrial Chemicals
4. Cooperative Bulk Handling Grain Terminal
5. Cockburn Cement works
6. State Energy Commission of Western Australia gas supply pipeline
7. ALCOA alumina production
8. CSBP and Farmers Fertiliser manufacturing
9. Commonwealth Industrial Gases
10. Coogee Chemicals
11. BHP Steel works
12. Kleenheat LPG depot
13. Western Australia Natural Gas pipeline
14. CSBP Chlor-alkali plant
15. Wesfarmers LPG plant
16. CSBP/Norsk Hydro Ammonia-Urea plant
17. Petrochemical Industries Company Limited (PICL) petrochemical complex
18. CSBP Sodium Cyanide plant
19. TIO2 Pigment plant

The effects of the proposed changes to this "base case" are discussed below.

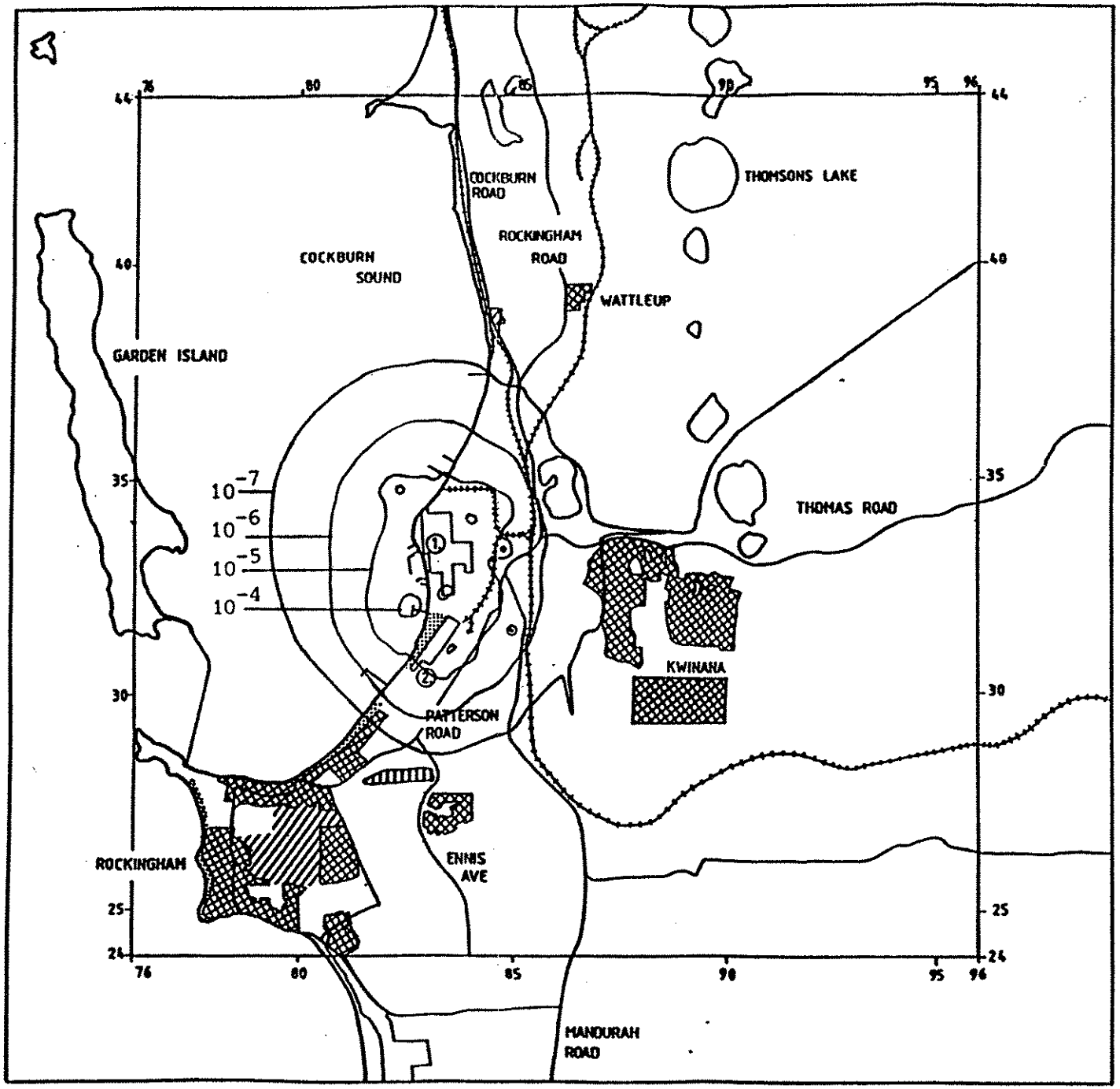

FIGURE 3.1: BASE CASE CUMULATIVE RISK FOR KWINANA

3.1 Ammonia/Urea Plant

The storage tank and pipeline have been relocated as specified by CSBP (1988). In theory a larger diameter pipeline would have a lower historical failure rate; however the difference between a 300mm and 250mm pipeline is considered to be within the error limits of the study and has not been modelled. The failure cases have not been changed because the overall hold-up of the pipeline is not significantly changed. No extra cases have been added for the proposed cool-down system because the risk from the smaller line would be much less than that for the main pipeline. The cumulative individual risk with the proposed changes included is shown in Figure 3.2 below.

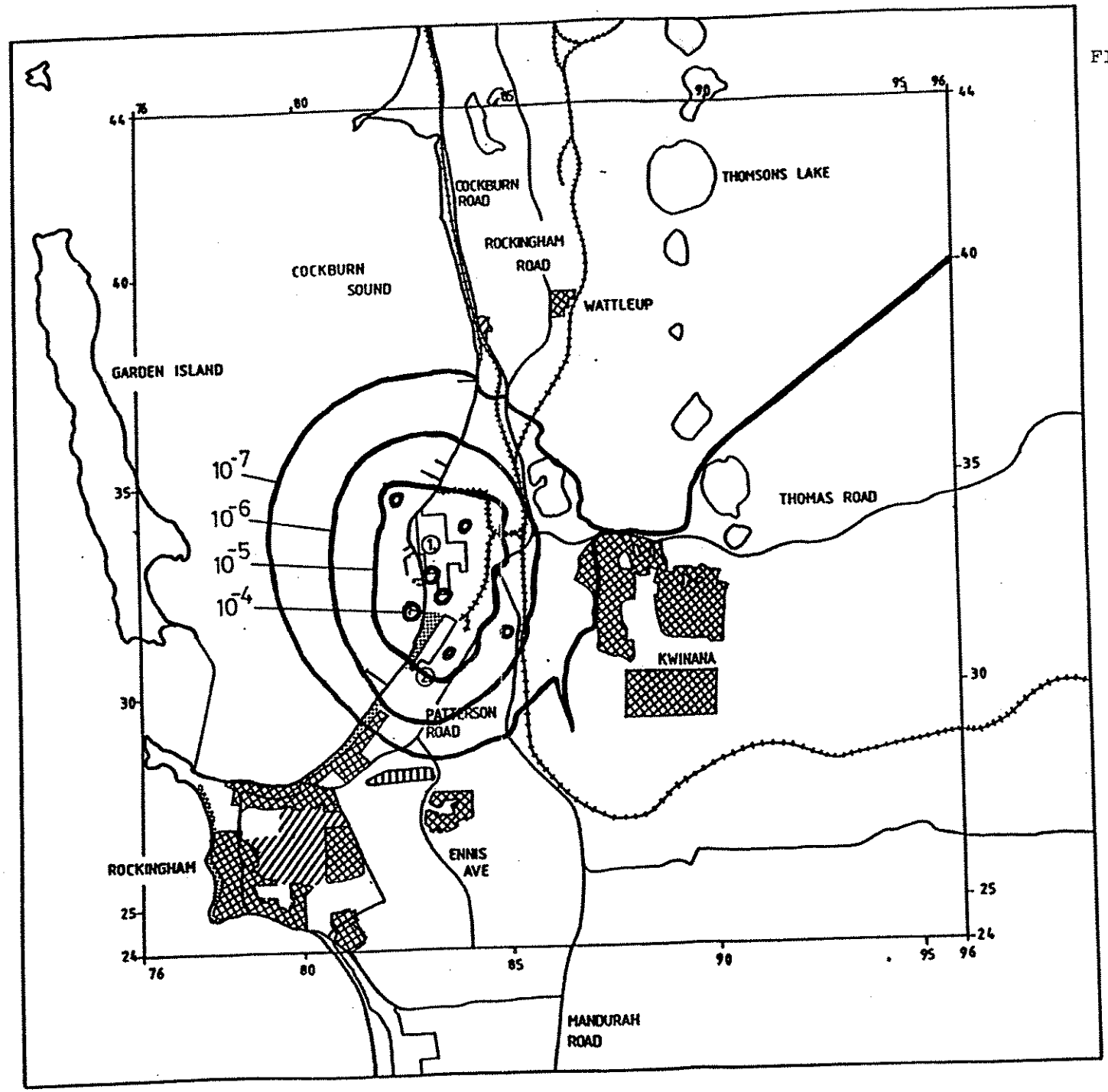

FIGURE 3.2: KWINANA CUMULATIVE RISK CHANGES MADE TO AMMONIA/UREA PLANT

Appendix 4 (Cont'd)

3.2 Sodium Cyanide Plant

Failure cases for the proposed second NaCN plant have been defined, duplicating those for the first plant. The increase in onstream factor could require an increase in failure case frequencies but it is likely that debottlenecking would reduce the frequency of startup/shutdown operations which are historically more accident-prone than normal operation. Hence, the failure case frequencies have not been modified. The cumulative individual risk with the additional processing plant included, is shown in Figure 3.3.

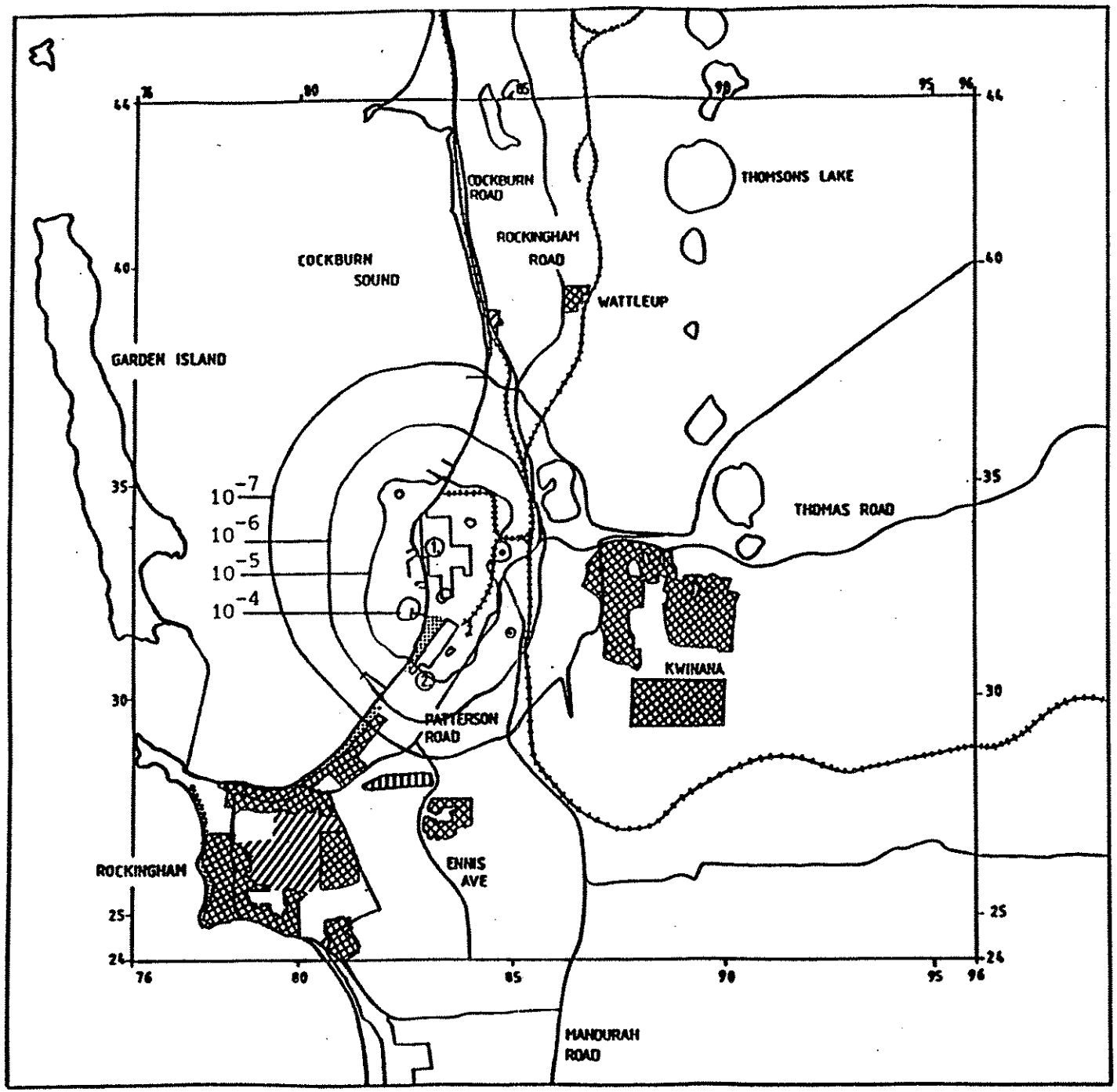

FIGURE 3.3: KWINANA CUMULATIVE RISK

DUPLICATION OF SODIUM CYANIDE PLANT

RAILWAY

ROAD

UNDER 5 PEOPLE/HECTARE

5–10 PEOPLE/HECTARE

11–20 PEOPLE/HECTARE

21+ PEOPLE/HECTARE

① BP REFINERY

② KWINANA BEACH

SCALE

0 1 2 3 4 5 KM

Appendix 4 (Cont'd)

3.3 Combined Effect of Changes

The cumulative individual risk with both the ammonia/urea and sodium cyanide plants revised, is shown in Figure 3.4 below.

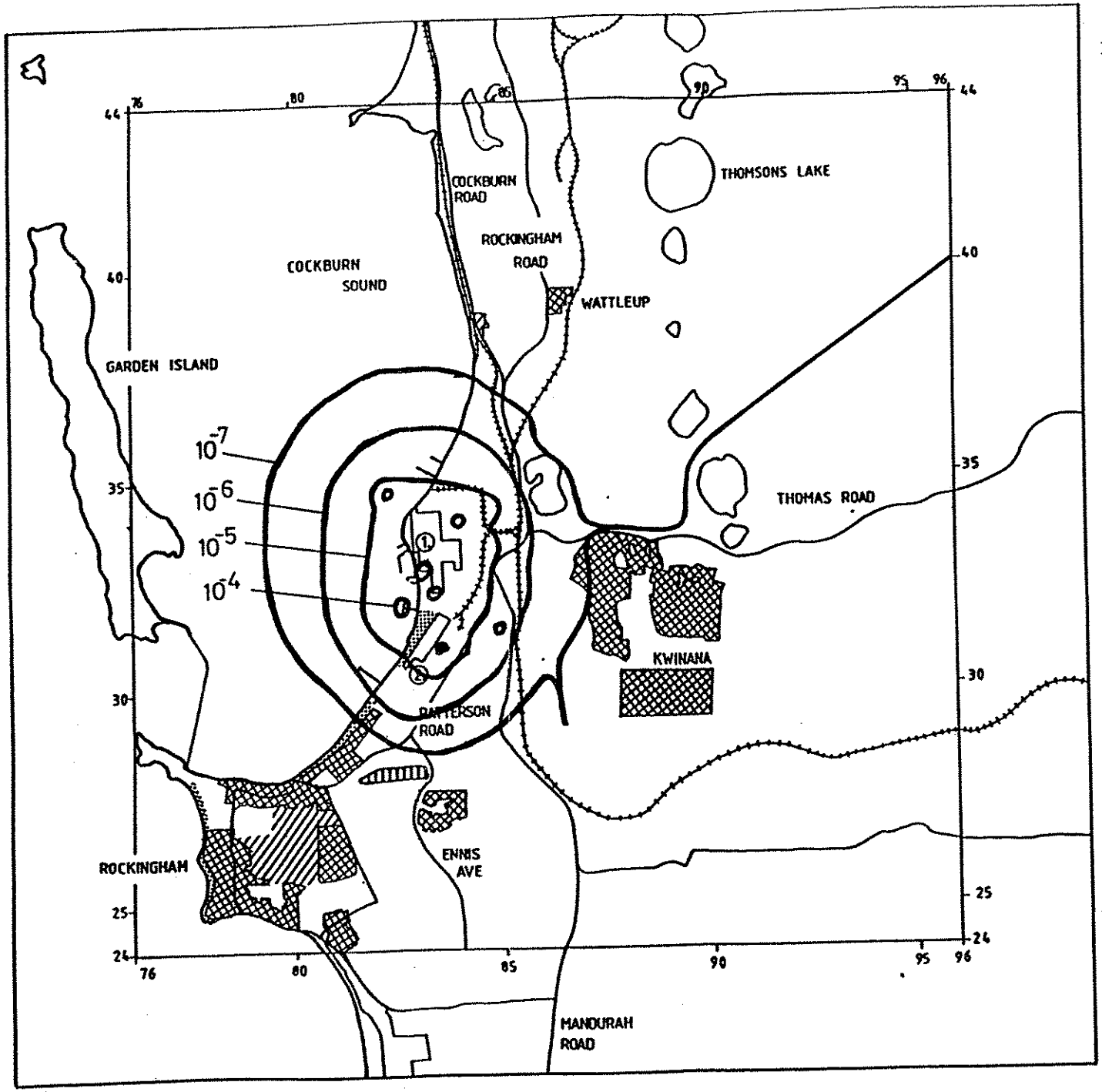

FIGURE 3.4: KWINANA CUMULATIVE RISK

BOTH PLANTS [illegible]NGED

RAILWAY

ROAD

UNDER 5 PEOPLE /HECTARE

5–10 PEOPLE/HECTARE

11–20 PEOPLE/HECTARE

21+ PEOPLE/HECTARE

① BP REFINERY

② KWINANA BEACH

SCALE 0 1 2 3 4 5 KM

Appendix 4 (Cont'd)

4. CONCLUSIONS

The revised estimates of individual risk for the ammonia/urea and sodium cyanide plants show that the changes proposed to these plants do not significantly increase the cumulative individual risk for Kwinana, both separately and in combination.

The cumulative risk for the area remains within the EPA individual risk guideline (EPA, 1987) that residential areas should not be exposed to a risk of fatality above 10 in a million (10^{-5}) per year. The risk to the nearest residential area is in fact below the one in a million (10^{-6}) per year level, which is considered by EPA to be negligible.

REFERENCES

1. Kwinana Cumulative Risk Analysis, Main Report, Technica April 1987.

2. Supplementary Report on the Proposed Ammonia Urea Plant, Technica November 1986.

3. Supplementary Report on the Proposed Sodium Cyanide Plant, Technica November 1986.

4. Facsimile messages from DRD to Technica, 4.10.88 and 5.10.88.

5. EPA Guidelines: Risks and Hazards of Industrial Developments on Residential Areas in Western Australia, EPA Bulletin 278, May 1987.