ANNUAL REPORT 1991-92

Department of Mines

Western Australia

DEPARTMENT OF MINES

Honourable Gordon Hill JP MLA
Minister for Mines
Parliament House
PERTH WA 6000

Dear Minister

In accordance with Section 62 of the Financial Administration and Audit Act 1985, I submit for your information and presentation to Parliament the Annual Report of the Department of Mines of the State of Western Australian for the year ending June, 1992.

The Annual Report has been prepared in accordance with the provisions of the Financial Administration and Audit Act 1985.

The Report uses the format established in previous years, with the Department's activities described under Corporate Programs. These are set against a background of the mining and petroleum industry in 1991-92.

Information of a more general nature about this Department and its activities will be published later in the year as an Annual Review.

I commend to you the loyal and responsible contribution of officers from all sections of the Department towards the implementation of Government policies.

Yours sincerely

D. R. Kelly

D R Kelly
DIRECTOR GENERAL
August 1992

Cover Photograph:
This award-winning photograph by Tony Baley of Experance captures the 'tailing of pipe' on the mobile offshore drilling unit, Maersk Valiant.

Message From The Minister

I have much pleasure in presenting to Parliament this 1992 Annual Report which provides a record of the activities and achievements of the Department of Mines during the 1991-92 financial year.

The Department plays an important role in facilitating and managing the mining and petroleum industries. In 1991-92 these industries provided 74% of the total exports from the State. They also provided the second most important source of State Government discretionary revenue for the year, with only payroll tax providing more.

In addition to its important role with respect to the mining and petroleum sectors, the Department also has a valuable role to play in the management of the State's ground-water resources, public safety in respect to explosives and dangerous goods, and the provision of chemical services through the Chemistry Centre.

I was pleased to be able to arrange special funding during the year of $1.5 million which was provided to the Department for special mineral and petroleum projects of assistance to industry. This grant recognised the fundamental importance of these sectors to the economy of the State.

The downturn in world commodity prices has placed considerable pressures on industry to improve its productivity and remain competitive in world markets. The Department of Mines has also had to adapt to these pressures and I am confident that it will continue to do so.

This report provides a good summary of the most important sector in our economy and I recommend it for your attention.

Gordon Hill, JP, MLA
MINISTER FOR MINES

Contents

Highlights for the Year

Program 1
Minerals and Petroleum Titles

- Petroleum title applications up by more than 50%.
- Mineral title applications up by 12.5%.
- Computerised system for monitoring rentals and expenditure conditions introduced at Kalgoorlie.
- Agreement reached with CALM on standard access conditions for reserve land.
- A computerised tenement graphics prototype demonstrated.

Program 2
Exploration and Development of Natural Resources

- Confirmation of a massive underground water resource in the South West of the State.
- Release of a wide range of new maps, including the first map that the Department has produced entirely by means of computer technology.
- Special Government grant used for the purchase of geophysical data for the Kurnalpi area, near Kalgoorlie.
- A geographical information system study was completed on the Pilbara iron ore province.
- A MERIWA-sponsored study into column flotation facilities was undertaken.

Program 3
Environmental Protection and Rehabilitation

- Launch of new environmental excellence awards for the mining and petroleum industries.
- A total of 213 notices of intent for mining were assessed by the Department for environmental compliance.
- Company environmental management programs were improved significantly.
- Co-operation with a Land Conservation District Committee saw the successful rehabilitation of an abandoned mine site.
- Groundwater pollution monitoring studies increased.
- A Working Party set up to prescribe routes for dangerous goods vehicles delivered its recommendations.

Program 4
Community Benefits

- Collection of royalties and rentals from mining and petroleum companies exceeded $400 million for the first time. This elevated the Department's contribution to the CRF to second position in the importance of all State revenue collections.
- Royalties were paid by more than 140 companies with 850 royalty returns received and checked.

Program 5
Worker and Public Safety

- Workers' compensation insurance premiums for mining companies continued to decline demonstrating an improved safety performance for the industry.
- Development of new safety measures for the transportation of dangerous goods, and the protection of the environment.
- Exposure of workers to crystalline silica and respirable dust continued to decline.
- New regulations covering safety in the metallurgical and coal sectors were prepared.

Program 6
Chemical Services

- Commencement of Stage One planning for a new Mineral Research Centre at Bentley.
- Approval of funding for a new co-operative research centre for hydrometallurgy.
- A new molybdenum diagnostic service launched for wheat research.
- Prosecution of an American fertiliser producer following the detection of high cadmium and lead levels.
- Completion of a survey of groundwater contamination under metropolitan tip sites.

Program 7
Corporate Services

- Announcement by the Premier that the Department of Mines would become part of a new Department of Minerals and Energy from 1 July 1992.

Director General's Report

The 1991-92 financial year was a challenging one for the Department. Community and industry demands and expectations for the delivery of services continued to increase while resources to supply these services have not kept pace.

While two financial years ago the Department employed an average 793 staff, in 1991-92 the number was 50 lower at 743. Thus, the Department has had to review its priorities, increase its productivity and improve its reporting systems.

In common with the clients we serve, improving our efficiency is being increasingly achieved by automation and computerisation. The trend is thus towards a more capital intensive method of work employing a smaller but more highly skilled and flexible workforce.

All six programs of the Department have been affected.

For the programs concerned primarily with the mining and petroleum industries, conditions in the industries had a significant impact upon our activities. The health of the industry is best demonstrated by the reduction that took place in the gross value of production.

For the first time in over 20 years the value of mineral and petroleum production declined. This was despite an increase in production for most commodities which was the logical reaction of producers attempting to maintain their cash flow in a climate of declining world prices.

Production rose in varying amounts across all sectors except heavy mineral sands and nickel where world supplies were considerably in excess of demand.

The depressed conditions have placed greater demands on Government agencies servicing the industry. To remain competitive, companies are seeking to minimise their costs in the exploration, extraction, and processing of the basic mineral commodities. This means that companies seek from Government ready access to land for exploration, improved information to assist in their search, faster processing times for all bureaucratic processes, direct financial support, regulatory reform to allow more flexible working hours and great co-operation in research and development.

While industry is adjusting to the recession, community expectations are also changing. The last few years have seen a strong trend towards improved environmental management and rehabilitation and an increased emphasis on occupational health and safety issues . Access to land for exploration has also become more difficult with more areas being set aside in conservation reserves with greater restrictions on potential users and increased difficulty in gaining access to Aboriginal reserves.

During the year, the number of mineral title applications increased by 12.5%, while there were over 50% more petroleum exploration titles granted. Despite the increase in mineral titles, over 60% were dealt with by the Department within five months of receipt.

Access to land for mineral and petroleum development was improved in a number of ways during the year. Agreement was reached with the Department of Conservation and Land Management over standard conditions under which exploration can be carried out on conservation estate land. Further improvements were made to computer systems to facilitate the process of issuing titles. Development of a prototype computerised graphic system supporting an electronic title system was undertaken using special funds allocated by the Government.

The Government also announced that legislation will be introduced to improve access to private land which represents 7% of the State. This will assist in mineral and petroleum exploration in the South West of the State where it has been difficult to reach agreement with the large groups of land owners necessary for any extensive exploration activities.

Despite the increase in mineral and petroleum title applications, the number of staff devoted to this program remained the same as in the previous year. Industry consultation, however, increased through four industry liaison committees already set up to cover the mining, petroleum and mapping sectors. These groups provide a valuable forum for discussion on ways the Department can improve its service to industry and carry out its activities most efficiently. A user-pay system for the survey of mineral titles was introduced on 1 July 1991 as a means of reducing the backlog and providing a more efficient survey system.

With the aid of a direct Government grant, airborne geophysical data were acquired for the Kurnalpi area in the Kalgoorlie region. The combination of the geophysical data acquisition and a strong mapping program meant that 46 maps were completed and published during the year. Computer–aided map publishing was used to produce the Cheritons Find map. This was a first in Australia and the same techniques are now being used in further map production.

Also during the year, the Department continued to develop its expertise in Geographical Information Systems. This was applied to aspects of land ownership in the Pilbara region. Natural and cultural features were entered into databases designed to assist land–use planning and reduce land-access conflicts.

There was a substantial increase in geological data released to industry to assist in petroleum and mineral activities. A revised policy covering the release of interpretative petroleum exploration reports will make this information available to industry at an earlier stage. The backlog of mineral reports to be entered into the WAMEX database was eliminated. This was a noticable achievement while work continued on the development of another database covering all mines and mineral deposits in WA.

As a part of our groundwater evaluation role, the Scott Coastal Plain groundwater drilling program was completed. This assisted in the definition of an extremely large groundwater resource located in the southern Perth basin. This resource contains an estimated 300 000 million cubic metres of potable groundwater with an estimated annual renewable resource of some 200 million cubic metres which is equivalent to the current amount of water supplied to Perth via the scheme water supply.

To assist the mining sector improve productivity, the Chemistry Centre continued to provide consulting services and test work facilities. Rotary kiln runs were conducted for various clients with ilmenite upgrading being the major area of interest. Gold industry services were active with a demand for research and development to improve gold extraction.

To ensure that proper attention is given to the protection and rehabilitation of the natural environment, one of the Department's programs concentrates on those activities of the mineral and petroleum sector which impact upon the environment. There has been a substantial improvement in the rehabilitation performance through improved environmental management at minesites. This has been obtained through attitudinal change and a higher commitment to the environment by industry management.

Progressive rehabilitation at minesites has now become the norm, and, to highlight this improvement, the Department's Environmental Excellence Awards for industry were inaugurated. These annual awards will give recognition to those operators who have conducted their activities in an environmentally-sensitive manner. Two important liaison committees were also established. They involve mining and petroleum representatives as well as conservation groups, trade unions, industry and relevant Government agencies. These committees have met on a regular basis to review the Department's policies and activities related to environmental management.

The Transport and Storage of Dangerous Goods Working Party set up by the Department in 1989 to examine the feasibility of prescribing routes for dangerous goods delivered its report. The recommendations made by the Working Party are aimed at protecting important water assets in the South West of the State.

In ensuring that the community receives a fair return from the extraction of the State's mineral and petroleum resources, the Department continued to develop and implement appropriate mineral and petroleum royalty systems. Total payments to Government by producers increased from $358 million to $375 million during 1991-92. Total collections were about 5% higher than in the previous year, with the State's share of collection being $320 million and the Commonwealth share $55 million. Extensive audits were conducted during the year and four petroleum royalty agreements were finalised with producers.

In 1991-92 total payments by the mining and petroleum industries to the State Government exceeded the total stamp duties for the first time. This made the

industries' contribution the second most important source of State Government discretionary revenue for the year with only payroll tax providing more.

A major emphasis of the Department's activities continues to be to ensure that all operations in the mining and petroleum industries and activities involving explosives and dangerous goods, are conducted in a manner that is safe for workers and the public. There was a continued improvement in the general trend in lost-time injuries and the industry continues to demonstrate sound occupational health and safety practices. However, the number of fatalities is still a concern and the Department is actively working to improve occupational health and safety by changes to legislation, inspection arrangements and education activities.

Mining inspectorate activities during the year emphasised induction training for all employees. Mining engineering inspectors also audited all underground mines for emergency preparedness with respect to fires and evacuation procedures. Underground diesel equipment was also modified with fixed-fire suppression equipment. As the most effective means of preventing injury or harm to health, some sections of mines were closed by the inspectorate and items of defective equipment taken out of service. Several prosecutions were successfully conducted for breaches of the Mines Regulation Act. Safety education was further boosted by the Department with regular publication of newsletter and safety pamphlets and assistance with a number of industry education initiatives.

Departmental staff gave increased emphasis to the geotechnical and rock mechanical aspects of open pit and underground mines with over 70 individual assessments or reviews being completed. A large proportion of these included field inspections and, in many cases, the advice led to modification of mine design or operating procedures.

Substantial progress is being made in the industry towards reducing the exposure of mine workers to crystalline silica and respirable dust. Progressive reduction of these contaminants is being maintained and compliance is high with about 95% of samples tested below the exposure standard.

To improve the effectiveness of its services, the Chemistry Centre has progressively embarked upon the installation of more sophisticated and more highly-automated equipment. For example, in the forensic science laboratory, gunshot residue particle detection is the most recent example of automation of an otherwise highly labour-intensive operation. A further example has been in the examination of fire debris for flammable accelerants in which ten items can now be analysed on each overnight run. A wide range of chemical services is provided through agricultural,forensic, environmental, health, materials science and racing chemical laboratories.

Initial funding was provided by the Government during the year for the preparation of detailed plans and tender documents for Stage 1 of the Chemistry Centre proposed for a site at Bentley. The Stage 1 Mineral Research Centre will see the housing of the West Australian component of the CSIRO Division of Mineral Products and Curtin University of Technology School of Chemical Engineering adjacent to the Mineral Processing Laboratory of the Chemistry Centre. Stage 2 will see the transfer of the remaining Chemistry Centre laboratory to the Bentley site. The existing Chemistry Centre facilities are very out-dated and new laboratories are a high priority.

With a reduction in Government funding and staffing levels, increasing demands from our clients and the need for further effort in our safety and environmental programs, the Department continues to face a challenging future. It will not do so as a Department of Mines, because after 98 years, it will change its name to the Department of Minerrals and Energy on 1 July 1992.

I am confident that the dedication, professionalism and initiative of our staff will be maintained and that the new Department will combine to serve the State of Western Australia as the old one has for so many years.

D R Kelly
DIRECTOR GENERAL OF MINES

The Mining and Petroleum Industry in 1991-92

Introduction

Depressed economic conditions in the major industrialised countries adversely affected world markets with poor prices being recorded for virtually all commodities. The Australian economy remained depressed with a low growth rate and high unemployment. Falling domestic interest rates and escalating foreign debt levels combined to reduce Australia's exchange rate with its major trading partners. The reliance of Australia's minerals and petroleum industry on overseas markets was again demonstrated as depressed prices continued to force adjustments across most sectors. Producers have reacted in a variety of ways, and although the general trend has been towards improved productivity and restructuring, there has been some mine closures.

Western Australia

Despite increases in the production levels of many commodities, the total value of production declined for the first time in 20 years.

Fortunately for the State economy, the decrease was not as large as forecast, with a fall of 2% on the previous year (Figure 1). The contribution of commodities to the total value of production is shown in Figure 2.

Producers generally responded to falling prices by expanding production and thereby increasing overall sales revenue. Production levels rose for iron ore, petroleum, alumina, diamonds, and base metals while the only significant sectors which did not see increased production were heavy mineral sands and nickel.

An industry wide recovery is likely in the medium term because of the range of mineral and energy products and the nature of the markets served. While there will be some variation between sectors, the overall volume of mine production should be steady during 1992-93. Modest real price rises for both mineral and energy products should begin to emerge during the current trading period and strengthen during 1993.

Gold

Gold production increased marginally (2%) to approximately 185 tonnes. The slight rise in tonnage produced did not offset the lower average price which prevailed during the year (Figure 3). The calculated value of production was $2.7 billion although, given the widespread use of forward sales contracts, the actual sales value of all gold produced was probably nearer $3.0 billion.

The prevailing low price on world markets of around US$350/oz continues to be the main concern of Western Australian miners. Other factors affecting the industry include reduced exploration expenditure and rising input costs, the latter mainly as a result of the depletion of easily won ores. The lower exploration expenditure and the concentration of spending on project extensions are a matter of concern for the industry's longer term viability.

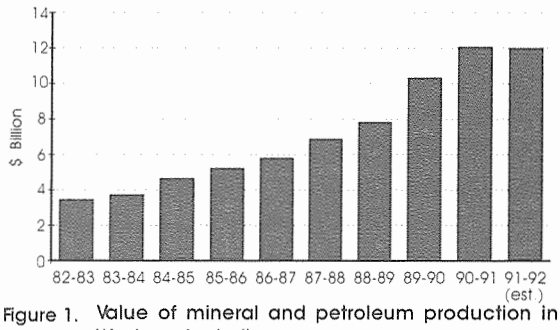


Figure 1. Value of mineral and petroleum production in Western Australia

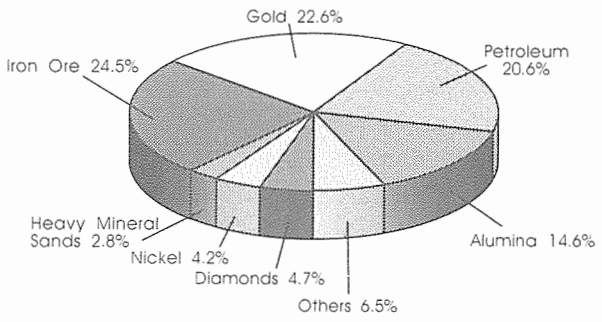


Figure 2. 1991-92 Value of mineral & petroleum production
Total: $12 005 MILLION (est)

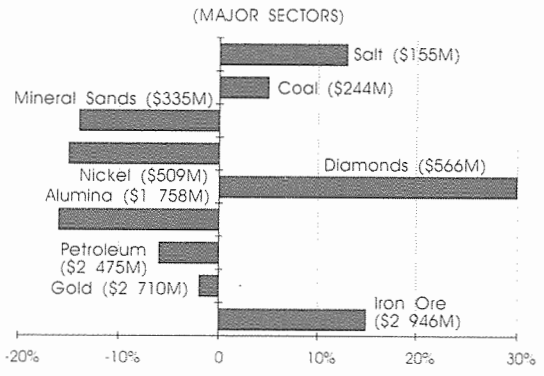


Figure 3. Change in value of production 1991-92 (est.) (major sectors)

The industry shakeout which ensued during the year would have been more severe had it not been for the sound structure of the State's main companies, the collective ability of developers to restrain cost increases, and the use of a range of financing mechanisms. While some mine closures occurred they were generally a result of rationalisation and concentration.

Despite the tight market conditions there were some significant new investments announced. The Telfer project is undergoing a large expansion of capacity, primarily through heap leaching, while the Yilgarn Star, Marymia, Mount McClure, Mount Monger and Bannockburn projects all commenced production. Kanowna Belle, the largest discovery for many years, continued to increase its resource base and is at an advanced feasibility stage. Open cut operations should commence by early 1993.

Petroleum

Western Australia's petroleum industry recorded another year of strong activity. LNG production rose by 19% while condensate and crude oil increased by 7% and 6% respectively.

The total value of output was approximately $2.5 billion which was 6% lower than the value of 1990-91 sales. The reduction was a direct result of falls in world market prices. Crude oil and condensate receipts contracted marginally to just under $1.3 billion, while natural gas sales similarly fell to about $350 million. Sales of LNG continued to grow, albeit marginally, to approximately $840 million for the trading period.

At approximately A$24 per barrel the average world trade weighted price of crude oil rose by a nominal 10% during the year. The relatively subdued nature of price movements can be principally ascribed to the effects of the recession on the industrialised nations being partly offset by strengthening demand in developing countries and OPEC's restraint on output. In the absence of any demand shock, the average price of crude oil is forecast to continue to gradually strengthen during 1992-93. The medium to longer term outlook is for OPEC's market power to become steadily enhanced with falling Commonwealth of Independent States' sourced output being replaced by Kuwaiti, and eventually Iraqi, production.

North West Shelf investment continued at very high levels. Towards the end of the financial year, however, there were signs that exploration expenditure was contracting due mainly to the relatively low wildcat discovery rate over the past 18 months. After successive size downgradings, which have significantly altered the economic viability of the project, the Cossack field is finally set to be developed in conjunction with the larger Wanaea discovery. The combined project is likely to involve a floating production ship with gas pipeline linkage to the North Rankin/Goodwyn A line. Phase 3 of the North West Shelf project, which involves $1.7 billion of new investment in a production platform and associated infrastructure centred on Goodwyn, is progressing on schedule. The third LNG train should be operational by the end of 1992.

Hadson Energy's gas gathering project was completed during the year and in a move which bodes well for the State's natural gas industry, BHP Petroleum announced a development plan for the Griffin oil field which included future provision for gas gathering on the immediate and surrounding fields. This two stage project is scheduled to be commissioned in March 1994 and has an estimated field life of 13 years. The Roller field, close to Onslow, was committed to development early in 1992 with production planned to commence within 2 years.

The overall outlook for the petroleum industry in Western Australia is very promising. Medium term developments in international markets should provide demand and price growth, while planned investment, will allow capacity expansions through the 1990s.

Iron Ore

In a year when global steel production contracted, the Western Australian iron ore industry continued to record strong results. Aggregate domestic sales and export tonnages increased by 5% to a new record of 113 million tonnes. A small exchange rate variation offset the slight price decrease negotiated for the trading period, resulting in a modest overall increase in value of production. At approximately $3.0 billion, industry receipts were up by 15% on the 1990-91 result.

Both supply and demand factors significantly affected the international steel market during the trading period.

Production fell in the former Eastern Bloc countries and Commonwealth of Independent States' because of falling consumption and the gradual closure of inefficient plant. Among the industrialised nations of Western Europe and North America, sluggish demand from steel users and rising inventories resulted in a contraction of iron ore sales. The effect on Japanese steel production was delayed, but for the first time in six years, output could drop below 100 million tonnes in 1992. The emerging nations of South East Asia have been exceptions to this trend. A mild though steady recovery is expected to emerge in all these markets during 1992-93.

Forecast regional growth in steel demand for heavy construction and continued demand from China, Korea and Taiwan, should substantially offset any continuing weakness in the other main markets for Western Australian iron ore. Overall, demand for the State's iron ore should stabilise at present levels, or only be partially reduced, during 1992-93.

In December 1991, Western Australia's iron ore companies were forced to accept an average 5% price cut for all sales completed during the 1992-93 Japanese fiscal year. Given current market conditions, and evidence that steel mills over–bought in 1991, it is unlikely that any real price increases will be considered in the year–end negotiations. Consequently, there will be pressure for further price reductions.

In commissioning new mines and advancing feasibility studies for future projects, the State's iron ore producers have continued to take a long term view in their investment and production strategies. Current investment of about $750 million is designed to sustain expected production by the three major operators for the next 20 years. The Marillana Creek (Yandi) mine was commissioned early in 1992 and the Brockman No. 2 detritals project came on stream mid–year. The Marandoo development, which is being geared to gradually replace Tom Price from the mid 1990s, is steadily progressing through the approvals process, whilst Mesa J is being progressed to development at Deepdale. Hamersley Iron is also predicting higher production levels during the current year as a result of a steady increase in the capacity of the Channar mine.

Major expansions of port handling facilities are being undertaken by BHP and the Robe River Joint Venturers.

The local industry is also being boosted by the construction of a direct smelting plant at Kwinana. There has also been a revival of interest in the feasibility of developing relatively small steel mills which could exploit the benefits available in different parts of the State.

The short–term outlook for the massive iron ore industry is tied to developments in the world economy generally, and to Japan in particular. In the medium to longer term, market fundamentals, such as the predicted swing in the trade cycle and a steady increase in demand from North and East Asia, will benefit the State's industry. Capacity expansions, in place, and under development and an ongoing program of work-place reform, will allow a steady supply increase and some important market flexibility.

Alumina

While marketed output from Western Australia's producers rose marginally during the year to over seven million tonnes, the total value of production fell by 14% to approximately $1.8 billion.

Aluminium prices strengthened in the first quarter of 1992 after a prolonged downturn. The improvement was a result of falling producer stocks, consumer doubts over certainty of supply from the Commonwealth of Independent States' (CIS) and some speculative purchasing. The London Metals Exchange stock levels have stabilised as a result of demand steadily rising over current production. Any sustained price rise for aluminium is, however, contingent on the CIS continuing to reduce supply. Western Australia's producers remain cautiously optimistic that contract prices will gradually strengthen and spot prices will improve by approximately 10% during the current trading period.

Being among the world's most cost efficient producers, ALCOA and Worsley have continued to improve capacity and efficiency during the market downturn. Aggregate production should increase even further during 1992-93 as a result of the commissioning of the Worsley de-bottlenecking and start up of the Wagerup expansion now scheduled for early 1993. Worsley is also taking a longer term view in its feasibility

study into a 50% capacity expansion which will necessitate the investment of nearly $500 million. ALCOA is closely considering a threefold expansion of its current output of hydrated alumina to 800 000 tonnes per annum.

Western Australia's large, low cost producers are well positioned to supply a significant proportion of the forecast 3% national increase in exports during 1992-93.

Nickel

The estimated value of nickel sold from Western Australian mines as refined metal and matte fell in 1991-92, as did the total tonnage of contained metal produced. Compared with the previous year's sales of nickel metal, sales contracted by approximately 4% to 52 000 tonnes, while the value of production slid by 15% to $509 million. This outcome was primarily attributable to the gradual weakening of market prices over the trading period.

Almost all production was sourced from the predominantly underground operations at Kambalda and Leinster. Proposed expansions of smelting and refining capacity at these projects will significantly increase the production of nickel to 65 000 tonnes over the next few years. This plan includes expansions to smelting and refining capacity. The small Pilbara mine and plant at Radio Hill was placed on care and maintenance during the year as a result of financial and technical problems. Production from the Windarra mines ceased in late 1991.

The development of the Mount Keith and Yakabindie deposits in the North Eastern Goldfields is seen as crucial for the long term future of the Western Australian industry. Detailed evaluation and feasibility studies are progressing for the projects, although final commitment will be contingent on indications of firm nickel prices and the ability to secure long term contracts.

The development of the relatively high grade Forrestania deposits are on schedule for commissioning late in 1992. At full production the project will export up to 7 500 tonnes per annum of nickel in concentrate form through Esperance.

Analysts have predicted consumption growth of a fairly strong 2% for nickel ore during the rest of 1992, and a more robust 3.5% for 1993.

Diamonds

The two producers reported a 50% increase in total carats sold during the year but price falls resulted in this rise not being fully reflected in the value of sales which increased by 22% to $532 million.

The recession in the main industrialised countries has decreased demand for diamonds. It is estimated that worldwide sales by the Central Selling Organisation (CSO) contracted by around 10% over the year. This included a 14% fall in the first six months of 1992. The sales outlook remains bleak with the CSO considering the imposition of quotas on production to underpin current price levels.

Diamond exploration within the State remains relatively strong with annual expenditure of around $23 million.

Heavy Mineral Sands

The heavy mineral sands industry was again tested in a very difficult trading environment. Plagued by weak demand and a significant supply overhang, titanium dioxide pigment prices continued to decline as did the quoted price of zircon. Demand and sales of synthetic rutile, which showed some strength during the year, was the one bright spot in an overall soft market.

The total value of production was down on the previous year by about 14% at approximately $335 million. Producers generally attempted to reduce tonnages in response to contracting demand. The volume of zircon sales did rise, however, even while prices continued to decline sharply. Healthy demand for synthetic rutile on world markets was not reflected in the price, which was fairly stable over the trading period. Synthetic rutile sales rose by 14% to $150 million while production increased by 12% to just under 300 000 tonnes.

In the longer term it is not a lack of demand growth which is causing industry concern, but the amount of production planned in other countries. Greenfields projects, and expansions in the pipeline as a result of the booming markets of the past five years, could see ilmenite and rutile production rise by 45% during the next five years.

Despite these future market prospects, and the industry's sensitivity to changes in economic activity, Western Australian producers have over $350 million of new investment either at advanced feasibility stage or under consideration. Significant developments are planned for Jangardup and Dardanup. Although full scale mining of the Beenup deposit has again been delayed, the project management has announced a major program of bulk sampling to be undertaken later this year. Westralian Sands' planned $100 million expansion at Capel has moved a step closer with the company expected to make a decision on funding in the new year in order to have the extra capacity on stream by 1995.

Other Minerals

Coal output and the value of production only increased marginally following several years of strong growth. This was due to a reduction in tonnages and prices negotiated by SECWA in conjunction with the State Government's decision to opt for another base load coal fired power station.

The proposed Windimurra vanadium and the Mount Weld rare earths projects will increase the diversity of minerals produced in the State. Both developments are at the stage of final feasibility study prior to development decisions which are expected before the end of 1992.

The $50 million Windimurra project will produce vanadium pentoxide for export into a market which has in the past been very volatile. The Mount Weld developers are evaluating an open pit and beneficiation plant at a site near Laverton with rare earth concentrates being trucked to Meenar near Northam for further separation. Stage 1 of the project is scheduled for completion in 1994 at a total cost of approximately $70 million.

The salt industry saw several large capacity expansions during the year with overall investment of approximately $50 million. Producers will face fairly strong price competition over the next few years as the market moves into a period of oversupply.

Zinc production and exports increased significantly, and there were solid performances from the State's copper, lead, tantalite spodumene and talc operations. The production tonnages of industrial minerals, which are mined to essentially serve the local market, were consistent with those recorded in recent years.

Minerals And Petroleum Exploration

Western Australia continues to attract around 55% of national exploration expenditure on minerals. Actual spending levels have remained reasonably steady at approximately $320 million per annum for the past three years.

Although the dominance of gold exploration in total expenditure has abated slightly from the late 1980s it still accounts for around 64% of expenditure (Figure 4). Industry analysts contend that current levels of exploration expenditure, while moderately reduced, are being applied more effectively with much of it being geared to maintaining output levels.

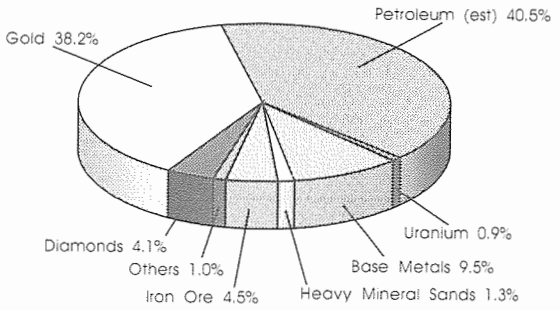


Figure 4. W.A. mineral and petroleum exploration expenditure
Total $559.6 million

The resurgence of nickel in 1988-90 boosted interest in base metals exploration although the activity was largely that of revisiting discoveries made during the boom of the late 1960s. The amount of funds flowing into nickel exploration is currently around $40 million per year, or 12-13% of total mineral exploration funds. This effort is widely spread across the different styles of mineralisation in the Kimberley, Yilgarn and Central and East Pilbara regions.

The increase in iron ore exploration activity in the early part of the year is a reflection of the resurgence of development plans which have been semi-dormant since the early to mid 1970s. Considerable effort is also being focussed on the evaluation of detrital iron ores in order to sustain the proportions of premium quality lump ore in the overall production blend. Total sector expenditures reached the unprecedented levels of over $30 million in 1991-92.

Petroleum exploration was again strong as the industry continued to focus attention on the offshore Carnarvon Basin.

Thirty eight exploration wells (27 offshore &11 onshore) and five development wells were commenced during the period. This compares favourably with annual drilling figures recorded over the past decade.

In excess of 225 000 line kilometres of seismic survey commenced during the year, this new record being more than five times that undertaken in 1990-91. Most of this total was contained in three dimensional surveys. Woodside's East Dampier survey , the largest seismic work ever commenced in Australia, began in March 1992 and is progressing. The Woodside study has been planned to cover 2 720 square kilometres at an estimated cost of $28 million.

Current exploration permits total 114 with 25 new permits, again mainly in the Carnarvon Basin, having been issued during 1991-92.

The Department of Mines

Enabling Legislation

The Department is established by the Governor pursuant to Section 21 of the Public Service Act 1978 and, in so doing, satisfies Section 11 of the Mining Act 1978.

Background

The Department was established on January 1, 1894 as the regulatory body to ensure the safe and orderly development of mineral resources in this State, and to allow the Government and the community to benefit from these activities. This is still the major role of the Department.

The Geological Survey, which had been founded six years earlier, was incorporated with the Department of Mines. This was closely followed by the establishment of a system of State gold batteries. In 1902 the Government Analyst's Laboratory was transferred to the Department and signified the start of another role — the provision of services to the mining industry.

These services have evolved with the technological growth of modern mining. As the industry became prominent and complex, regulatory functions demanded a wide range and depth of internal services and expertise. Consequently, many of the sections of the Department traditionally involved in regulation were able to provide further services in the form of technical advice, tenement maps, and safety recommendations. Progressively, this role has been extended and now the Department is called upon to provide services to the community beyond those exclusively related to the mining and petroleum industries, particularly in relation to chemistry and public safety.

Government policy aims to encourage responsible investment in exploration, extraction and utilisation of the State's mineral and petroleum resources. Because of their major contribution to the economy for almost 100 years, mining activities have ramifications that reach directly or indirectly into the whole economic and social fabric of Western Australia. This is reflected in the wide range of activities currently administered by the Department of Mines.

Vision

The Department of Mines will be recognised for its commitment to excellence and quality in meeting the needs of the community, industry and Government in the areas of minerals and science.

Corporate Philosophy

Western Australia is fortunate in being endowed with abundant mineral and petroleum resources, held in trust by the Government on behalf of the community.

Recognising that the community requires mineral and petroleum products to sustain its standard of living, the Department of Mines has been given the responsibility to ensure that the exploration for and development of these resources is carried out equitably, with due care for the environment and worker safety, in the best interests of the community, and in accordance with the principles of integrated catchment management.

The general principles and philosophies fundamental to the Department's role, programs, structure, functions and strategy are summarised hereafter.

The mineral and petroleum resources of the State are owned by the Crown, but are almost entirely explored for, and developed by, private enterprise.

Exploration and development are undertaken in an organisational framework controlled and directed by Government with appropiate recompense (benefit) to the wider community.

The mineral and petroleum industries play a major role in the economy of the State and a high level of exploration is essential to identify the mineral, petroleum and groundwater resources which will be required to sustain our economy and maintain our living standards.

Mineral and petroleum deposits are almost always difficult and expensive to find, small in size relative to the total land mass, finite, and non-renewable.

Mineral and petroleum deposits are assets only after they have been discovered and delineated, and the potential for an appropiate financial return provides the incentive to engage in high–risk exploration necessary to find them.

Mineral and petroleum developments are a temporary land-use and should be integral to the principle of multiple land-use.

Changes in the economy, technology, and geological understanding will lead to the re–appraisal of previously tested ground; thus the potential of any area can never be totally written off and there is a need to ensure that information is not lost and as much land as possible is made available for exploration.

Geoscientific data available from studying the geological record are essential for general land–use planning (for planning and designing urban areas, dams, roads, ports and harbours); such information can also assist in understanding and predicting events associated with the Greenhouse Effect.

Chemical research and services at a high level of confidence and integrity are needed to ensure that independent and standardised information is provided to the community.

Management and the workforce must work together to create a safe working environment.

Public safety is of major concern in relation to the transportation, storage and use of explosives and dangerous goods.

Resources allocated to the Department are to be administered efficiently according to the prevailing principles and standards expected of the Public Service.

The Department must respond quickly and effectively to changes required by the community through Government.

It is against this background and in this environment that the Department must operate.

Role

The role of the Department is to ensure that the community of Western Australia:

- receives maximum benefit from the responsible exploration and development of minerals and petroleum with proper regard to the protection of the environment;
- is protected from hazards associated with mineral and petroleum activities, explosives and dangerous goods;
- has access to independent geotechnical, chemical and engineering advice relevant to land-use planning, and the mineral and petroleum industries;
- is provided with information about the geoscientific environment including the distribution of mineral, petroleum and groundwater resources; and
- is provided with independent chemical research, consultancy and analytical services.

PROGRAMS:

In its defined role the Department of Mines carries out certain programs, as follow:

1 Minerals and Petroleum Titles Program

The objective of this program is to ensure that exploration and development titles for minerals and petroleum are issued fairly and without delay.

1.1 Titles System Sub–Program

Provides an equitable system for granting secure exploration and development titles as a basis for petroleum and mineral assessment and production.

1.2 Dispute Management Sub–Program

Minimises potential for disputes over exploration and development titles and facilitates the prompt settlement of disputes when they do arise.

2 Exploration and Development of Natural Resources Program

The objective of this program is to foster and assist responsible mineral and petroleum exploration and development, groundwater assessment, and land-use planning by providing high-quality scientific and technical services and advice to industry, Government and the public.

2.1 Geological Data Collection Sub-Program

Meets the need for geoscientific mapping, research, and resources assessment required to produce up-to-date maps, reports, and advice on the geology of the State and its mineral, petroleum and groundwater resources.

2.2 Metallurgical and Analytical Services Sub-Program

Provide mineral and metallurgical analytical and research services.

2.3 Geoscientific Data Dissemination Sub–Program

Provides timely dissemination of scientific and technical data from company exploration activities and Departmental studies.

2.4 Geotechnical and Mining Engineering Advice Sub-Program

Meets the need for geotechnical, geoenvironmental, hydrogeological, and mining engineering advice and services.

2.5 Community Relations Sub–Program

Fosters a favourable climate in the community for mineral and petroleum exploration and development.

3 Environmental Protection and Rehabilitation Program

The objective of this program is to ensure that proper attention is given to the protection and rehabilitation of the natural environment as it may be affected by mineral and petroleum exploration and development, and to facilitate the protection of groundwater resources.

The program also provides chemical services for environmental management plus geological and mineral resource information and advice for planning and management of National Parks and Conservation Reserves.

4 Community Benefits Program

The objective of this program is to ensure that the community receives a fair return from the extraction of the State's mineral and petroleum resources.

It ensures that royalty collection is carried out in an economically and administratively efficient manner.

5 Worker and Public Safety Program

The objective of this program is to ensure that all operations in the mining and petroleum industry, and activities involving explosives and dangerous goods, are conducted in a manner that is safe for workers and the public.

5.1 Worker Safety and Health Sub–Program

Maximises the safety and health of workers in the mining and petroleum industry.

5.2 Management of Dangerous Goods Sub–Program

Minimises hazards to the public from activities involving explosives and dangerous goods.

6 Chemical Services Program

The objective of this program is to enhance agricultural and industrial development, and the protection of community, consumer, environment and health standards by providing high-quality independent chemical services to Government, industry and the public.

7 Corporate Services Program

The objective of this program is to ensure that the human, financial and other resources of the Department are used efficiently and effectively to provide a service responsive to the needs of the community, industry and Government.

The Organisation

Minister

The Minister for Mines, the Honourable Gordon Hill, J.P., M.L.A.

Principal Officers

Dr D.R. Kelly, AM, BE(Hons), PhD, FTS, FIE Aust.
DIRECTOR GENERAL OF MINES AND ACCOUNTABLE OFFICER
(Appointed by the Governor pursuant to Section 29 of the Public Service Act)

Dr C.D. Branch, BSc(Hons), PhD, FAusIMM.
ASSISTANT DIRECTOR GENERAL OF MINES

Mr L.C. Ranford, BSc(Hons), F Aus IMM
ASSISTANT DIRECTOR GENERAL OF MINES

Dr P.E. Playford, BSc(Hons), PhD, MAusIMM.
DIRECTOR,
GEOLOGICAL SURVEY DIVISION

Mr I.Fraser, BSc(Hons).
DIRECTOR,
PETROLEUM DIVISION

Dr J.W. Hosking, MSc, PhD, FAusIMM, FRACI.
DIRECTOR,
CHEMISTRY CENTRE (WA)

Mr M.L. Meaton, BSc(Agric)(Hons), BEc.
DIRECTOR,
ROYALTIES AND POLICY DEVELOPMENT DIVISION

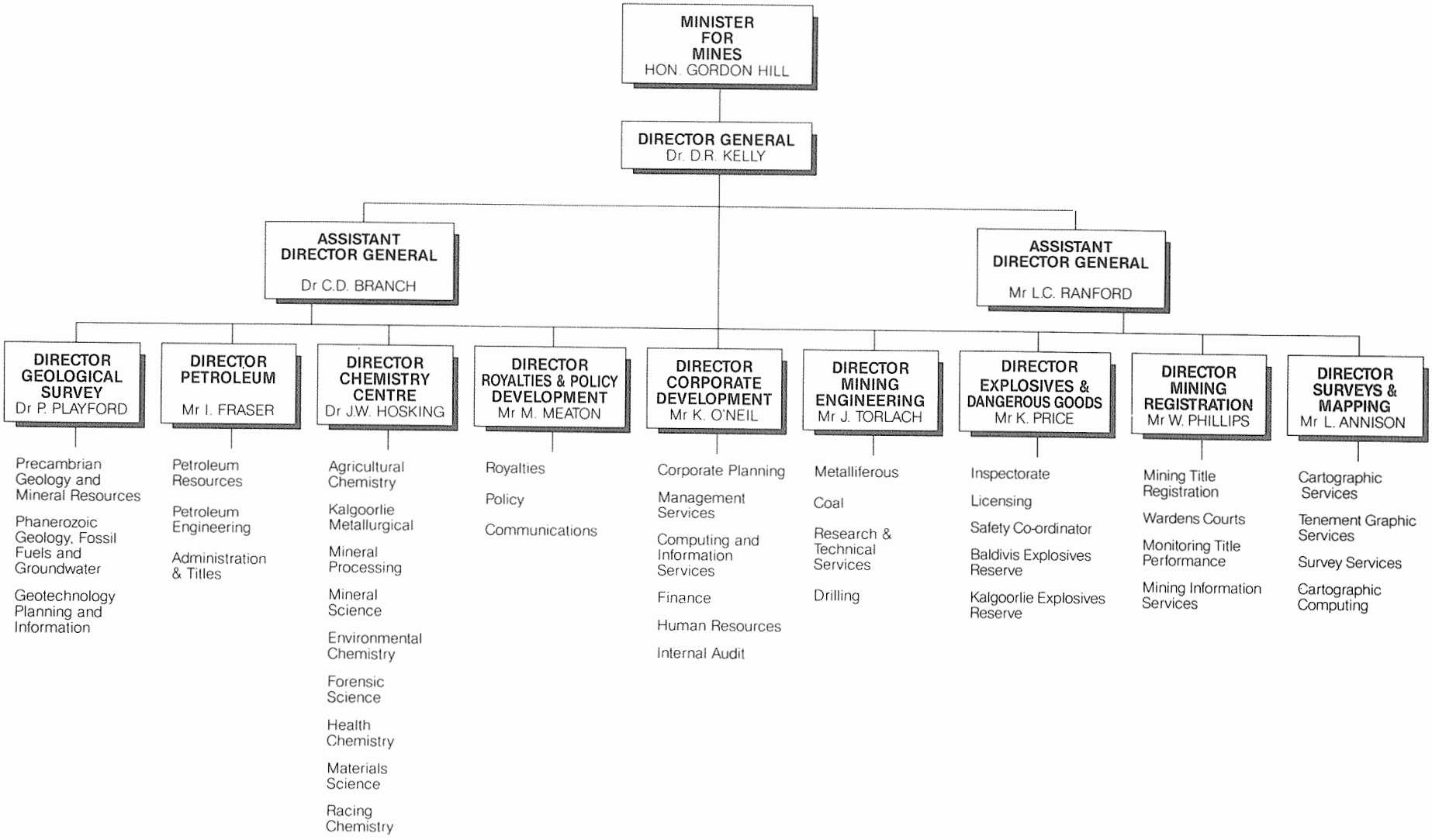
Mr K.O. O'Neil,MBA,CPA, Dip Pub Admin.
DIRECTOR,
CORPORATE DEVELOPMENT DIVISION

Mr J.M. Torlach, BE(Min), MAusIMM.
DIRECTOR,
MINING ENGINEERING DIVISION

Mr K.R. Price, BSc(Hons), ARACI, Grad Dip Admin.
DIRECTOR,
EXPLOSIVES AND DANGEROUS GOODS DIVISION

Mr W. Phillips, Dip Pub Admin.
DIRECTOR,
MINING REGISTRATION DIVISION

Mr L. Annison, L.S.
DIRECTOR,
SURVEYS AND MAPPING DIVISION


MINISTER FOR MINES
HON. GORDON HILL
DIRECTOR GENERAL
Dr. D.R. KELLY
ASSISTANT DIRECTOR GENERAL
Dr C.D. BRANCH
ASSISTANT DIRECTOR GENERAL
Mr L.C. RANFORD
DIRECTOR GEOLOGICAL SURVEY
Dr P. PLAYFORD
Precambrian Geology and Mineral Resources
Phanerozoic Geology, Fossil Fuels and Groundwater
Geotechnology Planning and Information
DIRECTOR PETROLEUM
Mr I. FRASER
Petroleum Resources
Petroleum Engineering
Administration & Titles
DIRECTOR CHEMISTRY CENTRE
Dr J.W. HOSKING
Agricultural Chemistry
Kalgoorlie Metallurgical
Mineral Processing
Mineral Science
Environmental Chemistry
Forensic Science
Health Chemistry
Materials Science
Racing Chemistry
DIRECTOR ROYALTIES & POLICY DEVELOPMENT
Mr M. MEATON
Royalties
Policy
Communications
DIRECTOR CORPORATE DEVELOPMENT
Mr K. O'NEIL
Corporate Planning
Management Services
Computing and Information Services
Finance
Human Resources
Internal Audit
DIRECTOR MINING ENGINEERING
Mr J. TORLACH
Metalliferous
Coal
Research & Technical Services
Drilling
DIRECTOR EXPLOSIVES & DANGEROUS GOODS
Mr K. PRICE
Inspectorate
Licensing
Safety Co-ordinator
Baldivis Explosives Reserve
Kalgoorlie Explosives Reserve
DIRECTOR MINING REGISTRATION
Mr W. PHILLIPS
Mining Title Registration
Wardens Courts
Monitoring Title Performance
Mining Information Services
DIRECTOR SURVEYS & MAPPING
Mr L. ANNISON
Cartographic Services
Tenement Graphic Services
Survey Services
Cartographic Computing

Divisions of the Department

The Department of Mines is structured into nine divisions which represent homogeneous centres of professional excellence in a diverse organisation.

Activities of the divisions are targetted at achieving the objectives of seven corporate programs. The matrix at pages 20, 21 shows the divisions and the programs into which they have input.

The Geological Survey Division systematically records and interprets the geology of the State and provides this information to Government, industry and the general public in order to assist the exploration, development and conservation of the State's mineral, petroleum and groundwater resources.

It evaluates mineral and petroleum resources as a basis for decision-making by Government and assists and advises on a variety of community needs, including urban planning, land-use matters and engineering developments.

The Petroleum Division facilitates the undertaking by industry of geophysical and drilling programs for the identification and exploitation of oil and gas accumulations. It ensures that sound engineering principles and standards are applied to the design and construction of exploration and production facilities and that safety management systems are in place to secure the occupational health, safety and welfare of the workforce. It also maintains an effective title allocation and registration system, and monitors, advises and interprets State and Commonwealth petroleum legislation.

The Chemistry Centre (WA) provides chemical, mineralogical, metallurgical and associated analytical, investigative and advisory services to Government, industry and the public in the following areas: the development of the State's mineral, water and agricultural resources; monitoring and improving public and occupational health, environmental and material standards within the community; and scientific support to law enforcement and racing agencies.

The Royalties and Policy Development Division develops mineral and petroleum royalty systems which are fair and equitable and administers the collection and audit of royalties paid on behalf of the State and Commonwealth. It also provides economic advice on mining and petroleum industry issues, collects and disseminates statistics and assists in the development and co-ordination of general Departmental policies. The division informs staff, industry and the public about the role of the Department and the importance of the mining and petroleum industry.

The Corporate Development Division provides corporate services for the Corporate Executive and the divisions of the Department whilst responding to the requirements of Government and central agencies. These services include corporate planning, building and purchasing services, computing, typing, records, telecommunications, finance, human resource and auditing activities.

The Mining Engineering Division administers mine safety legislation to safeguard and promote the health and safety of those working in the industry. It provides advice to the Government and to industry on mining engineering matters including deep mining, open-cut mining, quarrying, drilling, the environment and rehabilitation. It monitors exploration safety and administers contract drilling for the Department.

The Explosives and Dangerous Goods Division reviews, formulates and administers laws, regulations and policies aimed at the safe manufacture, storage, handling and transport of explosives and dangerous goods. It provides safety advice on these matters and major hazard control.

The Mining Registration Division receives applications and allocates titles that give legal rights to explore for and mine minerals in Western Australia pursuant to the Mining Act. It maintains a mining tenement registry which records tenement holders, conditions and term of the grant and expenditure details from which the division monitors compliance with the provisions of the Mining Act.

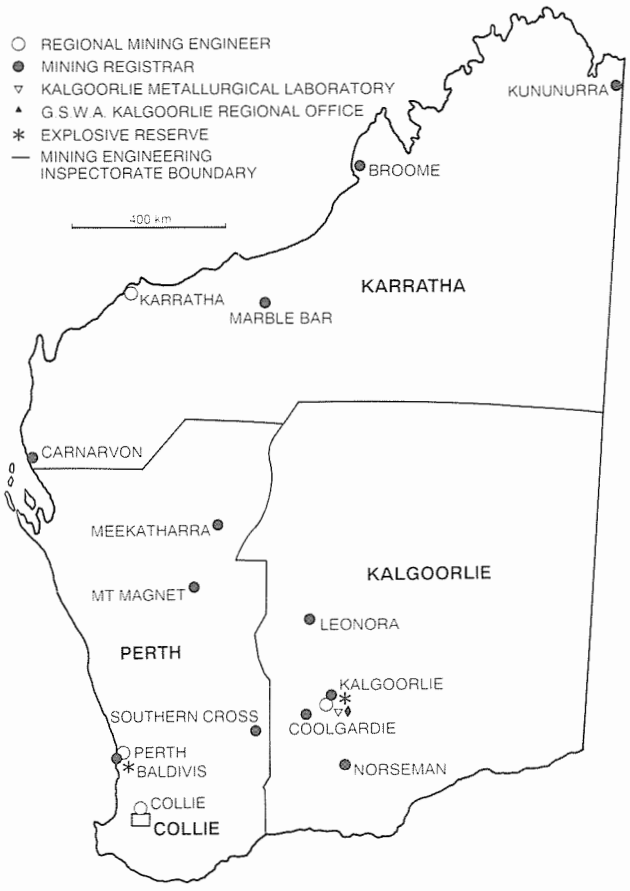
The Surveys and Mapping Division determines, documents and validates the boundaries of tenements and produces and updates all maps and plans necessary for the operations of the Department. All functions from primary field surveys to final map production are embraced. The range of cartographic activities includes charting, field surveying, computations, mapping reprographics, and maintenance of archival materials as an integral part of the tenement management process.

The officers of the Department are mostly located in Perth, although five divisions — Geological Survey, Mining Engineering, Chemistry Centre, Explosives and Dangerous Goods, and Mining Registration — have staff situated in regional centres. Most of these people work in areas that are large and remote by world standards (Figure 5).

In addition to providing services for land-based operations, the Department is also required to administer State and Commonwealth legislation covering offshore oil and gas exploration, exploitation, pipeline transportation and royalty payments.

A Department directory listing the principal offices is included in the Appendices.

Figure 5 Regional Operations



DIVISIONAL ACTIVITIES TO MEET CORPORATE PROGRAMS 1991-92

PROGRAM	SUB-PROGRAM	GEOLOGICAL SURVEY	MINING ENGINEERING	PETROLEUM
MINERALS & PETROLEUM TITLES **1** To ensure that exploration and development titles for minerals and petroleum are issued fairly and without delay.	1.1 Provide an equitable system for granting exploration and development titles as a basis for petroleum and mineral assessment and production.	Provide technical advice in relation to administration of Petroleum and Mining Acts.		Award, maintain and monitor rights to explore and develop petroleum onshore and offshore.
	1.2 Minimise potential for disputes over exploration and development titles and facilitate the prompt settlement of disputes when they do arise.	Technical advice or tenement matters.	Technical advice on tenement matters.	Process dealings, assess fees and advise on legislation.
EXPLORATION & DEVELOPMENT OF NATURAL RESOURCES **2** To foster and assist responsible mineral and petroleum exploration and development, groundwater assessment, and landuse planning, by providing high-quality scientific and technical services and advice to industry, Government and the public.	2.1 Meet the need for geoscientific mapping, research, and resource assessment required to produce up-to-date maps, reports and advice on the geology of the State and its mineral, petroleum, and groundwater resources.	Obtain, interpret and evaluate data on all aspects of geoscience and earth-based resources (mapping, data, collation, evaluation).	Administer contract drilling to support resource assessment.	Provide technical and advisory services to ensure efficient and effective oil-field practice in exploratory and development drilling, testing and production.
	2.2 Provide mineral and metallurgical analytical and research services.			
	2.3 Provide timely dissemination of scientific and technical data from company exploration activities and Departmental studies.	Publish information and maintain geoscientific databases.	Publish reports and guidelines.	Provide information and statistics on petroleum exploration and development.
	2.4 Meet the need for geotechnical, geoenvironmental, hydrogeological, and mining engineering advice and services.	Provide advice and prepare special maps.	Ensure that effective mining engineering advice is available as required.	Advise on oil and gas volumes, field behaviour and production techniques to ensure optimum production and conservation of resources.
	2.5 Foster a favourable climate in the community for mineral and petroleum exploration and development.	Inform and advise Minister, and liaise with industry. Aboriginal and other community groups.	Ensure mineral exploration and mining operations meet community standards.	Develop strategies to encourage a strong and active oil and gas industry.
ENVIRONMENTAL PROTECTION & REHABILITATION **3** To ensure that proper attention is given to the protection and rehabilitation of the natural environment as it may be affected by mineral and petroleum exploration and development, and to facilitate the protection of groundwater resources.	• Ensure protection and rehabilitation of the natural environment as it may be affected by mineral and petroleum exploration and development.	Review and advise on environmental and/or rehabilitation aspects of exploration and mining proposals.	Ensure protection and rehabilitation of the environment as it may be affected by mineral exploration and development.	Implement audit procedures to ensure industry commitment and compliance with environmental requirements.
	• Facilitate the protection and rehabilitation of groundwater resources.	Provide hydrogeological advice on groundwater contamination.	Ensure drilling and tailings dams are managed to minimise groundwater contamination.	Ensure oil drilling operations do not pollute underground water resources.
	• Provide chemical services for environmental management.			
	• Provide geology and mineral resource information and advice for planning and management of National Parks and conservation reserves.	Provide geoscientific advice for landuse planning.		Advise on petroleum prospectivity and possible development methods for environmentally sensitive areas.
COMMUNITY BENEFITS **4** To ensure that the community receives a fair return from the extraction of the State's mineral and petroleum resources.	• Ensure that royalty collection is carried out in an economically and administratively efficient manner.	Provide geological advice to assist royalty determination.	Inspect mineral projects to assist with royalty determination and collection.	Ensure standards are met for oil and gas metering systems, and for the measurement of petroleum quantity and composition.
WORKERS & PUBLIC SAFETY **5** To ensure that all operations in the mining and petroleum industries, and activities involving explosives and dangerous goods, are conducted in a manner that is safe for workers and the public.	5.1 Maximise the safety and health of workers in the mineral and petroleum industries.	Provide geotechnical advice relating to mine safety.	Ensure compliance with the Act and Regulations by regular inspections, training and advice in mineral exploration and metalliferous and coal mines.	Carry out audits and safety inspections of petroleum operations; provide technical advice on exploration and development proposals and plant modifications.
	5.2 Minimise hazards to the public from activities involving explosives and dangerous goods.		Ensure public safety at abandoned mines.	Ensure the design, installation and operations of licenced petroleum pipelines comply with approved safety standards.
CHEMICAL SERVICES **6** To enhance agricultural and industrial development, and the protection of community, consumer, environmental and health standards, by providing high-quality independent chemical services to Government, industry and the public.	• Agricultural chemistry services; • Forensic science services; • Environmental chemistry services; • Public and occupational health chemistry services; • Materials and consumer protection scientific services; • Racing chemistry services.			

CHEMISTRY CENTRE W.A.	EXPLOSIVES & DANGEROUS GOODS	MINING REGISTRATION	SURVEYS & MAPPING	ROYALTIES & POLICY DEVELOPMENT
		Award, maintain and monitor rights to explore and mine minerals onshore and offshore.	Provide and maintain maps depicting all mining and petroleum tenure and other land tenure; provide public searching facilities; record and certify position and other land tenure status of tenements; and manage surveying operations to establish tenement boundaries.	
		Operate Warden's Court and process Ministerial Appeals, Monitor effectiveness of legislation.	Provide a means of resolving conflict arising in respect to tenement boundaries, positions or markings.	
Provide chemical, mineralogical, analytical and advisory services on minerals and water.		Monitor performance of tenement holders in the submission of geoscientific reports.	Provide supporting geographical information systems.	
Provide chemical, extractive metallurgical and mineral processing advisory services and undertake investigations to enhance the processing of minerals.				
		Record and publish tenement data for industry.	Provide a cartographic and map preparation facility.	
Provide analytical and advisory services on groundwater, ores, mining and mineral processing.			Provide a cartographic and map preparation facility.	
Develop and monitor new technology appropriate to further processing of minerals.		Liaise with industry.		Inform Government and community.
Inspect, investigate and advise on environmentally sensitive areas, including mine wastes.		Issue and monitor titles with due regard to protection and rehabilitation of the environment.	Provide a graphical index and record of environmental themes.	
Provide chemical advice on the protection and rehabilitation of groundwater.	Ensure that dangerous goods are transported in a manner that provides maximum protection to the environment.			
Analyse and identify contaminants and natural constituents in air and water. Provide soil testing services for soil conservation projects.				
Provide chemical and mineralogical analytical services on geological materials.			Monitor changes to Environmental Reserve boundaries and maintain graphical systems.	
			Support the site location data base.	Collection of royalties and statistics.
Inspect, test, investigate and advise on occupational health matters.			Provide a repository for information concerning plans of mines and minesites.	
Inspect, test, investigate and advise on chemical aspects of dangerous goods, handling, storage and transport.	Provide a high level of assurance of public safety at places where explosives and dangerous goods are manufactured, stored or transported.			
Undertake investigations, solve problems and provide scientific support, for agricultural research and regulatory programs; for law enforcement and drug free racing; for protection of community health, consumer and environment standards, and for the support of chemical industry.				**CORPORATE SERVICES** **7** To ensure that the human, financial and other resources of the Department are used efficiently and effectively to provide a service responsive to the needs of the community, industry and Government. (Affects all programs.)

PROGRAM 1: Minerals and Petroleum Titles

To ensure that exploration and development titles for minerals and petroleum are issued fairly and without delay.

This program aims to facilitate responsible mineral and petroleum exploration and development by providing legislation and administrative systems which are efficient, equitable and responsive to the needs of those engaged in the mineral and petroleum industries.

The capital-intensive nature of the mining and petroleum industries makes security of title imperative for those engaged in the exploration and development of mineral and petroleum resources. The rules for access to land and security of tenure are embodied in the State's mining and petroleum legislation and, in the case of some offshore areas, in Commonwealth legislation. This legislation not only protects the rights of the title holder but also the rights of the community.

Large exploration titles are provided under both legislative codes to enable wide-ranging assessment of the State's mineral and petroleum resources, utilising modern techniques that involve minimal ground disturbance.

Mineral and petroleum development titles are much smaller in area and issued subject to stringent environmental and rehabilitation conditions.

Mineral title is awarded on the basis of first in time, either by pegging in the case of prospecting licences and mining leases, or the time of lodgement with an exploration licence.

Vacant petroleum exploration areas are advertised nationally and, in some cases, internationally, with details of previously-acquired data and special conditions that may apply. Applications are assessed and awarded on the basis of the exploration work programs submitted and the capacity of the applicant to undertake the proposed program.

In all cases, the holders of exploration and development titles are required to meet expenditure or work commitments and comply with the conditions of approval to retain the rights to explore and develop.

The framework under which the Department operates is aimed at protecting the rights of all parties (from the large corporation to the individual), as well as providing a fair and reasonable return to the community for the rights given to carry out exploration and development operations, and to see that such operations are carried out in harmony with other land-use activities.

An on-going review of legislation, procedures and policies is undertaken to ensure that registration of titles and related dealings are dealt with efficiently and within acceptable time frames.

Resources allocated to Program

Human Resources:	165 FTEs*
Expenditure:	$6.89 M

* Includes 6.5 FTEs based in regional outstations servicing court systems and associated procedures for the Crown Law Department.

Divisional Roles

Five divisions are involved in the program with prime responsibility resting with the Mining Registration and Petroleum Divisions which issue mineral and petroleum titles, both onshore and offshore, and handle title registration, transfer and other dealings.

The Surveys and Mapping Division determines and documents the boundaries of mineral and petroleum titles on a State-wide plan system and co-ordinates the survey of mineral titles to determine exact boundary positions.

Surveys and Mapping, Geological Survey and Mining Engineering Divisions provide technical advice needed to formulate conditions for mining tenements. They also assist in the monitoring of titles for compliance with statutory obligations. Field inspections are sometimes a requirement of these functions.

The Geological Survey Division provides ongoing advice on geoscientific and geotechnical matters relevant to the administration and regulation of proposed exploration programs and mining projects.

In addition to the Head Office in Perth, Mining Registrars' offices are located at 11 regional centres throughout the State. These offices accept applications and dealings and provide access to public plans and other Departmental services.

A Warden's Court system operates to deal with disputes, complemented by both legal and administrative appeal rights. As well as the Warden's Court in Perth, Wardens sit on a regular basis in courts located throughout the State in the regional Mining Registrars' offices ensuring that customers located in these areas have ready access to Warden's Court services.

An overview of departmental activities within this program is given below under the two sub-program headings.

TITLE SYSTEMS

The objective of this sub–program is to provide an equitable system for granting secure exploration and development titles as a basis for petroleum and mineral assessment and production.

Mineral Titles

The year again saw a substantial increase in the number of mineral title applications received (Table 1). This increase in activity was matched by increased work output in the form of public plans and title maps and in the number of applications granted. The area held under granted title as at 30 June 1992 was 23 219 571 hectares which is the third highest total on record.

The Department's measure of performance for this activity is the proportion of applications which have been determined within a five-month period from date of application. Despite a 12.5% increase in the number of applications received, 60% were determined within the five-month time frame. This was below the desired objective of 70%.

Table 1: Mineral Title Applications

	1989-90	1990-91	1991-92
Prospecting Licences	2 426	2 720	3 284
Exploration Licences	1 451	1 285	1 445
Mining Leases	998	695	689
Other	201	289	195
Total:	5 076	4 989	5 613
Area applied for (hectares)	17 184 235	15 046 424	17 371 776
Applications Granted			
Prospecting Licences	2 202	1996	2 746
Exploration Licences	785	830	955
Mining Leases	1 044	679	694
Other	164	218	177
Total:	4 212	3 723	4 572
Area granted (hectares)	8 963 752	9 344 478	11 126 345
Tenements in Force :			
(1978 Mining Act)			
Prospecting Licences	7 725	5 517	5 992
Exploration Licences	2 264	2 183	2 376
Mining Leases & Others:	6 953	6 728	6 531
(1904 Mining Act)			
Mineral Claims & Others	507	419	419
Total	17 449	14 847	15 318
Areas in force (hectares)	22 107 827	20 472 186	23 219 571
Changes to Public Plans			
Additions	5 160	4 949	5 610
Removals	10 273	8 065	5 144

Registration of Mineral Dealings

Dealings such as transfers and caveats involving changes to the title register totalled 11 584 for the year. This was a 20% decrease on the number of dealings received in the previous year (14 620) and 12% lower than 1989-90 (12 988).

The objective of registering 70% of dealings received within one month of lodgement was met or exceeded in eight of the last 12 months with an annual average of 74% registered within the one month time frame (Figure 6).

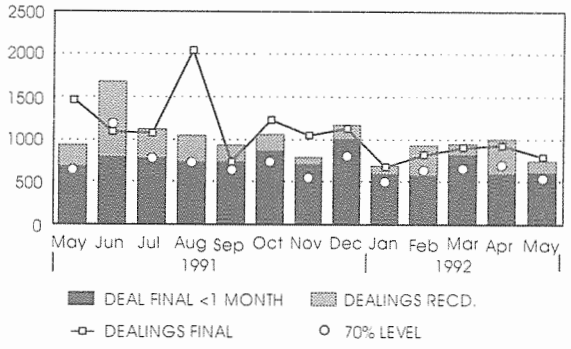


Figure 6. Performance indicators - Dealings

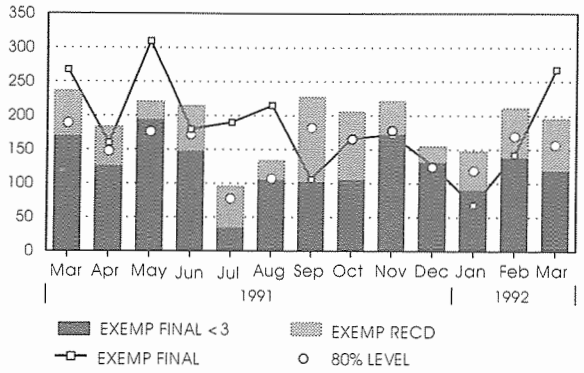


Figure 7. Performance indicators - Exemption

Mineral Title Monitoring

A computer system for rental and expenditure monitoring (TRAX) was introduced in the Kalgoorlie Mining Registrars office in November 1991. This system allows for a much improved method of monitoring obligations and client reaction so far has been very favourable.

Over the year the number of operational reports received fell by 5% while applications for exemptions dropped 15% (Table 2, Figure 7)

Table 2: Tenement Surveillance

	1989-90	1990-91	1991-92
Reports on Operations Received	11 499	9 580	9 350
Applications for exemption	3 356	2 744	2 338
Tenements Forfeited	1 317	962	468

Land Access Issues

A seminar on land access and prospectors' rights held in Kalgoorlie in August 1991 was attended by more than 80 prospectors. The seminar provided an opportunity to explain the rights and obligations of prospectors and, at the same time, to receive valuable feedback on changes that could be made to improve the effectiveness of current legislation and procedures.

By way of a follow up to the seminar, an excursion was organised involving 10 prospectors and officers from the Departments of Mines and Conservation and Land Management. The inspection of mined areas near Kalgoorlie provided a useful interchange of views on the environmental rehabilitation of previously–mined land.

During the year, agreement was reached with the Department of Conservation and Land Management over standard conditions under which exploration can be carried out on conservation-estate land in accordance with the Government's Resolution of Conflict Policy.

Petroleum Titles

There was a significant increase in the number of onshore and offshore exploration titles granted (25 as against 16 for the previous year) taking the total number of in-force petroleum titles to 170 at 30 June 1992 (Table 3).

Two releases comprising 14 offshore areas and four quarterly releases of all onshore vacant areas were advertised during the year.

An overseas mission was undertaken in November 1991 by State and Commonwealth petroleum officials to promote the December release of highly prospective offshore areas in the North West of the State.

The State-wide onshore release of vacant areas and the inclusion of regular closing dates on a quarterly basis introduced last year made it easier for companies to develop and implement their exploration strategies.

Table 3: Petroleum Titles

	1988-89	1989-90	1990-91	1991-92
Exploration Permits Granted				
Onshore	9	5	8	12
Offshore	8	3	8	13
Total	17	8	16	25
Exploration Permits				
Onshore	66	57	49	56
Offshore	41	42	47	58
Total	107	99	96	114
Production Licences				
Granted	1	1	1	3
In Force	20	21	22	25
Pipeline Licences				
Granted	2	1	1	4
In Force	19	20	22	25
Retention Leases				
Granted	-	-	-	4
In Force	1	1	1	5
Petroleum Lease				
Granted	-	-	-	-
In Force	1	1	1	1
TOTAL	**192**	**259**	**272**	**170**

The new offshore exploration permits were spread over several basins including six in the Perth, three in the Canning, two in the Carnarvon, one in the Bonaparte and one in the Browse Basin. The onshore exploration permits were mainly in the Carnarvon Basin, with one in the Canning and one in the Perth Basin.

Fourteen exploration permits were renewed, three were surrendered, three expired and one was cancelled. Three new production licences and four retention leases were granted. Other titles issued included 35 Access Authorities, seven Scientific Investigations and five Special Prospecting Authorities.

A petroleum tenement database to maintain tenement information was developed and implemented.

Mining Customer and Information Services

During the year, a complete review of the Mining Act information pamphlets was undertaken and revised pamphlets released incorporating the latest changes to the Mining Act.

The Mining Information Centre in Mineral House dealt with an average of 70 customers and answered an average of 100 telephone calls per day.

A survey to gauge the level of client satisfaction was undertaken in November 1990, and, as a result, some changes were made to improve customer service. These included placing more senior and experienced staff in the Information Centre and rotating the staff less often. The survey found that there was generally a high level of customer satisfaction with the standard of service provided by the Department in comparison with other Government organisations.

The Map Information Services Counter responded to 762 public enquires for archived tenement and survey information during the year.

Industry Liaison Committees

Regular meetings of the Mining Industry and Petroleum Industry Liaison Committees continued throughout the year. The inaugural meeting of the Surveys and Mapping Industry Liaison Committee also took place. Major issues dealt with included:

Mining Industry Liaison Committee

- changes to the requirements for advertising applications for mining tenements;
- amendment to the private land provisions of the Mining Act 1978 to remove the need for landowner consent and establish a compensation tribunal;
- a change to the Mining Act to overcome the practice of holders surrendering plainted tenements to avoid the Act's forfeiture provisions;
- a number of submissions from the Amalgamated Prospectors and Leaseholders Association relating to access to land held by companies;
- a proposal to appoint a Mining Court Judge; and
- the refund of survey fee deposits held by the Department following the introduction of the user-pay system.

Petroleum Industry Liaison Committee

- substitution of securities by appropriate insurance policies for State petroleum titles; and
- amendments to the Commonwealth Petroleum (Submerged Lands) Act to enable delegation of title related Joint Authority powers to Commonwealth and State officials.

Surveys and Mapping Industry Liaison Committee

- mineral title marking out regulations; and
- operation of the user-pays system of surveying mining tenements.

Public Plans and Title Maps

- A total of 3 078 public plans and working transparencies were maintained to chart all mineral titles throughout the State.
- A total of 5 610 mineral title applications were recorded, plotted and appraised for land-tenure status and 5 144 mineral titles cancelled from public plans.
- Petroleum title maps and plans were maintained and quarterly editions of the State Petroleum maps and booklets produced and released on schedule.

The Department aims to have new mineral title applications and cancellations charted on the public plans within 10 days of the information being received in Perth. This objective was met in 90% of cases in a year which saw an increase in new applications and a decrease in the number of cancellations.

The number of applications and cancellations processed per full-time employee is a measure of efficiency. In 1991-92 the level was similar to previous years (Table 4) with a small improvement in the charting of exploration licenses.

Table 4 : Title processing

	Quantity (Number)	Staff (FTE)	Number per FTE
Title Charting (Other than Exploration Licences)			
1989-90	3 670	3.5	1 050
1990-91	3 673	3.5	1 050
1991-92	4 168	4.0	1 042
Title Charting (Exploration Licences)			
1989-90	1 490	3.3	450
1990-91	1 276	3.0	425
1991-92	1 445	3.0	462
Exploration Licence Releases			
1989-90	470	3.0	150
1990-91	492	3.3	149
1991-92	428	3.0	143
Title Cancellations			
1989-90	10 270	3.5	2 930
1990-91	8 065	3.3	2 444
1991-92	5 144	2.0	2 572

Graticular Sections

A review of the early months of operation of Graticular Section Exploration Licences established positive client acceptance of the system. Major benefits identified were greatly increased security of title and ease of application for a licence.

Index maps at 1:1 million scale were produced for the South-West of the State in response to concerns from environmental groups locating the position of Graticular Section Exploration Licence applications from newspaper advertisements. These maps show the graticular section numbers with an index to the Public Plans overlayed in a contrasting colour, providing a quick guide to the application's location. Full State coverage of these indexes is planned for next year.

Tenement Graphics

The Department continued development of a computer-based tenement graphics system (TENGRAPH). This is a major component of a mineral title system which will provide a computer-based graphical display of 'on the ground' title boundary information, together with other land information. It will interface with other databases such as the mineral title index system (TENDEX).

The TENGRAPH prototype was successfully demonstrated to the Minister for Mines, Mining Industry Liaison Committee, IBM, West Australian Land Information System Committee, Valuer General, industry groups, tenement consultants, surveyors and other Government agencies. Industry response was overwhelmingly positive.

Depending on the availability of funding, the Department aims to formally introduce TENGRAPH in Kalgoorlie in March 1993, to coincide with the town's centenary. During the first stage the system will only be available for mineral titles in the Kalgoorlie Mining Registrar's administrative region.

Title Surveys

A total of 126 mineral titles were surveyed during the year leaving the number outstanding at 3 101. The survey vote was fully committed by the fourth quarter of the financial year. Surveys proceeded with the Department co-ordinating the preparation and issue of instructions to approved contract surveyors.

The user-pay system for the survey of mineral titles was introduced from 1 July 1991 and a "List of Approved Surveyors" publication was compiled and distributed as part of a commitment to industry.

Microfilm Program

Microfilming of original maps and documents continued with all the survey diagrams having now been microfilmed in black and white. The microfilming of survey field books has almost been completed.

DISPUTE MANAGEMENT

The objective of this sub–program is to minimise potential for disputes over exploration and development titles and facilitate the prompt settlement of disputes when they do arise.

The majority of objections and formal disputes (plaints) were heard or had an initial hearing in the Warden's Court within three months of lodgement. A total of 493 objections against 366 applications for mineral titles and 103 plaints for forfeiture of granted titles were received.

A low level of administrative appeals to the Minister against conditions imposed at the time of grant or the refusal of title applications was maintained.

Arising from submissions from prospectors and the Amalgamated Prospectors and Leaseholders Association amendments to the Mining Act are proposed to:

- overcome the practice of title holders surrendering plainted titles to avoid the Act's forfeiture provisions which give the plaintiff a prior right to the ground if forfeiture results; and
- provide access to land held under lease by others by providing for a Special Prospecting Licence to be granted over an existing mining lease where the lessee consents.

Several disputes between mining companies over the area of land available in competing applications for exploration licences were resolved by liaison between Departmental officers and the parties, thus avoiding legal proceedings and the potential for additional costs to be incurred by all parties.

Planned Achievements for 1991-92	Outcomes
Reduce the backlog of pending mineral title applications in accordance with the Government's Resolution of Conflict Policy.	Agreement was reached with CALM over standard conditions under which exploration can be carried out on conservation estate land in accordance with the Resolution of Conflict Policy.
Minimise loss of revenue by processing 70% of mineral title applications within five months of lodgement.	60% of all mineral title applications were determined within five months of lodgement compared with a planned achievement of 70% due to higher than expected workload in this area.
Introduce the next phase of computerising the graphical system (Tengraph) which supports the proposed electronic title system and the monitoring of obligations under the Mining Act.	The development of the prototype of the Department's computerised graphic system (TENGRAPH) supporting the proposed electronic title system and its demonstration to industry, relevant Government Departments and the public.
Participate in a pilot study of the GPS surveys of mining titles and develop standards and specifications for such surveys.	Standards and specifications were developed for surveys using the Global Positioning System (GPS) following pilot studies to ensure the suitability of GPS for the survey of mineral titles.
Microfilm archived Public Plans to achieve increased security, more efficient storage and improved client access.	The project to capture existing archived Public Plans on microfilm was completed. A maintenance program will continue as the current Public Plans are archived.
Introduce a full-user pays system for the survey of mineral titles.	A "user-pays" system for the survey of mineral titles was introduced on 1 July 1991.
Maintain the current low level of administrative appeals to the Minister and ensure the resolution of disputes in the Wardens' Courts within three months of lodgement.	A low level of administrative appeals to the Minister was maintained and the majority of objections and disputes were heard in the Wardens' Courts within three months of lodgement in accordance with Departmental objectives.
Consolidate and reprint the Petroleum Act, Petroleum (Submerged Lands) Act and the Petroleum Pipelines Act.	The Petroleum Pipelines Act was reprinted during the year and further work was undertaken to facilitate the consolidation and reprint of the Petroleum Act and the Petroleum (Submerged Lands) Act in 1992-93.
Work towards the introduction of the Drilling Reservation title into the State's territorial sea legislative zone.	Commonwealth concurrence was obtained for the introduction of Drilling Reservations into the State's territorial sea legislation zone by extending the State Petroleum Act, which already provides for Drilling Reservations, to the outer limit of the territorial sea legislative zone.

Planned Achievements for 1991-92	Outcomes
Work towards rationalising the State's petroleum legislation so that the State's Petroleum Act can be extended to the outer limit of the territorial sea to facilitate exploration and reduce administrative costs.	Discussions commenced with Commonwealth officials over the proposal to rationalise the State's petroleum legislation so that the State's Petroleum Act can be extended to the outer limit of the territorial sea.
Develop a computerised system to handle State petroleum titles and drill site data to facilitate the timely production of maps and information required by Government and industry.	Development of a computerised system for the handling of petroleum titles and drill site data is continuing. All existing data for permit boundaries have been captured and boundary descriptions are now being entered at the time of application to facilitate the timely production of maps and information required by Government and industry.

PROGRAM 2: Exploration and Development of Natural Resources

To foster and assist responsible mineral and petroleum exploration and development, groundwater assessment and land-use planning by providing high-quality scientific and technical services and advice to industry, Government and the public.

The discovery and development of WA's mineral, fossil fuel and groundwater resources are intrinsic to the State's development. This principle is the corner-stone of the Department's Program Two. Its specific activities are directed to the provision of scientific advice and services to industry, Government and the public, providing a basis for medium and long-term planning and decision-making, principally in relation to the mining and petroleum industries, but also in regard to the State's civil engineering activities for infrastructure development.

With the provision of timely and high-quality scientific information which improves the chances of success in exploration and development projects, the program strives to stimulate mineral and petroleum companies to invest in Western Australia. The same information is used to provide sound advice to the Government on land-use issues.

Decisions regarding the management of the State's mineral, fossil fuel and groundwater resources and the development of its road, rail and urban infrastructure need to be made on the best scientific information and advice available. The Department provides a central location for geoscientific information which is provided by mining and petroleum companies, various research organisations and institutions, as well as that generated in field and office studies conducted by the Department's own specialists. In conjunction with facilities for a broad range of mineral and metallurgical analytical services, the Department is able to provide a comprehensive scientific base for the successful exploration and development of the State's natural resources.

Resources allocated to Program

Human Resources:	227 FTEs
Expenditure:	$12.79 M

* Includes 7 FTEs provided through a special Government grant for the WAMEX database.

Divisional Roles

The program has been supported by six divisions of the Department.

The Geological Survey Division carries out geoscientific mapping and research, and provides advice relating to mineral, fossil fuel and groundwater resources within the State.

The Mining Engineering Division is responsible for the inspection of mineral exploration and drilling operations, organises and supervises contract drilling operations, and provides information about mining developments throughout the State.

The Petroleum Division is responsible for fostering onshore and offshore petroleum exploration, drilling, engineering, oil and gas production and pipeline transportation.

The Surveys and Mapping Division provides cartographic, mapping and land information services.

The Chemistry Centre provides expert services and advice with activities ranging from the analysis and characterisation of minerals and mineral products through metallurgical and mineralogical services to comprehensive process development for new ore deposits.

The Royalties and Policy Development Division coordinates the preparation of Departmental policies, and also provides economic and general advice and information to the Government and the public.

A number of liaison committees bring together the interests of industry and research institutions to ensure that the Department's activities meet their most appropriate requirements. Where necessary,

sub-committees have been established to meet special or area-specific needs.

An overview of departmental activities within this program is given below under the five sub-program headings.

GEOLOGICAL DATA COLLECTION

Geoscience Mapping, Field and Office Studies

Progress achieved in documenting geoscientific information about the State is shown in Figure 8, which displays the areas where data from departmental studies have been integrated with information from mineral and petroleum exploration companies and transformed into printed maps available to the public. Some mapping was carried out with the Bureau of Mineral Resources (BMR) under the National Geoscience Mapping Accord (NGMA).

The intensity of information aggregated in these reports and maps ranges from various degrees of regional synthesis (1:1 000 000, 1:500 000, 1:250 000 scales) to detailed analysis (1:100 000, 1:50 000, 1:25 000 scales) and results from an appreciation by the Department of industry's and Government's needs for the necessary degree of detail.

Geophysical data covering the Kurnalpi and part of the Kalgoorlie 1:250 000 map sheets were acquired with a special allocation of funds by the Government. These are being utilised in the regional geological mapping program.

Mapping projects were supported and enhanced by various specialist studies and technical support services. There was a small decline in the number of petrological examinations during the year compared with the previous year while the number of palaeontological reports and metres of borehole logged declined considerably (Table 1). This was a direct consequence of the closure of the Department's Drilling Branch and a reduction in funding for contract drilling.

Table 1: Geological Analysis

	1988-89	1989-90	1990-91	1991-92
Petrological Examinations				
Samples determined	1 360	539	365	347
Reports compiled	23	29	28	24
Palaeontological Reports	16	19	49	9
Geophysical Logging				
Number of boreholes	49	38	32	27
Aggregate metres logged	19 163	20 638	7 832	5 100

Mineral Resources

Work commenced on the production of a series of 1:1 million scale maps of mineral deposits to complement the 1:2 500 000 scale State map published in 1988. Details of all mineral deposits and occurrences on the Albany sheet area were entered into a database prior to compilation of a report, and a preliminary computer plot of deposit locations was prepared.

As a precursor to work on an Iron Ore Resources Bulletin, a Geographical Information Systems project was carried out for the Pilbara region. Data recorded for the project included cadastral information, mining tenements, company ownership, railways, iron ore geology, iron ore deposits and resources, and National Parks. These were plotted to develop a series of 14 maps intended to assist in the formulation of long-term development strategies for the Pilbara iron-ore industry and assess the impact on the Karijini National Park.

Petroleum Resources

The Department continued with its assessments of the State's oil and gas reserves and the evaluation of the petroleum potential of the State by revising the seismic mapping of the Cossack and Wanaea fields, and by recording and reviewing the data provided by petroleum companies in their development plans and proposals. Reviews included Sagasco's Beharra Springs Gas Project, Woodside's Goodwyn Gas Development Plan, and Hadson's Gas Gathering Development Plan.

In carrying out these assessments, the Department maintained close liaison with industry, conducting over 200 interviews in the Department as well as less formal contacts with industry representatives in other forums.

Groundwater Resources

The Scott Coastal Plain groundwater drilling program which had been suspended when the Drilling Branch was closed in 1991, was completed. Twenty five bores were drilled by a private contractor at 13 sites with an aggregate depth of 1 638 m. The drilling confirmed the existence of large groundwater resources and outlined an area of exceptionally low salinity groundwater.

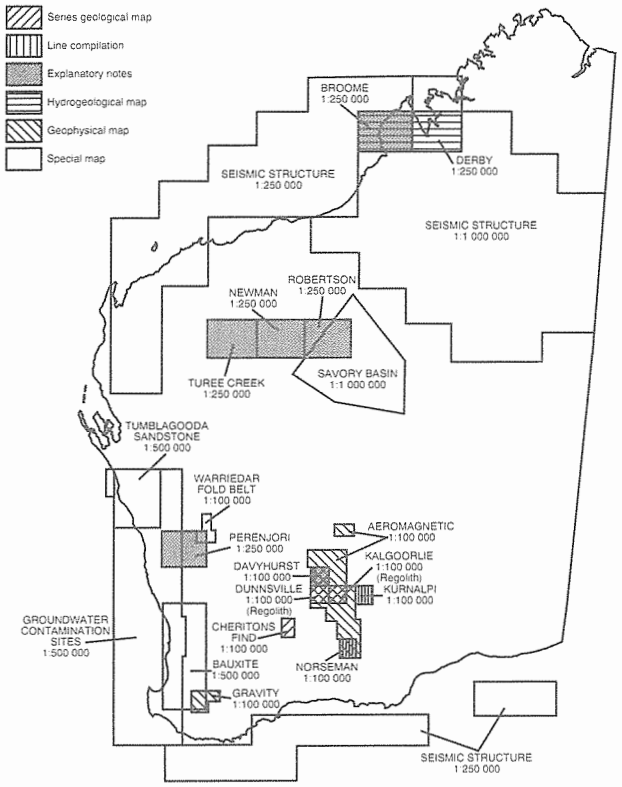


Figure 8. Maps and explanatory notes published in 1991-92

With the completion of the above program, and with data from the Karriedale and Cowaramup lines of deep bores, the groundwater resources of the southern Perth Basin have been re–appraised. The major aquifer is up to 1 500 m thick and covers an area of about 4 000 square kilometres. It contains an estimated 300 000 million cubic metres of potable groundwater in storage, and has an estimated renewable resource of some 200 million cubic metres, equivalent to that supplied to Perth via the scheme water supply.

To assist in defining re–charge areas and rates of groundwater movement of the large groundwater resources in the southern Perth Basin, a program of groundwater sampling has commenced to determine the age of the groundwater using carbon–14 methods. One hundred and two samples have been obtained for this purpose. The work is being partly supported by the Water Authority of Western Australia, and will more clearly define the main areas of recharge, and further improve the estimates of the resource.

Reviews were completed of the hydrogeology and groundwater potential of sedimentary areas (including the Wilga and Boyup Basins) in the south-western Yilgarn Craton. Exploratory drilling has been recommended for these areas which may be important local sources of fresh and brackish water for public supply and industry. A regional review of the groundwater resources in the Murchison region has also been completed and a similar review in the north-eastern Goldfields is in preparation.

Groundwater assessments were completed for eight townships and 34 Aboriginal communities .

METALLURGICAL AND ANALYTICAL SERVICES

Analytical and mineralogical data and advice were provided by the Mineral Science Laboratory to support Departmental research programs and occupational hygiene matters impacting on the mining sector. The range of analytical data provided is the most comprehensive available from any similar laboratory in Australia. Particular attention was given to uranium and thorium using the new inductively-coupled plasma mass spectrometer (ICP-MS). This system was complemented during the year with a laser ablation facility enabling direct sampling of solids.

The Mineral Processing Laboratory continued to provide consulting services and testwork facilities to industry. Major pilot rotary kiln runs were conducted for various clients on different feedstocks with ilmenite upgrading being the major area of interest. The gold industry maintained demand for testwork, including carbon regeneration, with work on treating refractory ores increasing. The Laboratory provided important input into the research programs for the A J Parker Co-operative Research Centre for Hydrometallurgy prior to its commencing operations on 1 July 1992. Involvement with externally-funded projects was increased, with approval of a MERIWA-funded project on gold electrowinning in conjunction with Murdoch University.

The Kalgoorlie Metallurgical Laboratory maintained its involvement with rapid umpire bullion analysis for industry clients, despite some rationalisation of operations in that sector. Courses on atomic absorption spectroscopy for the gold industry and fire assaying were given in conjunction with the Western Australian School of Mines. The MERIWA sponsored project, for four industry clients, on column flotation for improved

beneficiation of gold and base metal ores was extended to include construction of a much larger pilot scale column for closer comparison of performance with plant systems. The key parameters for successful operation of a column flotation facility were evaluated.

GEOSCIENTIFIC DATA DISSEMINATION

Reports on Tumblagooda Sandstone, Devonian palynology, and the geology of the northern Canning Basin were released. Reports on bauxite resources, Permian studies and the geology of the Savory Basin are in print, and a report on coal resources of Western Australia is undergoing editing.

The production of the Cheritons Find 1:100 000 scale geological map, as a pilot study for computer assisted map production, proved successful and was acclaimed as the first series geological map to be produced in Australia using computer technology for compilation through to pringting. The new system is now in full-production and three other 1:100 000 scale map sheets (Melita, Broadhurst and Paraburdoo) are at advanced stages in their production using this technology.

A third Computer Aided Design unit, together with improved software, is having a significant influence on the preparation of all publication material while an additional desktop publishing unit further reduces the Department's reliance on external printing and design processes (Table 2).

Seven geological maps, two hydrogeological maps and two environmental geology maps were completed during the year. An additional 14 thematic maps were printed.

Table 2: Geological Publications

	1988-89	1989-90	1990-91	1991-92
Geological Publications				
Major coloured maps11	11	11	11	11
Other maps	6	7	40	60
Bulletins, Reports, Records, Notes	N/A	17	19	23

In addition to specialised geochemical, geophysical and hydrogeological databases, the main Departmental databases which fall under this Program are those relating to mineral and petroleum exploration reports submitted by companies.

Table 3: Exploration Reports

	1988-89	1989-90	1990-91	1991-92
Exploration Reports received from Industry				
Petroleum	383	496	675	368
Minerals	3 035	3 165	2 766	2 731
Exploration Reports released to Open File				
Petroleum (reports)	560	407	487	1 318
Minerals (volumes)	819	846	1 411	3 353

A new version of the mineral exploration report index (WAMEX) was brought into operation in January 1992. The WAMEX database now includes about 35 000 volumes representing 9 300 projects, about half of which relate to exploration for gold.

Petroleum reports are indexed on the WAPEX database which contains information on some 11 400 bound reports representing 6 900 activities (tenements, surveys, well and general reports), as well as those relating to seismic sections and well logs. The large increase in the number of open file petroleum reports released (Table 3) is a consequence of the revised policy covering the release of basic and interpretive data, while the increase in the number of mineral exploration volumes released reflects the activity of the special task force formed to eliminate the backlog of reports awaiting processing.

An audit of the database of mines and mineral deposit (MINEDEX) was undertaken prior to proposed in-house release for general inquiry purposes. The MINEDEX system now holds data on around 2 750 deposits or mine sites on 1 500 integrated mineral projects. In addition to the care of the base system, a major activity was the data maintenance of the mineral resources inventory (MININFORM) sub-system, which enables the Department to provide resource estimates in response to public and government enquires.

A pilot study commenced in May 1992 aiming to establish a database of geotechnical data for the Perth Central Business District (the PERTECH project).

Library

During the year there were 12 494 users of the library of which 6 298 were visitors to the Department (Table 4). The total was a 9% increase on the previous year. Two new microfiche reader/printers were installed to assist in coping with the increased demand for the use of microfiche reading and printing equipment.

Table 4: Public Library Use

	1988-89	1989-90	1990-91	1991-92
Number of people using the library	4 087	4 369	5 132	6 298
Number using microfiche/film readers	1 025	1 203	1 590	1 885

In response to public requests, library staff conducted 55 on-line searches of the WAMEX database, and 42 searches of the WAPEX database. A terminal was installed to allow members of the public direct access to WAMEX.

Conferences and Excursions

As a small but important aspect of information dissemination activities under this Program, the Department encourages participation of its officers in professional conferences and the presentation of papers at such gatherings. The Department also runs field excursions to explain features of the geology of the State.

During the year four geological excursions were organised for the benefit of industry and academic representatives. Two of these were in association with professional societies: one to the southern margin of the Pilbara Craton in conjunction with the Geological Society of Australia, and another to the Carnarvon Basin in association with the 1992 APEA conference held in Perth. Excursions related to the Department's geological mapping projects were run on the Kanowna and Kurnalpi 1:100 000 map sheet areas, and talks on the geology of the Eastern Goldfields were presented to industry and student groups.

GEOTECHNICAL AND MINING ENGINEERING ADVICE

Geotechnical advice was provided not only to industry but also to a number of State and local government agencies. Included among these were the Water Authority, the Main Roads Department, Westrail and the Collie Shire Council.

Advice given to the Water Authority included technical advice during the construction of the Conjurunup Pipehead Dam, assessment of contractual claims in relation to the construction of the new Victoria Dam, site investigations and tender document preparation for the proposed North Dandalup Dam, and the investigation of potential damsites at Margaret River and Wellstead. In addition, investigations of foundation conditions were carried out for pumping stations and sewerage transfer stations at Bickley and Lower King.

For the Main Roads Department, advice was given on proposed rock cuttings at Tom Price, Norseman, Madura, Eucla and Dunham Jump-up, a brief reconnaissance assessment of a damsite at Durham Jump-up, and assessment of quarries and quarry sites at McPhee's Creek, Nillibublbca and Oscar Range.

The Department provided input concerning mineral deposits and mining developments, for the WA Steel Task Force, the Pilbara 21 Study, and the Cape Range Limestone project.

Further advice on State mineral developments was given to a number of overseas trade delegations and local trade groups.

Mining engineering advice and services were sought by a number of private companies in regard to developing new mines and planning mine extensions.

The Department continued to provide groundwater and hydrogeolgical advice to the Water Authority on matters relating to management and licensing. Three hydrogeologists were on secondment to the Water Authority and a further three hydrogeologists worked on Water Authority matters including the supervision and assessment of drilling projects for Perth, Exmouth, Carnarvon, Leonora, Nullagine, Horrocks Beach, Mt Magnet and Gibson town water supplies.

COMMUNITY RELATIONS

To foster a favourable climate in the community for mineral and petroleum exploration and development, the Department strives to keep its staff and the general public well-informed as to the importance to the State of the mineral and petroleum industry sectors, and the role of the Department.

Media and Public Relations

Regular contact was maintained with key people in more than 50 newspapers, TV and radio stations, and mining journals, and over 100 media statements were released on a variety of topics.

In addition, the Department responded to wide-ranging public and media inquiries. Areas covered included information and assistance for prospectors, urban geology for landowners, mining

and its environmental implications, and educational geology for teachers and students. Enquires were received at a rate in excess of 200 per month over the year.

The Department also issued various information pamphlets, Fact Sheets and newsletters, and wrote a number of special feature articles for carriage in industry and other publications. These included a special feature on the WA iron ore industry for "Mine Life", a feature on mining and the environment for "Business World", and a special two-page editorial and photographic feature on the history of the Department of Mines in Kalgoorlie for the "Kalgoorlie Miner".

Displays

In addition to technical displays at industry conferences, a number of other displays were mounted in a range of venues. More prominent among these were: the "Mining and Petroleum Industry in WA" photographic competition, now established as an annual joint project with the WA Photographic Federation; a special display on minesite rehabilitation at the launch of the Department's Environmental Achievement Awards at the Joondalup Country Club; and a special display of historical photographs at the Museum of the Goldfields in Kalgoorlie which was subsequently opened by the Minister for Mines.

The Department demonstrated the TENGRAPH and GIS system at seminar and displays at a number of venues in Kalgoorlie and the Perth metropolitan area. Expositions of specific divisional activities were also held for industry, government agencies and Departmental staff.

Specific Community Relations

Advice in relation to Aboriginal issues is also an important part of the Department's community relations function. Regular communication has commenced between the Aboriginal Affairs Planning Authority and the Department in order to develop a better on-going working relationship to assist in the resolution of potential conflict in relation to land access and mineral exploration.

The Department is cognisant of the contribution it can make to the education of our State's youth. The Departmental museum was visited by eight classes of geology students during the year who were treated to lectures from various geoscientists. A total of 37 rock and mineral specimen sets were prepared and distributed to schools.

Policy Liaison

This sub-program covers the Department's role in preparation of briefing notes and speeches for the executive and Minister. Economic policy advice was provided on existing and proposed Government policies which impact upon the resources sector. Significant issues during the year included the Natural Gas Strategy group, Commonwealth Grants Commission, land freight policies and Commonwealth petroleum taxation and natural gas usage policies. A major undertaking was the development of a structure for a two part ad valorem/net income royalty, which was done in conjunction with assessing a request for royalty relief for a major mining project. The objective was to develop a system which could be offered to companies as an alternative to the present arrangements.

The Department has also been formulating a proposal to Government in relation to flaring of gas associated with oil production.

Planned Achievements for 1991-92	Outcomes
Release for petroleum exploration of some of the most prospective acreage on Australia's North West Shelf.	Twenty five exploration permits (sixteen in 1990-91) were issued for offshore petroleum exploration of some of the most prospective acreage on Australia's North West Shelf.
Assessment and approval of development plans for the Cossack and Griffin petroleum discoveries.	An assessment of the Cossack oil field has been completed and an assessment of the Griffin oil field Development Plan has commenced as a basis for recommendations to the Commonwealth Government concerning the development of these fields.
Recalculation of the State's petroleum and gas reserves in the light of significant new discoveries and development plans.	A recompilation has been completed of the State's oil and gas reserves in the light of new discoveries and development plans. The results will be published in the July 1992 issue of "Petroleum in Western Australia".
Produce 1:250 000 scale seismic time-structure maps to encourage onshore petroleum exploration.	Forty-six 1:250 000 scale seismic time-structure maps compiled from industry reports to Government were completed and published as an aid to the petroleum exploration industry.
Publish reports on bauxite resources, coal resources, Savory Basin, Northern Canning Basin, Tumblagooda Sandstone, Devonian palynology and Permian studies.	As part of the Department's aim to disseminate the results of scientific studies, reports on the Tumblagooda Sandstone, Devonian palynology, and the Northern Canning Basin were released during the year. Reports on bauxite resources, Permian studies, and the Savory Basin are in press, and a report on coal resources is being edited prior to publication.
Complete five geological maps, two hydrogeological maps and one environmental geology map.	To meet the continuing need for up-to-date regional geoscientific data, seven geological maps, two hydrogeological maps and two environmental geology maps were completed and an additional fourteen thematic maps were printed.
Continue town and Aboriginal community water suppliers assessments for the Water Authority.	Eight township and thirty-four Aboriginal community groundwater assessments were completed in response to requests from the Water Authority.
Complete hydrogeology mapping in the Eastern Goldfields.	Hydrogeology mapping of four 1:250 000 map sheet areas in the Eastern Goldfields has been completed; the maps are being edited prior to printing and subsequent release to the public.
Reduce the backlog of company mineral exploration reports awaiting microfilming and release to Open File.	A total of 3 400 mineral exploration reports have been released and the backlog awaiting microfilming has been eliminated.

Planned Achievements for 1991-92	Outcomes
Provide technical support for computer based programs for data input to the Integrated Land Information Program (ILIP).	The Integrated Land Information Program (ILIP) has been supported with the provision of facilities to import and export digital data.
Acquire high-quality aeromagnetic data over the Eastern Goldfields.	High quality aeromagnetic data covering the Kurnalpi and part of the Kalgoorlie 1:250 000 map sheets were acquired and are being utilised in the regional geological mapping program.
Acquire new analytical spectroscopic technique of ICP-MS and commission it for a wide range of mineral related systems, including the "finger printing" of gold ores	Equipment for the new analytical spectroscopic technique of ICP-MS has been acquired and installed. It is being used routinely for analysing a range of minerals. A proposal for a project to develop finger printing of gold ores has been submitted to the Australian Mineral Industry Research Association (AMIRA).
Undertake a program of work to study the application of pressure oxidation in treating refractory gold ores and concentrates.	A planned project to study the application of pressure oxidation in treating refractory gold ores and concentrates has been delayed while necessary technical components are being certified for use.
Continue to develop column flotation facilities and techniques and apply them to real mineral systems.	A MERIWA sponsored project on column flotation for mineral separation is progressing. The key parameters for successful operation of a column flotation facility have been evaluated.
Maintain the collection and curation of specimens for the State Mineral Reference Collection.	Some 300 new specimens have been acquired for the Mineral Collection. Requests from intra- and interstate for samples to be used in research investigations have been accommodated. New display facilities have been set up in the Chemistry Centre.
Improve media and community awareness of the role of the Department and the importance of the mining and petroleum sectors.	More than 100 media statements covering a variety of topics were prepared during the year. Various displays were mounted at a range of venues including the WAMEX 92 exhibition and the APEA conference.
Produce a series of fact sheets for public distribution on minerals and petroleum.	Ten out of a planned set of 12 Fact Sheets were designed and printed; the shortfall was due to reallocation of resources to meet revised priorities.
Implement the next stage of the development of a full Geographic Information System capacity and aid the resolution of key planning issues with the use of this technology.	The development and implementation of a full Geographic Information System capacity has been achieved in response to Government and industry demands for improved access and display of spatial information. The Hamersley project has been used by the Departments of Mines and State Development to develop strategies for the Pilbara iron ore region.
Completion of a pilot study into the use of computer-assisted map publishing techniques for multi-coloured geoscientific maps.	A pilot study commissioning computer-assisted multi-colour map publishing techniques has been completed. The Cheritons Find 1:100 000 geological map was printed using these techniques in December 1991, and three other maps are in production.

PROGRAM 3: Environmental Protection and Rehabilitation

To ensure that proper attention is given to the protection and rehabilitation of the natural environment as it may be affected by mineral and petroleum exploration and development, and to facilitate the protection of groundwater resources.

The Department is involved in a diverse range of management, monitoring and consultancy roles concerned with the protection and management of the environment. In addition to activities which specifically relate to the mining and petroleum sectors, the Chemistry Centre provides a range of analytical and advisory services covering all aspects of the environment.

This program aims to maximise protection and rehabilitation of the environment as it might be affected by petroleum and mineral exploration and production. It also aims to provide regulatory agencies with information on groundwater quality.

The strategies adopted to achieve these objectives include the employment of technically-qualified officers who liaise with other Government agencies, industry and the community. These officers monitor the adequacy of systems and practices used to achieve required environmental standards and participate in environmental training, education and research programs. Worksite visits are conducted to monitor and audit compliance with legislation and conditions of title. A security-bond system is also maintained to facilitate administration and emergency response plans in the event of a mishap.

The quality of the State's groundwater resources is the subject of ongoing investigations and monitoring in order to provide advice to regulatory authorities and to provide information which is published to increase community awareness.

Resources Allocated to Program

Human Resources:	31 FTEs
Expenditure:	$1.85 M

Divisional Roles

Seven divisions of the Department of Mines play an active role in supporting this program.

The Mining Registration Division places conditions on titles to ensure environmental protection and rehabilitation of land under held Mining Act titles.

Conditions for mining projects are developed by the Mining Engineering Division in consultation with the Environmental Protection Authority. All new development proposals are assessed, and appropriate conditions recommended, to ensure adequate environmental management and protection in accordance with Government policies. The Mining Engineering Division co-ordinates the Department's response to the Environmental Protection Authority for resource projects that are the subject of formal environmental assessments. Monitoring of these projects is undertaken by the Mining Registration and Mining Engineering Divisions. Where illegal mining or breaches of conditions have taken place, these divisions, in concert, may initiate prosecutions.

The Petroleum Division provides advice on environmental matters related to petroleum exploration and development and monitors the environmental performance of petroleum companies in this State.

The Surveys and Mapping Division monitors changes to conservation reserve boundaries and maintains graphical and digital systems to support agencies involved in environmental protection and rehabilitation associated with the mineral and petroleum sectors.

The Chemistry Centre reviews environmental assessments with regard to the impact of mining and industrial development on the environment. Key areas which the Chemistry Centre evaluates include; stack gas or other process chemical emissions, disposals of waste chemicals or by-products, the use of local water resources, and the effect on the quality of these resources.

The Geological Survey Division advises on rehabilitation aspects of exploration tenements and mining projects. It plays a major role in developing appropriate environmental conditions for exploration tenements. Negotiations are conducted with both the Department of Conservation and Land Management and the Environmental Protection Authority to ensure that environmentally sensitive areas are protected during exploration. Groundwater contamination and pollution studies are another important element of the Geological Survey Division's program.

The Explosives and Dangerous Goods Division ensures that hazardous substances are transported and stored in a manner which provides maximum protection to the public and the environment.

Mineral Exploration and Mining Activities

During the year 88 new mining proposals and 13 environmental management programs (for operating mines) were received and reviewed by the Department for their environmental impact. An additional 125 proposals for major expansions or amendments to existing operations resulted in a total of 213 Notices of Intent (NOI) being received, of which 166 were for gold ventures. Overall this was a small reduction in submissions from the previous year when 221 were received.

The procedures established for the preparation of Notices of Intent (NOI) and annual environmental reports have resulted in improvements in site environmental management. The assignment of greater responsibility by the EPA to the Department for environmental review and approval of mining projects is indicative of the success of the NOI assessment process.

There has been a substantial improvement in rehabilitation performance at minesites in the State in recent years. This has been achieved through attitudinal change, and a higher commitment to environmental management by industry management. Progressive rehabilitation at minesites is now the norm rather than a rarity.

Regional Mining Development Planning Committees established in the Yilgarn, Leonora and Laverton areas have achieved their aims with improved liaison between the local Councils and industry. The future role of these committees is now being reviewed.

Environmental Performance Bonds are now required for all new mining operations and at 30 June 1992 there were 684 bonds in place with a total value of $18.259 million. Only two Performance Bonds have been used to rehabilitate abandoned minesites. In one case, liaison with a Land Conservation District Committee enabled the rehabilitation work to be undertaken on a contract basis by the Committee and it is hoped this co-operation will continue in the future.

A total of 74 "Notifications of Intention to Clear Land" were reviewed by the State Mining Engineer through delegation from the Commissioner of Soil and Land Conservation under the Soil and Land Conservation Act.

Liaison and involvement of Departmental officers continued with the Goldfields Land Rehabilitation Group. Environmental officers at Karratha Office initiated the inaugural meeting and formation of the Pilbara Land Rehabilitation Group.

Following inspections and field visits by Environmental Officers, a number of prosecutions for mining without authority (Section 155) were obtained. Fines up to $1 500 were imposed for individual offences.

Breaches of tenement conditions for commencement of mining without the approval of the State Mining Engineer resulted in the Minister imposing penalties under Section 97(1) of the Mining Act 1978. In one case the maximum penalty of $5 000 was imposed. All penalties were in lieu of forfeiture of the tenements.

An initiative this year was a 12-month exchange of environmental staff between the Department and the US Bureau of Land Management. Mr Mark Cannon from the Kalgoorlie office, exchanged locations with Mr Ahmed Mohsen from Battle Mountain, Nevada.

The Quarry Rehabilitation Steering Committee commenced activities in August 1991 and held seven meetings and one site visit during the year. In response to public demand, the "Guidelines for the Development,

Operation and Rehabilitation of Quarries" publication was re-printed in May.

During the year the Department released a document entitled "Interim Guidelines on Safe Design and Operating Standards for Tailing Storages" as part of its program to improve management of waste disposal by the industry.

A clean-up operation to remove old mineral sands tailings with high radiation levels from rural and residential land at Wonnerup was completed. The operation was carried out by Cable Sands (WA) Pty Ltd under an agreement between Cable Sands, the Minister for Mines and land owners.

Continued support was provided to the mining industry in the form of analytical and advisory services on the environmental effects of mining operations. Two major gold mining companies are investigating rehabilitation techniques for tailings disposal areas and the Department is involved in monitoring the stability of the tailings during revegetation and soil conditioning trials.

Awards for Environmental Excellence in the mineral and petroleum industries were initiated in January 1992, with the first awards being due for presentation in July of that year. The awards are to be made annually to give recognition to those operators who have conducted their activities in an environmentally-sensitive manner. The awards are to be decided by a selection committee chaired by the Director General of Mines.

Standard procedures have been agreed with the Environmental Protection Authority and the Department of Conservation and Land Management for the processing of exploration tenements to ensure that suitable conditions are applied in environmentally sensitive areas. A set of guidelines was published during the year.

Petroleum Operations

A Senior Environmental Officer was appointed during the year and an environmental audit program was implemented to assess the impact of onshore seismic surveying operations in the Perth, Carnarvon and Canning Basins for the period 1985 to 1991. The audit program was backed up by field inspections in the three major onshore basins to monitor companies' activities and rehabilitation work.

There was improved co-ordination between relevant decision making authorities, the petroleum industry, interest groups and community in regard to environmental impact assessment and approvals. This was achieved through the provision of advice and guidelines by the Department.

A work-experience training program for new graduates from the Murdoch University School of Environment was implemented during the year.

Mapping Support

A range of mapping activities was undertaken to ensure that suitable conditions were applied to mining tenements to protect environmentally sensitive areas.

The regional conservation reserve map of Western Australia was updated. It continues to be in strong demand for use in the assessment of environmentally sensitive or restricted lands.

Mapping activities were undertaken to show the encroachment of mining tenements into Aboriginal Lands and Conservation Reserves while the EPA's Red Book areas were also plotted. Over 2 000 Conservation Reserves were entered into a plan monitoring system while work continued on developing a digital system to enable Declared Rare Flora to be identified at the mining tenement application stage.

The Conservation Estate

The Department participated in the formulation of the Marine Parks Policy which was released in May 1992. This policy clarifies the Government's position in relation to offshore petroleum and mineral exploration and development and Marine Parks and Nature Reserves. In accordance with the new policy, proposed new parks and reserves will be subject to a detailed mineral and petroleum resource assessment prior to subsequent Parliamentary approval.

Groundwater

Information was compiled on the Perth Basin to enable the preparation of a groundwater contamination susceptibility map. This will allow land-use decisions to be made that take into account the protection of groundwater quality.

Frequent advice relating to the location and management of landfill sites was provided to the Health Department. Advice on groundwater contamination (notably oil contamination beneath Fremantle Prison) was also provided to the Health Department and Environmental Protection Authority. Numerous bore

sites for road construction have been selected for the Main Roads Department in the Kimberley, Pilbara, Goldfields and Southwest.

The Chemistry Centre implemented changes to the chemical analysis procedures for groundwater, effectively reducing the backlog to around 5% of the intake level.

Community Consultation

During the year, two important consultative committees were established. The Minerals Environment Liaison Committee and the Petroleum Environment Liaison Committee are made up of representatives from conservation groups, trade unions, industry and relevant Government agencies. The committees meet on a regular basis to review the Departmental policies and activities relevant to this program. They are already making a contribution to improving the Department's overall performance by reviewing guidelines prior to release and suggesting areas that require special attention.

Transport and Storage of Dangerous Goods

The working party set up by the Department in 1989 to examine the feasibility of prescribing routes for dangerous goods vehicles delivered its report to the Western Australian Advisory Committee on Hazardous Substances. The working party made recommendations to protect the State's important water assets between Moore River in the north and the Murray River system in the south.

The recommendations included the proposal that the Main Roads Department category 1 and 2 routes be endorsed as the preferred routes for dangerous goods vehicles. Through traffic of dangerous goods vehicles should be prohibited along Neaves and Gnangara Roads across the priority 1 Underground Water Pollution Control Area. The committee also recommended that emergency response planning within the Western Australian Hazardous Materials Emergency Management Scheme be expanded to give due consideration to the environmental consequences of any spillage when wetlands and underground water pollution control areas are likely to be affected. Emergency response plans should be periodically tested and exercised while action is needed to identify and log drainage routes and water assets which may be immediately threatened by the spillage of liquid hydrocarbon fuels and solid cyanide in transport.

The report has been released for public review.

Planned Achievements for 1991-92	Outcomes
Implement an environmental audit program to monitor the efficiency of the petroleum industry.	Implemented an environmental audit program to assess the degree of environmental impact by onshore seismic surveying operations in W A Basins for the period 1985 to 1991.
Improve co-ordination between the relevant decision making authorities, the petroleum industry and the community in regard to the environmental impact assessment process.	Achieved improved co-ordination between decision-making authorities, the petroleum industry and the community in regard to the environmental impact assessment process through the provision of advice and guidelines by the Department of Mines, and the formation of the Petroleum Environment Liaison Committee.
Prepare and publish an updated conceptual plan for mining developments on the Golden Mile.	Continued work towards the completion of an updated conceptual plan for mining developments on the Golden Mile which will be published in 1992-93.
Improve environmental management of exploration activities by developing procedures and standard conditions for exploration tenements.	Standard procedures for the processing of exploration tenements have been agreed with the Environmental Protection Authority and the Department of Conservation and Land Management and a set of guidelines for standard conditions published.
Complete the current study of metropolitan storm-water infiltration basins.	Completed a study of metropolitan storm-water infiltration basins to assess the impact on Perth's groundwater.
Compile a groundwater contamination susceptibility map for the Perth Basin.	Compiled information from the Perth Basin for a groundwater contamination susceptibility map which will be completed in 1992-93 in response to community and Government concerns.
Improve the turn-around time for chemical analyses of groundwater; reduce backlogs to 5% of the intake.	The turnaround time for chemical analyses of groundwater has been improved to the extent that the backlog is now about 5% of the intake.
Complete the development phase of the computerised mining tenement system (TENGRAPH) and ensure the system provides the functionality required for assessment of conservation reserves.	The development phase of the computerised mining tenement system (TENGRAPH) is on schedule and arrangements have been made to ensure that assessment of conservation reserves is included in the system.

PROGRAM 4: Community Benefits

To ensure the community receives a fair return from the extraction of the State's mineral and petroleum resources.

In Western Australia, with only a few exceptions, mineral and petroleum resources belong to the community. However, under our economic system their extraction is undertaken by private sector developers.

The extraction and sale of mineral and petroleum resources provides benefits to the community. These benefits include employment, establishment of new towns and the provision of infrastructure as well as the direct financial payments made to the Government through various charges, rates and taxes. One of the charges is a royalty which represents a direct payment to the community for the loss of its non-renewable resource. As such it is a purchase price, not a tax which is a general revenue raising instrument.

The Department of Mines is responsible for the collection of mineral and petroleum royalties. This is undertaken on behalf of the State Government and the Commonwealth Government where projects lie in Commonwealth-controlled areas.

Royalty Systems

The method used to calculate royalty payments depends upon the value of the resource, the method of sale, and company accounting and financial structures. In 1981 the State Government adopted as a general policy a royalty level of 10% of the ex-mine value of production. The policy required royalties to be applied to the form in which the mineral was sold with rates set for each mineral to apply across the industry.

Since 1981 the WA Government has adopted a pragmatic approach to royalties with Government and developers negotiating arrangements which achieve the overall objectives but are tailored to the individual project. For this reason a wide range of systems and rates prevails which can be categorised into three broad types:

- Specific rate royalties are generally levied on low value products. Rates range from 30 cents to 50 cents per tonne with unique arrangements for some minerals.
- Ad-valorem royalties are based on the value of the mineral produced with rates varying from 1.65% to 7.5% of the sales value depending on the degree to which processing of the mineral takes place before sale. For petroleum, a rate of between 5% and 12.5% of the value of production at the wellhead is applied.
- Profit-based royalties have a much higher rate of royalty applied (generally 20%) but are based on net profit, thus allowing companies' deductions for all production costs.

Petroleum agreements are negotiated with producers which define the method by which the petroleum recovered is to be valued. These agreements are complex and take a considerable amount of time to negotiate. Royalty is collected on an interim basis until these agreements are finalised.

Resources Allocated to Program

Human Resources:	11 FTEs
Expenditure:	$0.67M

Divisional Roles

While the Royalties and Policy Development Division is primarily responsible for royalty collection, assistance is provided by four other divisions.

The Petroleum Division plays a significant role in ensuring technical standards are met for oil and gas metering systems. It ensures that accurate measurements are taken of petroleum quantity and composition.

The Geological Survey and Mining Engineering divisions provide geological advice and mineral project inspections to assist in royalty determination and collection.

This work is complemented by the Surveys and Mapping Division which provides maps and site location details.

Royalty Policy

Four petroleum royalty agreements were fully negotiated and finalised. Discussions continued with petroleum and mineral companies concerning requests for royalty relief and disputed royalty. The Department was involved in extensive discussions with the Commonwealth regarding the sharing of petroleum resource rent tax revenue and also participated in a Commonwealth/State enquiry into mineral royalties. The Department also has the responsibility for chairing a State inquiry into onshore petroleum royalties.

A review of specific royalty rates applying under the Mining Act commenced during the year.

The need for amendment to certain royalty provisions under the Mining Act was discussed with the Crown Law Department. These amendments relate to penalty provisions for unpaid and late payment of royalty, and the payment of royalty on the receipt of provisional sales amounts.

Royalties Collected

Total royalty payments to Government by mineral and petroleum producers was $375.1 million, of which $344.9 million passed through the State Consolidated Revenue Fund (CRF). Over 99% of the value of royalties was collected on time. The relationship between payments passing through the CRF account and royalty collections by the Department is shown below.

Royalty Collections ($M)

Legislation	Revenue Share: State	C'wealth	Total	Paid into CRF
State Legislation:				
Minerals	258.4	-	258.4	258.4
Barrow Island	8.1	24.4	32.5	8.1
Petroleum	40.5	25.2	65.7	65.7
Commonwealth Legislation:	12.7	6.0	18.7	12.7
Total 1991-92	319.7	55.6	375.3	344.9
Total 1990-91	297.5	60.5	358.0	324.4
Total 1989-90	252.0	49.9	301.8	264.2

Total royalty collections were 4.8% higher than the previous year. The State share of total collections was $319.7 million while the Commonwealth received $55.6 million which represents its share of royalty collected from offshore petroleum projects. In addition to royalty payments, the Department collected $24.5 million through iron ore additional lease rentals.

Royalty Audits

Royalties were paid by more than 140 companies operating under 27 Acts, including 23 project specific State Agreement Acts.

More than 850 royalty returns were received and checked at the Department's offices while over 1 200 returns were examined at company offices. Most royalty audits were completed in accordance with the audit plan but some difficulties were encountered, particularly in the industrial minerals area. Audit manuals for the Mount Newman and Hamersley iron ore operations were completed and significant progress was made towards completing a manual for all mineral sands projects.

The proportion of royalty audited increased significantly due to extensive company office audits conducted throughout the year. Of the total royalty received over the past two financial years, 84% has been fully audited and finalised. The remainder represents royalty payments which have not been audited either because they are being collected under interim arrangements, the returns were received late from producers, there was a backlog as in the case of petroleum production, or returns were received in the last month of the financial year.

A number of audit queries resulted from the royalty audits and these were discussed and where possible resolved. The issues discussed with companies are generally complex with those outstanding tending to involve large royalty adjustments.

Mining Information Database

To assist in identifying companies liable for royalties and to aid statistical and management reporting, the Department is developing a computer-based database covering all mines (MINEDEX). This system will include data on all mines and mineral deposits in Western Australia. Information about each site will include location, ownership, commodity, production and stage of development. Locality data is also included but has not yet been extended to a maintenance stage. All core data has been captured and 55% of the locality data completed.

Planned Achievements 1991-92	Outcomes for 1991-92
Completion of iron ore verification manuals.	Two iron ore royalty audit manuals were completed out of four planned. The remaining two are to be completed when resources are available.
99% of royalties collected on time.	99% of royalties were collected on time.
Royalty audits to be completed in accordance with audit plan.	Most royalty audits were completed in accordance with the audit plan but re–allocation of officers to higher priorities meant that some industrial mineral producers were not fully audited..
Penalty provisions in royalty collection systems to be reviewed.	Penalty provisions for royalties were delayed and are currently being discussed with Crown Law.
Three petroleum royalty agreements will be finalised	Four petroleum royalty agreements were finalised in accordance with the requirements of the Petroleum legislation
Specific-rate royalties will be reviewed.	The review of specific royalty rates commenced but has not been completed.
Extend MINEDEX coverage to maintenance stage and assist with monitoring statutory mine plans received.	The database on mines and reserves in Western Australia was not completely extended to a maintenance stage as allocation of staff to higher priority work meant that only 55% of the locality data has been completed.

PROGRAM 5: WORKER AND PUBLIC SAFETY

To ensure that all operations in the mining and petroleum industries, and activities involving explosives and dangerous goods, are conducted in a manner that is safe for workers and the public.

This program aims to achieve a low and decreasing incidence of serious bodily injury, occupational disease and fatalities among those employed in the petroleum and mineral industries; and an acceptably low level of risk to the public from the storage and handling of explosives and dangerous goods.

To achieve these objectives the Department employs scientifically and technically-qualified staff who develop suitable legislation; issue guidelines; audit and enforce compliance with regulations; promote and participate in safety education, training and research; monitor and audit industry safety systems and practice; and provide technical advice to Government, industry and the public.

Resources Allocated to Program

Human Resources: 116 FTEs

Expenditure $7.19 M

Divisional Roles

Six divisions of the Department are involved in this program with the specialised technical inspectorates from the Mining Engineering, Petroleum, Explosives and Dangerous Goods Divisions playing the major role.

The Mining Engineering Division has inspectors based in three mining centres with responsibility for ensuring safe working practices in mining operations across the State. They ensure that provisions of the Mines Regulation Act are complied with and that the occupational health of the industry's workforce is not jeopardised or compromised. This is achieved by regulation, inspection and a comprehensive education program.

The Geological Survey Division assists through the provision of geotechnical and rock mechanics advice and, in conjunction with industry and other research organisations, carries out studies and research on aspects of rock mechanics that affect mine safety.

The Surveys and Mapping Division records and preserves plans of mines and minesites to ensure that this information is readily available to inspectors.

The Petroleum Division acts to ensure public and worker safety in all petroleum exploration, construction and production activity.

The Explosives and Dangerous Goods Division acts to ensure public safety at places where explosives and dangerous goods are manufactured, stored or transported.

The Chemistry Centre undertakes technical inspections and tests and provides advice on occupational health matters within the mining industry for the Department and the Environmental Protection Authority.

An overview of Departmental activities is given below under the two sub-program headings.

WORKER SAFETY AND HEALTH

Lost-Time Injuries

While there is still room for improvement, the overall performance of the mining and petroleum sectors during the year was sound (Figure 9).

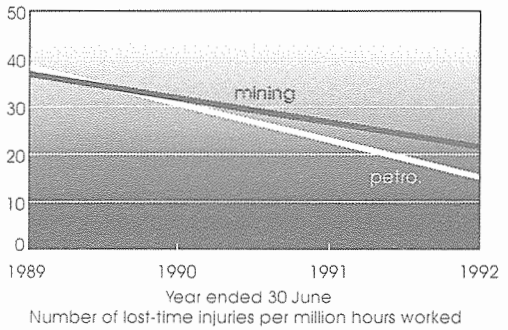


Figure 9. Lost time injury Frequency trends

The total number of mining lost-time injuries decreased by 355 between the years 1990-91 and 1991-92. There was an 18% decrease in the frequency of injuries and a 17% decrease in the incidence rate for mining overall (Table 1). Surface metalliferous mines recorded the most satisfactory performances, while the rates for underground coal remain unacceptably high (Figure 10).

The high rates for coal may be related to the different compensation arrangements applicable to that sector.

Despite the more difficult operating conditions, the offshore operations of the petroleum industry demonstrated the best safety performance (Figure 11). The increased level of offshore construction during the year, however, did contribute to a 17% increase in the incidence rate (Table 2).

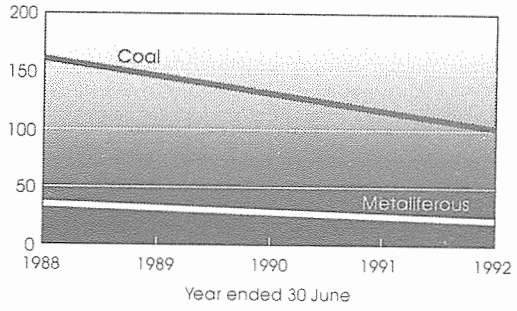


Figure 10. Western Australian mines
Lost time injury frequency rate trends

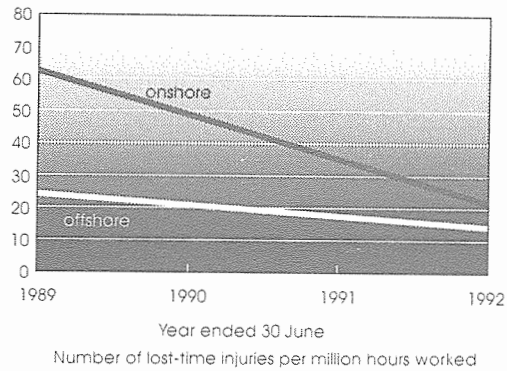


Figure 11. W.A. Petroleum industry
Lost time injury frequency rate trends

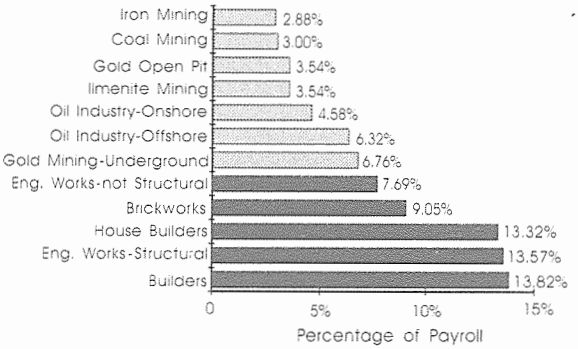


Figure 12. Recommended compensation premium rates 1992-93

The long-term trend for both industries remains favourable. This is reflected in the low levels of workers compensation premium rates in comparison to other general industry sectors (Figure 12).

Fatalities

Five fatalities occurred in the mining industry, of which three were in the underground nickel/gold sector. The fatality incidence rate of 0.147 per 1 000 employees, the lowest since 1986-87 (0.142), is still of serious concern to the Department. While the overall trend is declining there is still a scatter of incidence rates year-by-year which is typical of fatalities (Figure 13).

Full details of statistics were published during the year in the ninth 'Fatal and Lost Time Injuries in Western Australian Mines' report.

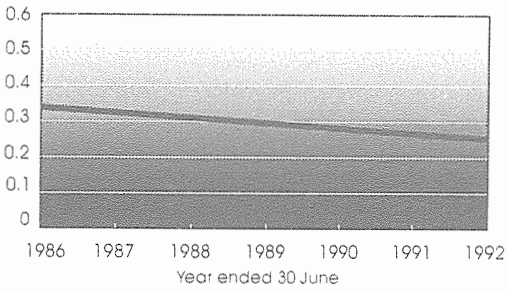


Figure 13. Fatalities per thousand employees

Table 1: Lost Time Injuries (LTI) - Mining

Mines	1990-91		1991-92		%Change	
	Incidence [1]	Frequency [2]	Incidence	Frequency	Incidence	Frequency
Metalliferous Surface	5	22	4	19	-20	-14
Metalliferous Underground	11	55	8	41	-27	-25
Metalliferous Total	5	25	4	21	-20	-16
Coal Surface	13	76	13	85	NIL	+12
Coal Underground	41	245	31	220	-24	-10
Coal Total	19	115	17	112	-11	-3
Total Mining	6	28	5	23	-17	-18

Table 2: Lost Time Injuries - Petroleum

Mines	1990-91		1991-92		%Change	
	Incidence [1]	Frequency [2]	Incidence	Frequency	Incidence	Frequency
Petroleum Onshore	9.8	44.7	4.5	20.5	-54	-54
Petroleum Offshore	3.0	13.7	3.5	16.1	+17	+18
Total Petroleum	4.9	22.3	3.8	17.3	-22	-22

 # Australian Standard AS 1885.1 - 1990

1.Number of LTI for each one hundred workers employed

2.Number of LTI for each one million hours worked.

Petroleum Engineering and Operations

The Schedule of Specific Requirements for design, construction and operation of petroleum pipelines was revised during the year and is expected to be released in the second quarter of 1992-93.

Progress continued on implementing the recommendations of the Consultative Committee on Safety in the Offshore Petroleum Industry (COSAP), but progress was slow due to the necessity for obtaining the approval of all State/Commonwealth Ministers for the guidelines and the need to implement legislative changes. The safety-case principles are progressively being introduced in relation to the assessment of new development applications.

A system for accreditation of independent design reviewers was implemented early in the operating year. Several local independent consultants were approved for pressure vessel design and minor structural work.

All petroleum inspectors have now undergone helicopter underwater escape and safety of life at sea training as part of a general industry-wide safety training program to increase the awareness of regular commuters to the potential hazards associated with transport to offshore installations.

Forty five field inspections were carried out during the year to monitor compliance with the Schedules and Acts. The frequency of field inspections was only 80% of that achieved in 1990-91, reflecting a lower availability of authorised inspectors to perform these functions.

Mining Operations

During the year, the inspectorate gave particular emphasis to ensuring that induction training for all employees was formally structured and carried out. Inspectors also audited all underground mines for their emergency preparedness with respect to fires and evacuation procedures. Many mines subsequently rectified inadequacies and introduced improved underground communications, strategically located refuge bays and self-contained self rescuers for their underground employees.

With records showing that diesel equipment and conveyor belts are the major source of underground fires, senior inspectors developed initiatives which ensured that all loaders, trucks and other vehicles rated at 100 kW or greater were fitted with fixed fire-suppression equipment. Nearly 350 underground vehicles are now equipped.

Sections of mines were closed and items of defective equipment taken out of service by the Inspectorate as the most immediate and effective action to prevent injury or harm to health.

Several prosecutions were successfully conducted for breaches of the Mines Regulation Act.

Safety education was enhanced by the regular publication of a newsletter, by the expansion of the "Nugget" series of safety pamphlets to 15 different themes, and the introduction of the Work Practices Series of pamphlets (five themes).

This year saw the introduction of an inspection system for exploration drilling safety and drill site environmental care. Over 280 inspections were carried out (target 180), with 1 531 safety defects and 27 environmental matters being brought to the attention of rig owners.

Figure 14 shows the mining industry injury index (days lost per million hours) has a close correlation with the declining trend of workers compensation premiums for the industy.

Geotechnical Advice

The increase in Departmental input into the geotechnical and rock mechanics aspects of open pit and underground mines continued with over 70 individual geotechnical assessments or reviews being completed. A large proportion of these assessments included field inspections in addition to office-based reviews of technical information. In many cases, the provision of this advice led to modifications in mine design and operating procedures by mine operators.

Research continued into the methods of mine design and ground control used in underground mines. Industry guidelines were published on recommended ground-control procedures and a handbook was prepared for Departmental Inspectors. In addition, seminars on ground control were organised in conjunction with the Brodie-Hall Research and Consultancy Centre at the WA School of Mines with over 60 industry representatives participating.

Collaborative research was instigated with the Chemistry Centre to assess the corrosion behaviour of friction rock stabilisers, a commonly-used rock bolt in underground mines. The results of these studies will be used as a basis for formulating future industry guidelines on the application of this type of rock bolt.

Occupational Noise

Inspection activity focussed on compliance with the occupational noise regulations gazetted on 15 February 1991. Guidelines to assist industry in meeting its commitments under these regulations were prepared and Departmental officers participated in industry training courses conducted through Curtin University.

Safety at Mineral Processing Plants

Inspection activity continued with the principal focus being the storage, handling and use of hazardous chemicals. Guidelines on the inspection of carbon-in-pulp gold processing plants were developed for use by the Inspectorate.

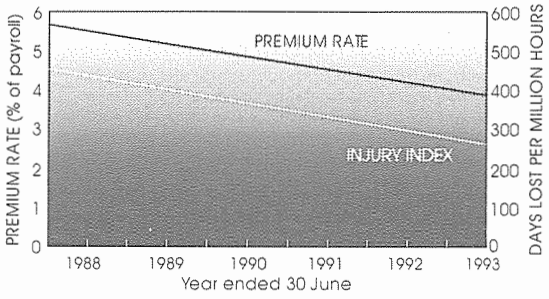


Figure 14. Western Australian mines
Comparison of injury index and compensation premium rate

Dust and Ventilation

Considerable attention was directed towards quantifying atmospheric asbestos fibre risk in underground gold and nickel operations. A guide on asbestos management in mining operations was developed and work commenced on a publication on the occurrence and management of asbestos in Western Australian mines.

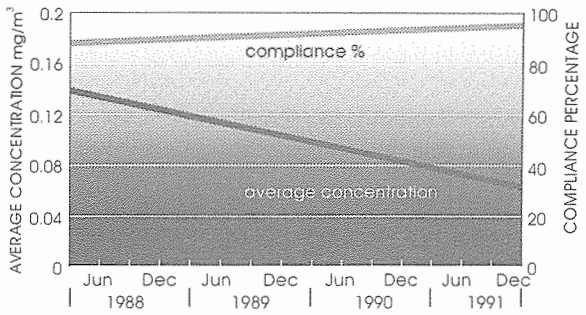


Figure 15. Crystaline silica sampling

Other airborne chemical agents investigated included manganese, vanadium, carbon disulphide, tetrabromoethane and bromoform.

Substantial progress is still being made in reducing the exposure of mine workers to crystalline silica, and respirable dust. Progressive reduction of these contaminants is being maintained (Figures 15 and 16) and compliance is high with over 95% of samples tested complying with the exposure standard.

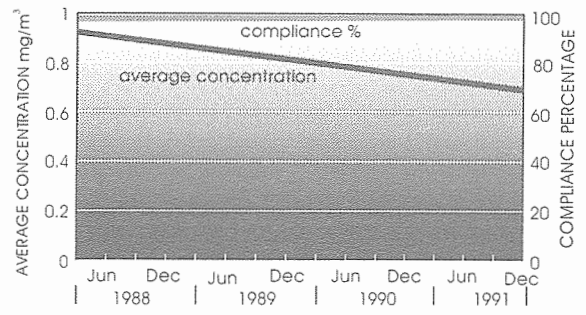
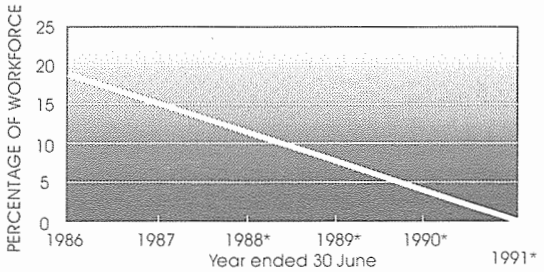


Figure 16. Respirable dust sampling results

The recording system for atmospheric contamination (CONTAM) was revised and introduced on 1 January 1992. The new system aids the Inspectorate in setting dust and contaminant sample quotas, and also provides on-line analysis and trend information. New atmospheric contaminant sampling guidelines, incorporating revised Australian Standards, were prepared and published.

Radiation

Further reductions in the radiation exposure of mineral sands workers were achieved. The percentage of the workforce assessed as receiving a radiation dose in excess of 15 millisieverts (mSv) has been reduced from 21% in 1986 to 0.5% in 1991 (Figure 17). No mineral sands worker received a radiation dose in excess of the occupational exposure standard of 50 mSv.



* Respiratory Protection Usage Accounted For At 1 Site Only

Figure 17. Radiation exposure
(Dose equivalent greater than 15 mSv)

A bioassay program completed during the year found that the amount of the radioactive element, thorium, absorbed and excreted by mineral sands workers was much less than expected. Further work is planned to clarify this situation and obtain information which will allow the best estimate of radiation dose.

Medical Surveillance of Miners

During the year, a discussion paper was prepared on the establishment of a revised medical surveillance system for mine workers. The existing system does not reflect current occupational hygiene conditions in the industry. However, as any change to the existing system needs careful consideration and extensive consultation, progress in developing a new system has been relatively slow.

Inquiry Into Safe Working Practice In Underground Gold Mines In Western Australia (the Torlach Inquiry)

There is evidence that as a result of this inquiry, industry has introduced new safety systems, procedures and equipment.

Safety-training programs continued, including joint health and safety representative courses conducted by TAFE. These have been well supported throughout the gold and nickel mining sectors.

Emergency response capacity and mine-rescue training and co-ordination were also given a high priority.

Enquiry Into Occupational Health And Safety In The Mining Industry In Western Australia (the Kelly Enquiry).

Departmental staff were actively involved in the enquiry process over several months with the State Mining Engineer committing considerable time and resources to assist Mr Kelly on the enquiry throughout this period.

The report was submitted to the Government in December 1991, and subsequently distributed to relevant bodies. The Department produced a response to the report in March 1991. The Government had not announced any decision on the Kelly recommendations at the end of the financial year.

An internal review of administrative support available to the Department's engineering inspectorate was undertaken following concern about this aspect raised by Mr Kelly. The recommendations arising from the review were under consideration at the end of the financial year.

Legislation Committee for Occupational Health, Safety and Welfare

The necessary regulations to enable proclamation of the Mines Regulation Amendment Act No. 85 of 1990 were drafted. Following review through the Commission for Occupational Health, Safety and Welfare, the proclamation was prepared. Proclamation has been delayed while further discussions take place between the Government and interested parties.

Concerns by Trades and Council representatives in October 1991 to the wording of the occupational health and safety requirements in the new Coal Mines Bill has delayed the Bill's submission to Parliament. The Bill is still before the WA Occupational Health and Safety Commission. Re–drafting of all regulations is in progress.

Retrospective Study Into Fatal Accidents In The Mining Industry

A retrospective study into fatal accidents in the mining industry was commissioned by the Minister for Mines after discussions with the Department, the Australian Workers Union (AWU), and the Chamber of Mines and Energy WA.

The purpose of the study was to determine, as far as practicable, the underlying causes of fatalities, and enable lessons to be learned which are not evident from examination of the circumstances of individual accidents.

The study was carried out by officers of the Chamber and the Department as the AWU was not able to nominate a representative.

The report was completed early in 1991 and published and distributed widely in March of that year. Local and interstate demand required a second printing.

The report identified and analysed the major causal factors with the critical areas in safety performance being highlighted. Recommendations were made for remedial action and some of these will result in changes to regulations.

Very positive responses to the report were received across the industry.

MANAGEMENT OF DANGEROUS GOODS

The monitoring of major chemical plants suffered a setback with the resignation of the Safety Co-ordinator midway through the year. Lower staff levels caused some longer term projects and audits to be deferred and the focussing of operations on the most critical areas to maintain confidence that major risk areas were being addressed and risks were maintained at an acceptable level.

The completion of a satisfactory quantitative risk analysis, the development of comprehensive emergency response plans, and the demonstration of the ability to maintain a high standard of emergency response capability, resulted in approval for the Esperance Port Authority to import up to eight 2 000 tonne shipments of ammonium nitrate through the port each year.

The reporting responsibilities within the Explosives and Dangerous Goods Division were altered in order to closely align its public safety functions with its structure. Staff numbers fell 17% during the year with the consequent effect that three of the five branches were unable to meet their workload targets for the year.

National uniformity in the regulation of dangerous goods is a significant micro-economic reform to which this program is committed. While actively embracing the principles and being fully committed to the goals of national uniformity, participants are ensuring that local needs are considered and there is no diminishment in public safety. Significant steps have already been taken in relation to of interstate movements of explosives and other dangerous goods by the adoption of national transport codes.

The Dangerous Goods Regulations, which will apply public safety principles to the storage, handling and transport of dangerous goods in Western Australia, were awaiting approval for publication at the end of the year. The Regulations call up a variety of Australian Standards and Codes of Practice to maximise national uniformity.

The Dangerous Goods Regulations were developed with the co-operation of industry and the unions. This co-operation continued in anticipation of proclamation of the Regulations with the development of a series of seminars and other public events to ensure that all those affected are aware of their responsibilities and the dates when the regulations come into effect.

Changes in work processes resulted in a performance improvement in the transport of dangerous goods with the annual work targets being exceeded. This improvement is attributed to two significant changes. The first was agreement with industry for vehicles to attend a central point for routine inspection, and the second was the use of accredited third-party auditors to check tank pressure tests.

Planned Achievements for 1991-92	Outcomes
Increase the frequency of petroleum installation inspections and deploy multi-discipline teams of inspectors.	The frequency of petroleum industry field inspections was only 80% of that achieved in 1990-91 reflecting a lower availability of authorised inspectors to perform these functions.
Implementation of recommendations from the report of the Consultative Committee on Safety in the Australian petroleum industry aiming at minimising the risk to workers, the public and the environment.	Progresive implementation of the recommendations of the Consultative Committee on Safety in the Offshore Petroleum Industry (COSOP) was achieved despite some delays because of the need for Australian and New Zealand Minerals and Energy Council (ANZMEC) approval of the guidelines and the need to implement legislative changes.
Expedite the proclamation of the Mines Regulation Amendment Act 1990 (No 85), following revision of the Mines Regulation Act Regulations.	After a protracted process of review through the Commission for Occupational Health, Safety and Welfare the proclamation was prepared but Proclamation is now delayed due to representations made to Government by several unions.
Maintain a high level of activity by the Inspectorates, in particular in education, training and safety promotion initiatives across the mineral and petroleum industries.	The planned high level of mine inspections, mine safety audits and consultation with safety committees and their representatives was achieved during the year.
Increase Departmental input into geomechanics programs, both open pit and underground.	Collaborative research into the corrosion behaviours of friction stabilisers - a method of ground support susceptible to corrosion - was initiated during the year as part of the Department's effort to improve safety in mines. The project involves input from the Mining Engineering Division, the Geological Survey and the Chemistry Centre.
Improve the format of data and summary presentation from the AXTAT system to facilitate wider use in industry by safety committees.	The format of data from the AXTAT system published in 'Fatal and Lost Time Injuries in Western Australian Mines' was reviewed and some changes made to address a wider readership. These changes were supplemented by safety publications directed at specific themes in the 'Nugget' and 'Work Practices Series' of pamphlets, and to topical themes through the MINESAFE magazine.

Planned Achievements for 1991-92	Outcomes
Continue to implement the recommendations of the 1990 Torlach Safety Inquiry following the Action Plan format.	Recommendations from the1 990 Torlach Safety Inquiry have been implemented extensively throughout the industry. Overall improvement in accident statistics, and the doubling of entries in the 1991 underground mine rescue competition confirm that the momentum for improved safety performance has been sustained.
Complete the Coal Mines Regulation Act revision and press for its enactment.	Concerns by the TLC representatives in October1991 to some wording in the new Coal Mines Bill delayed the Bill being progressed to Parliament. The Bill is still before the WA Health and Safety Commissioner. The total re-write of the regulations is progressing.
Continue to effect reductions in the level of assessed radiation doses to workers in the mineral sands industry in accordance with the ALARA Principle.	Reduction in the radiation exposure of mineral sands workers continued to be achieved. The percentage of the workforce assessed as receiving a radiation dose in excess of 15 mSv has been reduced from 21% in 1986 to 0.5% in 1991.
Commence a review of underground mine design methods and ground support, prepare a handbook on ground-support techniques, and conduct seminars on underground mine design and ground support techniques.	A review of underground mine design methods and ground support was initiated in February 1991 and a total of four seminars were held for industry personnel.
Develop criteria to identify preferred routes for dangerous goods vehicles and procedures for improving public safety with respect to packaged dangerous goods	The criteria to identify preferred routes for dangerous goods vehicles were developed and published during the year.
Promulgate and implement comprehensive dangerous goods regulations based on national codes.	Comprehensive dangerous goods regulations, based on national codes, were proclaimed in June 1992.
Complete a preliminary Departmental review into the Explosives Regulations, policies and administration.	A planned review of the Explosives Regulations, policies and administration was deferred pending implementation of a new structure in the Explosives and Dangerous Goods Division.

PROGRAM 6 : CHEMICAL SERVICES

To enhance agricultural and industrial development, and the protection of community, consumer, environmental and health standards, by providing high-quality independent chemical services to Government, industry and the public.

This program encompasses the main role of the Chemistry Centre which is to provide a range of highly-specialised services to Government, industry and the Western Australian public as distinct from the investigative and consultancy services undertaken in Programs 2, 3 and 5.

The program provides chemical advisory, problem solving, investigative and emergency response support to Government agencies, industry and the public. Government policy sectors supported include court services (Coroner), consumer assistance, Police services, prisoner detention and corrective services, occupational and public safety, disease prevention and health promotion, agriculture, environmental protection, conservation and construction and property services. Support is also provided to industries including the racing agencies and to the public.

The Chemistry Centre generally does not compete with private industry and where possible diverts routine analytical work to private laboratories. It exists principally to solve chemical problems which arise in Government instrumentalities and industry.

The Chemistry Centre also has statutory and advisory responsibilities in several Acts dealing with certification of analysts and analytical procedures. Furthermore, the program aims to ensure that the appropriate chemical competence and quality scientific services are available to industry and the public in Western Australia, especially in regard to industry's responsibility to ensure it meets Government, consumer, environmental and health standards.

The strategies adopted to achieve these objectives include the employment of specialist scientists, the maintenance of National Association of Testing Authorities (NATA) accreditation for an extensive range of chemical tests, and the upgrading of quality assurance programs to meet Australian Standard 3902. The scientific expertise of the staff, combined with sophisticated instrumentation, allows clients to be provided with reliable analytical and scientific information, interpretive and expert advice, solutions to problems, investigative assistance, and rapid response to emergencies.

Resources Allocated to Program

Human Resources:	103 FTEs*
Expenditure:	$5.75 M

* Includes 9 FTEs funded from external sources.

Agricultural Chemistry

Laboratory staff, working in conjunction with the Department of Agriculture, have completed a major survey which demonstrated that molybdenum deficiency in wheat could be assessed at a specific early stage of growth. As a consequence, the Department of Agriculture has launched a molybdenum diagnostic service. Samples are forwarded to the Laboratory for analysis with the results being passed on to the Department's extension officers within two weeks of receival.

Continuing support is provided to the Department of Agriculture's research efforts to improve the efficiency of fertiliser usage, particularly in the production of vegetables. Crops being investigated include potatoes, onions, lettuce, carrots and cauliflowers. These crops often receive very high rates of fertiliser application and the common theme of all the trials is to reduce nutrient leaching from the soils of the Swan Coastal Plain. Any reduction in leaching will result in less contamination of ground waters and less eutrophication of surface waters.

The Chemistry Centre assisted the Department of Agriculture and the Australian Customs Service in the screening of fertiliser consignments from the USA for

heavy metal contamination. The finding of violative levels of cadmium and lead in these consignments led to the successful prosecution of the exporter in the USA by the US Environmental Protection Agency.

Tests were developed to assist in the minimisation of nutrient loss in ground water and waterways as required by the Environmental Protection Authority. Details have also been provided to industry to assist in the development of housing and recreational facilities so that they have minimal impact on the environment.

The Laboratory assists the Department of Agriculture in its lupin breeding and production projects by providing a rapid assessment of the alkaloid content of the lupin grain. Lupin production has increased considerably in recent years with the Western Australian annual production now more than 700 000 tonnes. This provides export earnings of over $100 million to the State.

In most areas of the State, low soil phosphorus levels limit lupin production, and fertilisers, such as superphosphate, have had to be applied in recent years. Consequently, the Laboratory has analysed large numbers of lupin grains and lupin tops for phosphorus as part of a Department of Agriculture program investigating the effect of placement of superphosphate on lupin production. This work has demonstrated that laying down a band of fertiliser at a depth of 5-8 cm below the seed at sowing is the most effective and efficient way of applying fertiliser. The value of this potential increase in annual lupin production is in the order of several million dollars.

Forensic Science

The Forensic Science Laboratory's prime function is to assist law enforcement agencies in the detection and prosecution of crime. In order to provide a more responsive service, automation has been installed to improve the utilisation of human resources and expensive equipment. Gunshot residue particle detection in shooting cases is the most recent example of automation of an otherwise highly labour intensive operation. The result has been the elimination of backlogged gun shot residue cases and the ability to respond on an overnight basis to urgent enquires. A further example of automation in physical evidence examinations has been in the examination of fire debris for flammable accelerants. Ten items can now be analysed on each overnight run.

The Forensic Science Laboratory assisted Police in testing fingerprint enhancement reagents. Officers from the Laboratory have also assisted in Police training courses.

Assistance was provided to the Police in evaluating roadside and evidential breath-alcohol testing equipment. The Laboratory also assisted in the development of world-class breath analysis testing equipment by a Western Australian company.

Environmental Chemistry

Sources of water contamination are widespread and examination of potential sources has been the subject of extensive investigations by the Environmental Chemistry Laboratory. A major survey of metropolitan tip sites for the Health Department has indicated some potential problems in the detection of polynuclear aromatic and petroleum hydrocarbons.

Work continued with the Main Roads Department and Water Authority to study the environmental effects of run off from roadways into metropolitan lakes and compensating basins. Significant quantities of heavy metals and other materials have been found to enter lakes through this route.

The Laboratory was required to give a site-contamination clearance for a potential major industrial investment in Canning Vale. An analysis of soil and groundwater revealed only traces of pesticides and other chemicals. A major survey of Perth's metropolitan coastal waters showed that the marine environment is relatively non-polluted.

The Laboratory worked with the Western Australian Water Authority in investigating the groundwater quality compliance with accepted guidelines for organic pollutants in the Geraldton and Esperance regions. This work followed an extensive metropolitan area survey in 1989-90. Traces of disinfectant by-products have been detected in most reticulated water supplied, but at levels well within internationally-acceptable guidelines.

An analytical service was provided for the Environmental Protection Authority and Waterways Commission for monitoring water bodies such as the

Western Australian Estuaries including the Swan River and Peel. Special emphasis was given to effluents from Albany industries discharging into Princess Royal Harbour.

The Fruit and Vegetable Pesticide Residue Program 1991-92 was successfully completed with a revised sampling schedule. Two percent of the tested samples exceeded the maximum residue limits while 64 % had no detectable residues.

The Environmental Monitoring Sub Committee was established with membership drawn from Government departments and authorities and with provision for interaction with tertiary organisations and the private sector. Data gathering has commenced. The Government and public will be provided with advice and reports on residue monitoring projects in Western Australia.

Health Chemistry

Analytical services were provided in support of the on-going Western Australian Food Monitoring Program conducted by the Health Department. This work resulted in the joint production of reports on "Leachable Lead from Crystal Glassware", "Sulphur Dioxide in Foods" and "Mycotoxins in Western Australian Foods". Analytical work is continuing on projects involving "Nitrates and Nitrites in Smallgoods", "Edible Oil Survey" and "Lead in Canned Foods".

The timely preparation of a report on cadmium in Western Australian potatoes occurred just prior to a media report on contaminated superphosphate being shipped from the USA to Western Australia. The report demonstrated that, in general, cadmium residue levels in potatoes in Western Australia were lower than those found elsewhere in Australia.

The Chemistry Centre, in conjunction with the Health Department, assessed staff exposure to waste anaesthetic gases in seven country hospitals. Recommendations have been made to modify the ventilation and procedures in theatres and recovery rooms.

Methods were developed for the analysis of an additional five organic chemicals which occur in urine and are indicative of exposure to chemicals. These tests assist the Department of Occupational Lealth Safety and Welfare (DOHSWA) and other agencies assess workplace and community exposure to chemicals.

Materials Science

The Materials Technology Laboratory's contribution to the 19th Australian Polymer Symposium "Greening the Polymer Industry" was highly relevant to Government policy, which aims to recycle many products and more effectively use others. Apart from contributing seven papers, the Laboratory helped to organise the successful conference.

The Laboratory was also active in solving materials problems and investigating material failures in the polymer, building and mining industries. Assistance was also given in the preparation of specifications for cleaning and polishing products used in Government contracts.

Assistance was provided to the State Tender Board in the writing of specifications for many new cleaning and polishing products. The specifications were written to reflect both the needs of users and the environmental concerns of the community.

The building industry was assisted by investigations of paint failures, many of which were on swimming pools, and the assessment of a range of graffiti removers and anti-graffiti coatings. This latter work also assisted in resolving a sensitive union dispute.

The Ministry of Consumer Affairs was assisted with the evaluation of the stability of an automobile jack which slipped in use and nearly caused injury. The jack passed all safety requirements tested. Assistance was also given to DOHSWA in the evaluation of the cause of failure to rigging causing a death on a prawning trawler in Carnarvon. The close proximity of a high intensity light caused a synthetic rope to melt.

Racing Chemistry

The Racing Chemistry Laboratory's prime function is to monitor blood and urine samples taken in connection with horse and greyhound racing and pacing as part of programs to keep competing animals free of drugs at the time of racing. The drug testing program also includes testing urine samples taken from jockeys and reinspersons. Pre-race blood testing of total carbon dioxide levels in horses has been also

implemented. During the past 12 months the Laboratory increased the range of drugs detected and reported 20 positive cases.

Although these consisted primarily of anti-inflammatory drugs, other notable findings included a narcotic analgesic and two anabolic steroids. Only one positive finding resulted from the jockey and reinsperson testing program.

Mineral Chemistry Complex

Funding was provided in 1991-92 for the preparation of detailed plans and tender documents for Stage 1 of the Chemistry Centre's Bentley complex. Stage 1, the Mineral Research Centre, will see the housing of the Western Australian component of the CSIRO's Division of Mineral Products and Curtin University of Technology's School of Chemical Engineering, adjacent to the Mineral Processing Laboratory of the Chemistry Centre. Stage 2 will see the transfer of the remaining Chemistry Centre Laboratories to the Bentley site.

Training and Consultancy Programs

An important aspect of the Chemistry Centre's activities is to utilise its various areas of expertise to train staff in other Government agencies and industry. The Health Chemistry Laboratory, for example, was involved in conducting a variety of lectures and seminars on occupational health issues. These included presentations to TAFE, Conservation and Land Management and mining industry staff at surface and underground ventilation officers courses held by the Department of Mines. Similarly, the Forensic Science Laboratory staff were involved in training and examining Police officers responsible for calibrating and using breath analysis equipment. This is an essential function to ensure that breath alcohol tests are performed correctly.

Forensic staff assisted the Police by acting as instructors and observers at a four–day training exercise on explosives and bomb scene investigation. The staff also had a major role in assisting Police Forensic Branch training for new officers through lectures, discussions and practical demonstrations in the Laboratory.

Chemistry Centre expertise was exported in the form of consultancies when two staff members, one from the Environmental Chemistry Laboratory and one from the Health Chemistry Laboratory, spent four to six weeks providing assistance to the Malaysian Ministry of Health. Advice and recommendations on laboratory services and appropriate monitoring programs to ensure a safe food supply were made. Follow-up consultancies are planned for 1993.

Cost Recovery

Chemistry Centre charges are set to recover full costs including Consolidated Revenue Fund expenditure and allowances for superannuation, rent and equipment depreciation. Industry, public and Government Authorities are charged for Chemistry Centre services while Government Consolidated Revenue Fund funded agencies are notified of the cost. Financial procedures have been refined to allow the Laboratories to control an increasing proportion of their expenditure. These procedures will be enhanced as more computerised financial and laboratory management systems are implemented.

Laboratory Information Management Systems

Funding was made available to commence implementation of the Centre's Information Technology Plan. This plan will increase productivity in the Laboratories as well as support management systems handling the accountability information associated with full cost recovery. After an exhaustive evaluation which went to tender, an Australian product (METRIX) was chosen from the range of commercially-available laboratory information management systems. Two METRIX systems were ordered for installation in larger Laboratories. In parallel with these developments, attention was focussed on selecting an appropriate accounting software package for the administration function; this has to be of industry standard, with full accrual accounting capabilities, and meeting Government accounting standards.

Planned Achievements for 1991-92	Outcomes
Expand the soil chemistry activities in the Agricultural Chemistry Laboratory by closer interaction with interested bodies which require advice and soil tests to minimise nutrient loss into groundwater and waterways, and to meet EPA regulations.	Tests by the Agricultural Chemistry Laboratory have been developed to assist in the minimisation of nutrient loss in groundwater and waterways as required by the Environmental Protection Authority. Details have also been provided to industry to assist in the development of housing and recreational facilities which have minimal impact on the environment.
Continue to liaise with the EPA and Waterways Commission to ensure efficient and integrated analytical services for monitoring of water bodies for nutrient pollution.	The Environmental Chemistry Laboratory provided an efficient analytical service to the Environmental Protection Authority and Waterways Commission for monitoring water bodies such as the Western Australian Estuaries including the Swan River and Peel. Special emphasis was given to effluents from Albany industries discharging into Princess Royal Harbour.
Co-operate with Health and Agriculture Departments to ensure adequate and efficient monitoring of foodstuffs for pesticide contamination. Fruit and vegetable surveys to be maintained at one species per week minimum.	The Fruit and Vegetable Residue Program 1991-92 was successfully completed with a revised sampling schedule. Two percent of the tested samples exceeded the maximum residue limits whilst 64 percent had no detectable residues.
Establish through the Pesticides Advisory Committee a State pesticides monitoring data base which will collate all information available on pesticide monitoring in Western Australia.	The Environmental Monitoring Sub–Committee has been established with membership drawn from Government departments and authorities and with provision for interaction with tertiary organisations and the private sector. Data gathering has commenced. The Government and public will be provided with advice and reports on residue monitoring projects in Western Australia.
Develop and provide an enhanced fingerprint visualisation service for use by the Police in more difficult cases.	The Forensic Science Laboratory has assessed and assisted police in trialing fingerprint enhancement reagents. Officers from the Laboratory have also assisted in the Police training courses.
Continue a major survey jointly with the Health Department to determine levels of preservatives in local foods, in response to community health concerns.	A major survey, in response to community health concerns, has been conducted in collaboration with the Health Department to determine levels of food preservatives, in particular sulphur dioxide, nitrates and nitrites in processed foods. The results of these surveys have been published and provided to the community at large.

Planned Achievements for 1991-92	Outcomes
Increase the range of organic metabolites being determined for assessment of workplace and community exposure to chemicals.	Methods were developed by the Health Chemistry Laboratory for the analysis of an additional five organic chemicals which occur in urine and are indicative of exposure to chemicals. These tests assist DOHSWA and other agencies assess workplace and community exposure to chemicals.
Increase activity in investigation of corrosion and metals failure.	The Materials Technology Laboratory undertook several corrosion investigations including an investigation for the Mining Engineering Division on the corrosion of friction rock stabilisers. This investigation was linked to underground mine safety. The Laboratory has also investigated metal failures for DOHSWA, Ministry of Consumer Affairs and the Small Claims Tribunal.
Provide assistance in projects involving recycling waste products as alternatives to environmentally unacceptable products.	The Environmental Chemistry Laboratory provided expert input and consultative advice to the Health Department on recycling of waste products and on alternative and more environmentally friendly procedures.
Continue efforts to increase the range of drugs investigated in each sample submitted by the racing bodies.	The Racing Chemistry Laboratory increased the range of drugs detected in samples submitted by the racing bodies through the improvement of existing detection methods, the development of new methods and the incorporation of new commercial tests, as part of routine screening procedures.
Continue survey work to determine hospital theatre and recovery room staff exposure to anaesthetic.	The Chemistry Centre, in conjunction with the Health Department, assessed staff exposure to waste anaesthetic gases in seven country hospitals. Recommendations have been made to modify the ventilation and procedures in theatres and recovery rooms as a result of these assessments.

PROGRAM 7: Corporate Services

To ensure that the human, financial and other resources of the Department are used efficiently and effectively to provide a service responsive to the needs of the community, industry and Government.

The Corporate Services function provides administrative support services to the Department's Corporate Executive and operating divisions to assist in optimising the resources provided by Government.

The nature of these services is not only affected by the requirements of the operating Divisions, but is influenced by Government policy and the requirements of agencies such as the Department of Premier and Cabinet, Public Service Commission, Treasury, Office of Government Accommodation, State Services and Building Management Authority.

The trend in recent years towards greater Departmental accountability has seen a number of central agency functions devolved to the Department, putting pressure on resources within this program. This has necessitated a continuous review of systems and procedures to make the best use of staff and other resources.

Resources Allocated to Program

Human Resources: 99 FTEs

Expenditure: $7.81 M

The following summary emphasises the activities of the Corporate Development Division.

Corporate Planning

Over the last few years, the Department's corporate management process has been refined to enable the resources required to support the Department's programs to be clearly identified.

During the year, program steering committees were established with responsibility for developing, monitoring and reporting on the elements that make up each program.

The steering committees work under a model framework and program cycle which identifies agenda elements under consideration at any time. The framework will also assist the committees to meet program statement and Annual Report requirements in a co-ordinated and orderly manner.

The program committees will also have responsibility for reviewing the effectiveness of programs and the monitoring of outcomes. It is intended that over the next 12 months a schedule of program evaluations will be determined.

Management Services

In addition to co-ordinating the Department's capital and minor works projects, carrying out reviews into Departmental operations and providing a supply service, the Management Services Branch deals with all services of an administrative nature not covered by the other functional branches.

Significant achievements for 1991-92 were:

Capital Works

The Department was allocated $1.614 million for Capital Works in the 1991-92 financial year of which $114 000 was to complete works in progress. The balance of $1.5 million was provided to commence the detailed planning for Stage 1 of the new Chemistry Centre Complex at Bentley. The air conditioning for the Department's central computing facility was also upgraded at a cost of $55 000.

Building Services

Due to problems experienced with the existing security system within the Mineral House complex, a review of the system was undertaken.

Work commenced to increase the effectiveness of air conditioning within the Mineral House complex by integrating the computerised plant in Mineral House North with the manually-operated plant in Mineral House South.

Energy consumption for the 1991-92 financial year within the Mineral House complex increased primarily because of the installation of an additional air conditioning unit to service upgraded computer equipment. This increase in energy consumption was offset to a large extent by energy conservation initiatives undertaken during the year, thus keeping the energy consumption increase to a minimum.

Supply Services

Using the authority devolved to the Department, significant savings were achieved, including $100 000 for purchases of goods and services by locating competitive suppliers through effective sourcing practices; and $30 000 per year by formalising current service arrangements through the Department's contract/tendering system.

The Department actively supports recycling initiatives. During the year, the nomination of a Waste Paper Recycling Officer and promotion of recycling activities resulted in a steady increase in the collection of waste paper for recycling and the purchase, where possible, of recycled products.

Project Services

A computerised asset management system was successfully implemented. This will be used in conjunction with the existing motor vehicle and computer hardware/software assets systems to ensure the Department's assets are correctly managed.

The Department participated in and contributed to the establishment of a computerised Business Licence Centre for Western Australia, and will be seeking to gain "in-house" access to this centralised legislative and licence data base as an aid to the inspectorial and regional functions of the Department.

Computing

Good progress on the development of a number of key computer-based projects was achieved using innovative systems design and building techniques. The following industry based applications have been undertaken during the year:

TENGRAPH - This system, now under development, will utilise state-of-the-art networking, workstation and software techniques. Recent technological advances have provided higher levels of network reliability and improved data security which will enable the system to provide cross-department and public enquiry/access to tenement title and associated public plan information.

Mineral Exploration Database - WAMEX 2. Development effort on industry sub-systems will provide an enhanced database, an improved query facility to industry and the ability to extract and download required sub-sets from the database to micro–computers.

Western Australia Petroleum Exploration System - WAPEX - Development and implementation of enhanced WAPEX database has been undertaken with an improved query facility.

Contaminants Monitoring System - CONTAM 2. Development and implementation of an enhanced CONTAM database with an improved query facility was completed.

Mines Index Systems - MINEDEX & MININFORM. These systems required the development and implementation of a new comprehensive index and database of all WA mines and associated mineral deposits.

The development of a system to enable industry access to Departmental databases was undertaken, resulting in the completion of testing and evaluation, and the demonstration of a dial-in access facility. When implemented, this system will enable significantly faster and more direct access by industry and the public to Departmental databases.

To assist this development, completion of key extensions to the Departmental Local Area Network (LAN) was undertaken with automatic datalinks to the regional network and other WA Government agencies. There are now over 150 personal computer/intelligent workstations connected to the Departmental LAN.

During the year, additional effort was made to revise standards and improve controls by the introduction of revised personal computer and workstation standards and computer system development standards.

In addition, a Departmental audit of all computing hardware and software against the Department's

Assets Register was undertaken. As a result of the audit, tighter control measures have been introduced for the Department's personal computers.

Usage of the Department's centralised computer-based information systems has continued to increase at around 20%, in line with the capacity plan forecast. An upgrade to the central computer is expected early in 1992-93. The Department is also investigating the use of new micro–computer and LAN technologies in accord with industry trends to 'down size' or 'right size' corporate computer applications.

Word Processing

The ageing Wordplex equipment has proved difficult to maintain and within funding restrictions a graduated replacement plan was commenced. The replacement plan using the new Local Area Network (LAN) and microcomputers utilises standardised "Word for Windows" word processing software and is planned for completion in 1992-93.

Emphasis was placed on recruitment and personal development with an increased number of staff attending training courses to raise the quality of typing services and adapt to new technologies.

Records Management

Steady increases were experienced in the amount of incoming correspondence received, the number of Administrative, Mining Tenement, Petroleum and Mining Project files created, and the volumes of mail despatched. This was partially offset by a reduction in mining tenement correspondence received.

During 1991-92, new initiatives were undertaken to improve Records Management within the Department, including the establishment of protocols for the creation and title structure of "Petroleum Title" and "Petroleum Project" files and the establishment of Prime Headings for "Structured File Titling". All files created in 1991-92 have been structured according to the new file classification system.

An increase in the microfilm program enabled 43 000 inactive files to be filmed and destroyed (20 000 in 1990-91) to make better use of available physical storage areas.

Information technology continued to play a significant role in providing timely and effective services to the Department and industry. During the year further use of the Computerised Records Management System (RMS) was made to improve information management by recording Energy Policy and Planning Bureau and Exploration Safety and Drilling Branch files on the system.

In addition, an RMS facility to automatically print file covers using laser printers was introduced.

Telecommunication Services

Continued monitoring of telephone usage through the computerised Telephone Information Management System has enabled effective and efficient use of PABX facilities and cost control.

Technological advances in the facsimile industry have resulted in the use of PC-based communication facilities for receiving and sending facsimiles. As a result, the Department has updated its Facsimile Policy and Standards to ensure effective use of this new technology.

Financial Management

Following on from the major redevelopment of the financial management information system in 1990-91, which was undertaken to enable budgeting and financial management reporting to be conducted on both a program and divisional basis, further work has been undertaken in 1991-92 to refine and enhance the reporting system, including commitment reporting.

Development of a centralised sundry debtors system was initiated during the year and a design concept developed for its implementation in 1992-93. The fundamental aims of the system are to centralise control of sundry debtors and credit approval relating to sales of Departmental products on credit, and to implement a simple charging system to enable credit sales to be made easily and efficiently.

A review of Departmental fees and charges was conducted towards the end of the fiscal period to establish the basis on which fees are determined throughout the Department. The review indicated that the basis for many fees was established a long time ago, and it would be prudent to conduct a major reassessment on the basis of full cost recovery, where

appropriate, utilising generally accepted accounting principles. This assessment was commenced in May and is expected to take four months to complete. The outcome will be achieved in time for the determination of fees and charges for 1993-94.

The Financial Services Branch has extended its role in financial and accounting education throughout the Department with the establishment of a comprehensive training program for all staff having financial responsibilities under the Financial Administration and Audit Act. The program covers all divisions located at Head Office and also includes regular visits to outstations.

An immediate cheque facility was established to enable rapid payment of urgent accounts, and payment of invoices throughout the year was generally within 30 days of arrival at the Department.

Human Resource Management

Once again the Department experienced reductions in its staffing levels. This was attributed primarily to the restrictions on recruitment and to the Government voluntary severance process. It was through the latter process that 18 officers left the Department, although six of these were replaced with school-leaver recruits and a further two replaced by redeployees.

These cutbacks have put pressure on the Department's ability to deliver its programs, necessitating greater emphasis on staff training and management. To assist in this area a performance management system has been installed throughout the Department to provide employees with feedback on their personal development and performance.

Another initiative to maintain an efficient delivery of services is the increasing number of restructures which were commenced, including overall reviews of the Surveys and Mapping and Explosives and Dangerous Goods Divisions. There was also examination of the administrative support services within the Mining Engineering Division and assistance provided to the Chemistry Centre as a result of a reduction in the number of laboratories.

People Planning

In 1991-92 the Department's Approved Average Staffing Level (AASL) was 743 Full Time Equivalents (FTEs). An additional 16 FTEs were utilized in special activities with funding provided by way of a special Government grant and external sources. With the continued use of planning and monitoring strategies the Department was able to operate within this level.

The rate of turnover fell by approximately 22% on the previous year with 111 staff resigning or retiring (14% of staffing level). The most notable retiree was Dr Phillip Playford, Director Geological Survey, who has served the Department since 1962.

Consistent recruitment efforts have enabled the Department to maintain stability and a high level of expertise with a total of 108 new staff being recruited.

Training and Development

Intensive training initiatives continued this year with 1 052 staff attendances at a variety of management, development and technical seminars, workshops and courses. This represents a 29% increase in staff attendances since 1990-91.

Enterprise Bargaining

In October 1991 the Australian Industrial Relations Commission formally introduced a system of enterprise bargaining. This system was also adopted by the Western Australian Industrial Relations Commission in January 1992. As a result of these decisions the Industrial Relations framework will shift from a system based on award based initiatives to one based on the implementation of enterprise based initiatives.

This framework was adopted by the Western Australian Government and as such the Department will be placed under the Primary Industry Enterprise Bargaining Unit. The enterprise bargaining process will entail negotiations by employers, unions, and employees on wages and other benefits in return for actual implementation of enterprise specific measures designed to improve enterprise efficiency and productivity.

It is anticipated that negotiations in the effective introduction of the bargaining unit, and the Department's participation in it, will be negotiated during the 1992-93 year.

Equal Employment Opportunities

The Department has again shown its commitment to Equal Employment Opportunities in the workplace through strict adherence to its Equal Employment Opportunity policies and practises. In addition, the Equal Employment Opportunity yearly report was submitted to the Directorate for Equal Employment Opportunities in Public Employment in August 1991 and received a favourable response.

Occupational Health

Continuing emphasis with respect to occupational health and safety has resulted in a 19.9% reduction in the number of worker's compensation claims received by the Department.

During the year there were 26 workers' compensation claims of which 24 were accepted, one rejected and one remained under consideration.

A total of 920.50 person days were lost as a result of worker's compensation injuries, with 564.00 (61.2%) of these days lost being a result of long-term ongoing worker's compensation injuries.

Through the engagement of a part-time occupational therapist and external counsellors the Department was able to provide the following services:

- rehabilitation programs for all staff following work related injuries;
- workplace assessments to ensure safe working conditions and environments;
- health education programs designed to prevent accident or injuries;
- a confidential counselling service for work and personal issues that may impinge on staff productivity; and
- claims management for all workers' compensation claims.

Internal Audit

During the year, nine system-based audits were carried out in accordance with the strategic audit plan. These included an internal audit of the Energy Policy and Planning Bureau which became a sub-department of the Department of Mines as from 1 January 1992. Audits were also conducted at eight of the Department's regional offices including the Kalgoorlie Metallurgical Laboratory. This coverage together with the programmed transaction-based audit work represented a significant cross-section of the strategic audit plan for the 1991-92 financial year.

Accounting

The financial statements for the year ended 30 June 1992 have been prepared in accordance with the provisions of the Financial Administration and Audit Act, 1985 and the Treasurer's Instructions issued pursuant thereto. To assist in comparisons with other Government agencies they follow the format suggested in the appendices to the Treasurer's Instructions.

The Statements are prepared on a cash basis in that only collections received and payments made are included, with the exception of salaries where an accrual is made for salaries for one day.

The Statement of Consolidated Revenue Fund Receipts (Table 1) provides details of actual revenue received and credited to the fund. This is compared with the Consolidated Revenue Fund estimates under the headings "Territorial" and "Departmental" revenue where Territorial Revenue is revenue which has not been generated from fees and charges levied for services provided by the Department. Details of actual revenue for the previous financial year have also been provided to enable comparisons to be made.

Revenue

Consolidated Revenue Fund

During the financial year the Department was responsible for the collection of $405 million (Figure 18) through the Consolidated Revenue Fund (CRF), this being $24.5 million more than in 1990-91. Mineral and petroleum royalties collected from companies operating under State legislation comprised 85 % of this amount. Part of the revenue was also payments collected by the State on behalf of the Commonwealth for petroleum produced within Commonwealth waters. These receipts subsequently were paid to the Commonwealth by way of special purpose payments after payment into CRF.

In addition to royalties, the Department collected lease and other rental charges and Departmental revenue. The latter, while considerably less as a proportion (1.6%), was still significant ($6.6 million) and represented charges for goods and services provided by the Department (Figure 19). The Departmental revenue largely originated from charges associated with the Registration, Explosives and Chemistry Centre divisions.

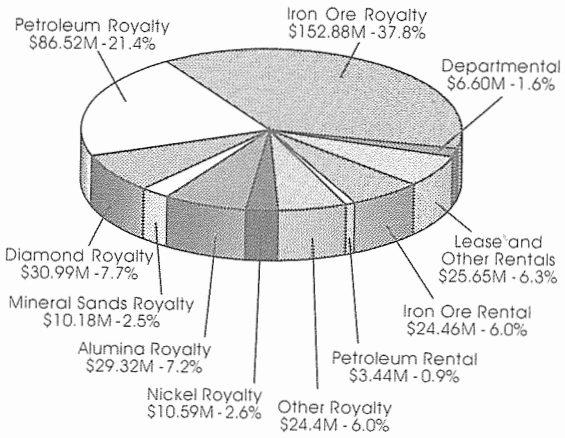


Figure 18. Revenue 1991-92
Total $405.03 million

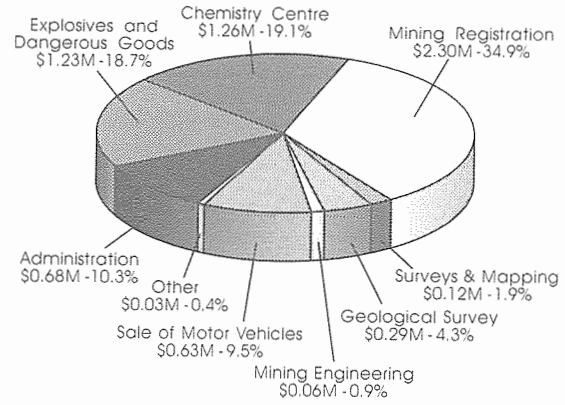


Figure 19. Department revenue 1991-92
Total $6.6 million

Expenditure

Consolidated Revenue Fund

Funds are appropriated by the Parliament through the Consolidated Revenue Fund to provide for the operating costs of the Department. This appropriation includes provision for equipment replacement as well as refunds of revenue collected in previous financial years. It also includes expenditure which relates to activities of the mining and petroleum industries which

are not operating costs of the Department. For example, costs associated with the Western Australian Coal Industry Council are included. This council provides a forum at which unions, coal mining companies and Government meet to gain a better understanding of industry needs. The payments, financed through the Consolidated Revenue Fund (Figure 20), are related to the programs of the Department.

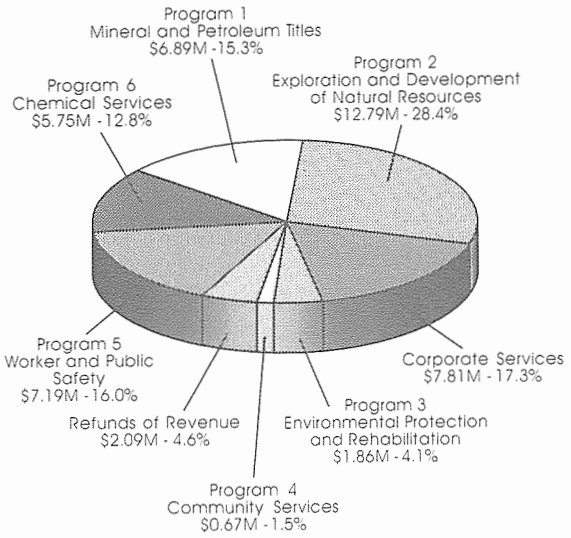


Figure 20. Department expediture 1991-92
Total $45.05 million

During the financial year the Department's CRF expenditure was $45.049 million which was $466 000 (1%) more than the original budget appropriation of $44.583 million. This additional expenditure of $466 000 was the net result of the following variations which were not provided for in the original allocation:

	$000
■ Net expenditure on voluntary redundancies which was originally to be provided for from the General Loan and Capital Works Fund	533
■ Expenditure on salaries of additional staff employed to carry out projects for external organisations, the full cost of which was recovered from those organisations and credited to CRF Revenue during the year	270
■ Additional refunds of revenue which was credited to CRF Revenue in previous financial years	109
	912
■ Less 1% overall reduction imposed on the Department during the financial year	446
	466

Special Acts

An appropriation is made under the provisions of the Petroleum (Submerged Lands) Act 1982 for the Commonwealth's share of royalties received from offshore operations. The Commonwealth revenue has been collected by the State into the Consolidated Revenue Fund. Payments to the Commonwealth totalled $25.228 million in the year, a slight reduction on the $26.940 million paid in the previous year (Table 2).

General Loan and Capital Works Fund

Major capital works projects are financed under the State's Capital Works Program from the General Loan and Capital Works Fund.

During the year $712 971 was expended on capital works funded from this source (Table 3) of which $543 971 related to planning fees for Stage 1 of the new Chemistry Centre complex at Bentley.

Financial Management

In accordance with the Government's accountability concept, the Department has continued to develop reporting mechanisms which provide the Accountable Officer with timely and comprehensive financial management reports to assist in resource allocation decisions. The financial management information system which was substantially modified in 1990-91 to link the philosophical view of organisational objectives as defined in the Corporate Plan into the budgeting and resource management processes of the Department was further enhanced and refined in 1991-92.

Pricing Policy

The Department generally adopts a full cost recovery user pays approach in determining fees and charges for services provided to the public and industry. With some services, where there is considered to be an element of "service to the general public", a nominal fee has been determined. However, this represents only a small fraction of services provided and has minimal impact on revenue.

The Department undertook a general review of the fees and charges currently being applied throughout the organisation. As a result of this review, it was resolved that a comprehensive cost accounting exercise will be undertaken in key areas of service delivery to determine the full cost (including notional costs) of providing each service. This will enable decisions to be made on the appropriate level of fees to be applied in each case with the view to implementing a new schedule of fees and charges in 1993-94.

A review of the fees and charges levied by the Chemistry Centre was conducted during the year in accordance with the cost accounting framework developed in 1990-91. In addition to charging for services provided to non-Government clients and Government trading concerns, the system of notional charging developed last year for services provided to other Government agencies is continuing. This initiative is a precursor to charging for services provided to these agencies by the Chemistry Centre.

Royalty Policy

The Department has a corporate objective of ensuring that the community receives a fair return for the removal of non-renewable resources owned by the people of the State. The Department aims to ensure that these royalties are collected on time and in an economically and administratively efficient manner.

FINANCIAL STATEMENTS

Table 1: STATEMENT OF CONSOLIDATED REVENUE FUND RECEIPTS

1990-91 Actual $		1991-92 Estimate $	1991-92 Actual $	1991-92 Variation $
	TERRITORIAL			
	Royalties			
130,935,141	Iron Ore	154,500,000	152,880,228	(1,619,772)
92,427,106	Petroleum	78,000,000	86,520,780	8,520,780
27,289,552	Diamonds	20,500,000	30,985,306	10,485,306
33,777,840	Alumina	30,000,000	29,315,958	(684,042)
13,734,122	Mineral Sands	12,000,000	10,184,303	(1,815,697)
10,597,323	Nickel	11,000,000	10,589,461	(410,539)
15,650,608	Other	24,000,000	24,404,569	404,569
49,708,461	Lease and Other Rental	52,500,000	53,551,441	1,051,441
374,120,153		**382,500,000**	**398,432,046**	**15,932,046**
	DEPARTMENTAL			
2,290,162	Registration	2,204,000	2,301,756	97,756
1,233,968	Chemistry Centre	1,210,000	1,259,500	49,500
1,206,785	Explosives	1,161,000	1,231,514	70,514
350,550	Sale of Motor Vehicles	550,000	627,800	77,800
766,658	Adminstration	700,000	681,059	(18,941)
322,820	Geological Survey	358,000	285,419	(72,581)
105,481	Surveys and Mapping	107,000	123,862	16,862
26,436	Engineering	65,000	61,219	(3,781)
101,908	Other	32,000	25,562	(6,438)
6,404,768		**6,387,000**	**6,597,691**	**210,691**
380,524,921	**Total Receipts**	**388,887,000**	**405,029,737**	**16,142,737**

Explanations of variations between the current year estimates and actual results, and the actual results compared with the preceding year, are set out in Note 2.

Table 2: STATEMENT OF CONSOLIDATED REVENUE FUND PAYMENTS

1990-91 Actual $	Division 62 - Mines	1991-92 Estimate $	1991-92 Actual $	1991-92 Variation $
44,148,920	Item 157 Amount provided for Services for the year	44,583,000	45,048,987	465,987
	Description			
8,827,973	**Corporate Services**	7,343,000	7,811,227	468,227
1,804,886	**Refunds of Revenue**	2,000,000	2,088,995	88,995
	Program 1:			
6,693,371	**Mineral and Petroleum Titles**	7,298,000	6,891,164	(406,836)
	Sub Programs			
5,039,512	Title Systems	5,861,000	5,680,371	(180,629)
1,653,859	Dispute Management	1,437,000	1,210,793	(226,207)
	Program 2: **Exploration and Development of**			
11,971,448	**Natural Resources**	12,961,000	12,789,973	(171,027)
	Sub Programs			
3,971,535	Geological Data Collection	3,591,000	3,347,401	(243,599)
2,921,588	Metallurgical and Analytical Services	3,102,000	2,931,564	(170,436)
3,449,163	Geoscientific Data Dissemination	3,880,000	4,091,498	211,498
842,172	Geotechnical and Mining Engineering Advice	1,237,000	1,202,135	(34,865)
786,990	Community Relations	1,151,000	1,217,375	66,375
	Program 3: **Environmental Protection and**			
1,750,758	**Rehabilitation**	1,780,000	1,854,772	74,772
	Program 4:			
590,715	**Community Benefits**	667,000	666,302	(698)
	Program 5:			
6,984,524	**Worker and Public Safety**	7,007,000	7,193,556	186,556
	Sub Programs			
5,572,996	Worker Safety and Health	5,537,000	5,822,989	285,989
1,411,528	Management of Dangerous Goods	1,470,000	1,370,567	(99,433)
	Program 6:			
5,525,245	**Chemical Services**	5,527,000	5,752,998	225,998
44,148,920		44,583,000	45,048,987	465,987
	Special Acts Expenditure **Petroleum (Submerged Lands)**			
26,940,348	**Act 1982**	20,600,000	25,228,063	4,628,063

Explanations of variations between the current year estimates and actual results, and the actual results compared with the preceding year, are set out in Note 2.

Table 3: STATEMENT OF CAPITAL WORKS PAYMENTS AND SOURCE OF FUNDS

1990-91 Actual $	Activity	1991-92 Estimate $	1991-92 Actual $	1991-92 Variation $
	COMPLETED WORKS AND WORKS IN PROGRESS			
	CHEMISTRY CENTRE (WA)			
52,057	Alterations	-	-	-
25,546	Agricultural Science Laboratory	-	-	-
170,000	Material Science Laboratory Upgrade	111,000	114,000	3,000
	KALGOORLIE METALLURGICAL LABORATORY			
41,059	Noise and Dust Abatement	-	-	-
	NEW CHEMISTRY CENTRE COMPLEX BENTLEY			
52,558	Planning Fees	3,000	-	(3,000)
	NEW WORKS			
	CHEMISTRY CENTRE (WA) COMPLEX BENTLEY			
	Stage 1 Mineral Research Centre			
-	Planning Fees	1,500,000	543,971	(956,029)
	MINERAL HOUSE			
	Computer Suite Air Conditioning			
-	Upgrade	-	55,000	55,000
341,220	**TOTAL**	**1,614,000**	**712,971**	**(901,029)**
	SOURCE OF FUNDS			
341,220	General Loan and Capital Works Fund	**1,614,000**	**712,971**	**(901,029)**

Explanations of variations between current years estimates and actual results are set out in Note 2.

Accounts of the Trust Fund

Survey of Leases Under the Mining Act Account

Survey fees collected under the Mining Act are paid into this account. The actual cost of surveys is charged to the Consolidated Revenue Fund, and fees previously collected are then transferred to Consolidated Revenue. If the applicant decides not to proceed with the survey, the fee collected is refunded.

	1990-91 $		1991-92 $	
Opening Balance July 1	6 393 046	CR	6 119 498	CR
Add Receipts				
Survey Fees	1 138 816		13 983	
	7 531 862		6 133 481	
Less Payments				
Transferred to Revenue	361 748		255 668	
Refunds	1 050 616		890 397	
Total Payments	1 412 364		1 146 065	
Closing Balance June 30	6 119 498	CR	4 987 416	CR

Chemistry Centre Trust Account

The account was created to hold monies received from industry and other organisations for the purpose of conducting specific projects.

	1990-91 $		1991-92 $	
Opening Balance July 1	238 376	CR	156 421	CR
Add Receipts				
Contributions From				
Industry	267 342		301 520	
Government	214 660		158 528	
Total Receipts	482 002		460 048	
	720 378		616 469	
Less Payments				
Salaries	277 176		264 684	
Travel	10 041		1 872	
Equipment, Misc	276 740		141 231	
Total Payments	563 957		407 787	
Closing Balance June 30	156 421	CR	208 682	CR

Barrow Island Royalty Trust Account

The account was created under the Barrow Island Royalty Trust Account Act 1985 which provides for royalty payments received under the Barrow Island lease to be credited to the account and subsequently apportioned between the Commonwealth and the State.

	1990-91 $		1991-92 $	
Opening Balance July 1	5 609 575	CR	8 086 561	CR
Add Receipts				
Royalties Received	36 883 886		32 584 265	
Total Receipts	36 883 886		32 584 265	
	42 493 461		40 670 826	
Less Payments				
Transferred to Revenue	9 199 894		8 130 258	
Remitted to C'wealth	25 207 006		24 514 134	
*Refunds of Royalty (i)			84 311	
Total Payments	34 406 900		32 728 703	
Closing Balance June 30(ii)	8 086 561	CR	7 942 123	CR

(i) Refunds of royalty due to quarterly provisional receipts exceeding assessed royalty due.

(ii) Commonwealth share of royalty payment payable in July 1992 $7 942 123.

Deposits: Mines Department Account

Funds held are received for the issue of temporary reserves and exploration permits pending finalisation of certain legal requirements.

	1990-91 $		1991-92 $	
Opening Balance July 1	305 706	CR	301 954	CR
Add Receipts				
Bonds, Securities	427 990		590 000	
Interest	52 123		32 117	
	785 819		**924 071**	
Less Payments				
Refund of Bonds, Securities	401 100		539 000	
Refund of Interest	2 828		-	
Transfers to Revenue				
•Interest	44 552		38 906	
•Bonds, Securities	33 700		—	
•Other	1 685		—	
Total Payments	**483 865**		**577 906**	
Closing Balance June 30	**301 954**	**CR**	**346 165**	**CR**

Transfers to Suspense Account

The account is maintained to hold funds to meet any relevant end of year commitment in respect of plant and equipment or land.

	1990-91 $		1991-92 $	
Opening Balance July 1	139 307	CR	29 000	CR
Add Receipts				
Transfers ex CRF - Plant & Equipment	89 669		-	
	228 976		**29 000**	
Less Payments				
Purchase of Plant & Equipment or Land	199 976		29 000	
Closing Balance June 30	**29 000**	**CR**	-	

Treasurer's Advance

Drilling

Recoverable drilling expenditure is initially charged to a Treasurer's Advance Account. The cost of work performed, together with overhead charges, are recovered and credited to this account. The amount of the advance outstanding as at 30 June 1992 is $215 766.

Chemistry Centre

The purpose of the advance is to enable the Chemistry Centre to operate a stores function, for purchasing stock items which may relate to unbudgeted contract analytical activities. Recoupment of the advance is the stores portion of the service charged to and collected from clients.

The amount of the advance outstanding as at 30 June 1992 is $68 918.

Departmental Receipts in Suspense

This amount is used to hold moneys temporarily pending identification of the purpose for which the funds were received. The balance of the account as at 30 June 1992 is $1 056 353 being a royalty payment held pending allocation.

Notes to and forming part of the Financial Statements for the year ended 30 June, 1992

1. Accounting Policy

(a) The Financial Statements are prepared on a cash basis in that only collections received and payments made are reflected therein. The disbursements include a net payment of $126 000 to the Treasury Accured Salaries Account for accrued salaries.

(b) The financial statements included in this report have been prepared in accordance with the provisions the Financial Administration and Audit Act, 1985.

(c) All expenditures incurred by the Department of Mines in the provision of services are not appropriated to the Department. The employer's share of superannuation pensions is met by Treasury. Rental of office accommodation is met by the Office of Government Accommodation. Maintenance of Government buildings is met by the Building Management Authority. The servicing of the Department's General Loan and Capital Works Fund debt is met by Treasury. As from 1991-92 motor vehicle acquisitions have been met from a special allocation in the General Loan and Capital Works Fund.

(d) Property disposals are effected through the State Tender Board and proceeds credited to Revenue Government Property Sales. Exceptions are:

(i) when the original acquisition was met from General Loan and Capital Works Fund the proceeds are credited to Loan Repayment.

(ii) proceeds received from the disposal of Departmental vehicles were credited to general departmental revenue within the Consolidated Revenue Fund.

2. Explanatory Statement

(a) Details of expenditure in advance of appropriation approved in accordance with Section 28 of the Financial Administration and Audit Act, 1985.

Supplementary funding of $466 000 was approved to cover the following:

	$000
Net cost of voluntary severance scheme	533
Cost of employees funded from external sources	270
Additional refunds of revenue	109
	912
Less 1% saving required to bring State Budget back on target	446
Supplementation provided	466

(b) Significant variations (greater than 10%) between actual revenues and budget estimates for the financial year.

Territorial Revenue

(i) Petroleum (+ $8 520 780)

Higher petroleum royalty collections resulted from increased output and demand.

(ii) Diamonds (+ $10 485 306)

Increased diamond royalties have resulted from a much higher level of production than expected, and the central buying authority's ability to take a higher level of output.

(iii) Mineral Sands (- $1 815 697)

The shortfall in mineral sands royalty collections resulted from reduced prices, for all mineral sands commodities.

Departmental Revenue

(i) Sale of Motor Vehicles (+$77 800)

Earlier than expected sale of replaced 4 wheel drive motor vehicles resulted in increased revenue collections.

(ii) Geological Survey (-$72 581)

Sale of publications were below anticipated levels, resulting in less revenue.

(iii) Surveys and Mapping (+$16 862)

The increase in collections in Surveys and Mapping resulted from higher than anticipated revenue from in-house printing.

(iv) Other (-$6 438)

Decreased revenue resulted from a number of very minor variations in miscellaneous revenue.

(c) Significant variations (greater than 10%) between actual expenditure and budget estimates for the financial year.

Capital Works Expenditure

(i) New Chemistry Centre Complex Bentley - Planning Fees (-$3 000).

An amount of $3 000 was provided to cover minor contingency costs which may have flowed over to 1991-92 after completion of the planning phase of the project in 1990-91. As these funds were not required they were reallocated to cover a minor cost over run of a like amount on the Material Science Laboratory upgrade project.

(ii) Chemistry Centre (WA) Complex Bentley - Stage 1 Mineral Research Centre - Planning fees (-$956 029).

Due to the complexity of the project the planning process proceeded at a slower rate than estimated with a correspondingly lower level of expenditure on planning fees.

(iii) Mineral House - Computer Suite Air Conditioning Upgrade (+$55 000)

Treasury approved the reallocation of $55 000 from underspending described at (ii) above to meet the cost of an emergency upgrade of the Department's Computer Suite Air Conditioning.

(d) Significant variations (greater than 10%) between actual results for the financial year (1991-92) and results for the immediately preceding financial year (1990-91).

(i) Consolidated Revenue Fund Receipts.

Territorial Royalties

	1990-91$	1991-92$	Variance$
Iron Ore	130 935 141	152 880 228	21 945 087

Increased revenue was attributable to an all time record shipped tonnage in the 1991 calendar year and a price increase for the 1991-92 sales.

	1990-91$	1991-92$	Variance$
Diamonds	27 289 552	30 985 306	3 695 745

Increased revenue was attributable to increased sales to the Central Selling Organisation by both Argyle Diamond and Poseidon Bow River Diamond mine as compared to budget estimates.

	1990-91$	1991-92$	Variance$
Alumina	33 777 840	29 315 958	(4 461 882)

The decrease in revenue was caused by falling alumina values.

	1990-91$	1991-92$	Variance $
Mineral Sands	13 734 122	10 184 303	(3 549 819)

The decrease in revenue was attributable to a de-pressed mineral sands market which in turn resulted in mine closures and reduced production.

	1990-91$	1991-92$	Variance$
Other	15 650 608	24 404 569	8 753 961

The substantial increase in revenue was attributable to the first full year of sales from the Golden Grove zinc/copper project, significant increases in manganese sales from the Pilbara manganese joint venture and increased royalty rates on SECWA coal sales.

Departmental

	1990-91$	1991-92$	Variance$
Sale of Motor Vehicles	350 550	627 800	277 250

Increased revenue for sale of vehicles resulted from the Government's changed replacement policy for 6 cylinder vehicles from 2 years or 40 000 kilometres to 3 years or 60 000 kilometres causing revenue in 1990-91 to be lower than usual.

	1990-91$	1991-92$	Variance$
Administration	766 658	681 059	(85 599)

Recoups from external organisations for work done by Chemistry Centre staff in 1989-90 were not collected until 1990-91. This was the major reason for the higher than usual revenue in 1990-91.

	1990-91$	1991-92$	Variance$
Geological Survey	322 820	285 419	(37 401)

This decrease is directly attributable to a small decline in demand in recessionary times.

	1990-91$	1991-92$	Variance$
Surveys and Mapping	105 481	123 862	18 381

The increase in Surveys and Mapping resulted from higher than anticipated revenue from in-house printing.

	1990-91$	1991-92$	Variance$
Engineering	26 436	61 219	34 783

Revenue in the Engineering area has increased by a large percentage as a result of large increases in fees for Management Certificates of Competency and charges for Acts.

	1990-91$	1991-92$	Variance$
Other	101 908	25 562	(76 346)

The decrease in other revenue was attributable to the fact that the 1990-91 figure included forfeiture of petroleum exploration permit cash securities following cancellation.

(ii) Consolidated Revenue Fund Payments

Departmental

Description	*1990-91$*	*1991-92$*	*Variance$*
Corporate Services	8 827 973	7 811 227	(1 016 746)
Refunds of Revenue	1 804 886	2 088 995	284 109

The decrease in Corporate Services expenditure is attributable to reallocation of the cost of services to the Programs to which it relates.

The increase in Refunds of Revenue is attributable to a refund to Hamersley Iron of $351 000 for leases relating to the Dampier Archipelego.

PROGRAM 4

Description	*1990-91$*	*1991-92$*	*Variance$*
Community Benefits	590 715	666 302	75 587

The increase in expenditure is attributable to salaries costs being slightly higher in this area than anticipated.

3. Special Acts

An appropriation is made under the provisions of the Petroleum (Submerged Lands) Act 1982 for the Commonwealth's share of Royalties received from offshore operations. Payments to the Commonwealth totalled $25.228 million for the year, a slight reduction on the $26.940 million paid the previous year. This reduction was the result of oil price fluctuations. However the figure was well above the budgeted $20.6 million as the predicted decline in production levels did not eventuate.

4. Supplementary Financial Information

	1990-91 $	1991-92 $
Losses of public monies and public or other property through theft or default	5 985	2 934
Amount Recovered	4 000	434
Losses for write off	1 985	2 500
Public and other property, revenue and debts due to the State, written off in accordance with section 45 of the Financial Administration and Audit Act by:		
The Accountable Officer	5 327	14 812
The Minister	-	23 804
	5 327	38 616
Analysis of losses written off		
Stock shortages	4 269	2880
Bad debts	1 058	35 736
	5 327	38 616
Consolidated Revenue Fund revenues due and uncollected	170 222	267 899
Less considered to be irrecoverable	34 609	3 715
Amount considered to be recoverable	135 613	264 184
Unpaid expenditure claims as at 30 June 1992 - CRF	37 817	73 170

CERTIFICATION OF FINANCIAL STATEMENTS

The accompanying financial statements of the Department of Mines have been prepared in compliance with the provisions of the Financial Administration and Audit Act 1985 from proper accounts and records to present fairly the financial transactions for the year ending 30 June 1992 and the state of affairs as at 30 June 1992.

At the date of signing we are not aware of any circumstances which would render the particulars included in the financial statements misleading or inaccurate.

D R Kelly
ACCOUNTABLE OFFICER

13 August 1992

P H Palmer
PRINCIPAL ACCOUNTING OFFICER

OPINION OF THE AUDITOR GENERAL

I have audited the accounts of the Department of Mines for the year ended 30 June 1992 under the provisions of the Financial Administration and Audit Act 1985.

The Director General is responsible for keeping proper accounts and maintaining adequate systems of internal control, preparing and presenting the financial statements, and complying with the Act and other relevant written law.

My audit was performed in accordance with section 79 of the Act to form an opinion based on a reasonable level of assurance. The audit procedures included examining, on a test basis, evidence to provide reasonable assurance that the financial statements are free of material misstatement and that the controls exercised are in accordance with legislative provisions. The accounting policies and principles used were assessed to determine that they are consistent with the Treasurer's Instructions and relevant accounting concepts and standards. Significant judgements made by management were evaluated for consistency with my understanding of the entity's operations.

In my opinion,

(i) the controls exercised by the Department of Mines provide reasonable assurance that the receipt and expenditure of moneys and the acquisition and disposal of property and the incurring of liabilities have been in accordance with legislative provisions; and

(ii) the Statements of Receipts and Payments and the notes thereto are based on proper accounts and present fairly the transactions for the year ended 30 June 1992.

D D R Pearson
AUDITOR GENERAL
7 October 1992

PROGRAM 1: Minerals and Petroleum Titles

Effectiveness

The proportion of mineral title applications which are finalised within five months of receipt.

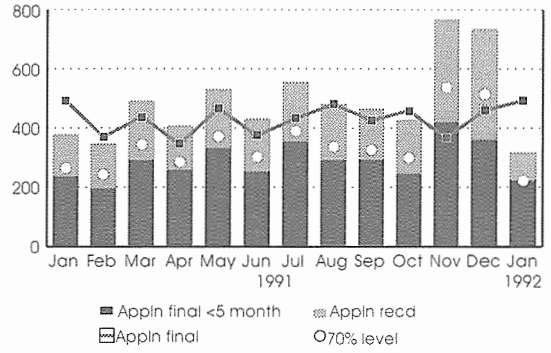
This indicator reflects the Department's ability to process title applications in a timely manner. The five month period has been chosen as a realistic duration given the processes involved including the public objection period.

The graph opposite illustrates performance during 1991-92. A target of 70% achievement has been set because approximately 30% of applications are subject to delays beyond the control of the Department, such as where the application involves private land or Aboriginal and Conservation Reserves or is delayed through legal disputation.

The 70% target was not achieved in 1991-92 with only 60% of applications being determined within the five month period.

	1990-91	1991-92
	%	%
	60	60

PERFORMANCE INDICATOR-APPLICATIONS



The average time taken to determine each major title category during the year.

This indicator also gives a general indication of the timeframes of the processing of all applications.

	1991-92 (months)
■ Prospecting Licences	2.0
■ Exploration Licences	6.3
■ Mining Leases	4.4

The proportion of clients satisfied with the petroleum title process.

Petroleum title issue effectiveness is to be measured by a client survey to be conducted for the first time in 1992-93.

Efficiency

The administration cost for mineral and petroleum titles.

This indicator reflects the Departmental cost of issuing and maintaining titles.

The costs are calculated using average salary levels and allowances for overheads with all costs in 1991-92 dollars

	1990-91	1991-92
Mining Titles (cents/ha)	34	30
Petroleum Titles (cents/sq km)	NA	84

PROGRAM 2: Exploration and Development of Natural Resources

The objectives and key performance indicators for Program 2 are being revised to comply with guidelines issued by the Office of the Auditor General in April 1992. It is envisaged that specific effectiveness and efficiency indicators will be used to gauge program performance for the 1992-93 financial year.

An appropriate questionnaire is currently being devised to be used in gauging stakeholder satisfaction.

PROGRAM 3: Environmental Protection and Rehabilitation

Effectiveness

The extent to which mineral operations comply with Departmental environmental completion criteria.

For mining this is measured by the proportion of companies completing their rehabilitation to the Department's standards.

The performance of this indicator is assessed by field inspections and completed reports maintained in the Mining Engineering Division.

Mining - 70% of the projects completed during the year met the environmental criteria.

The extent to which there is acceptance by the community of the Department's role in the environmental management of the mining and petroleum industries.

It is intended to implement an annual survey of organisations such as the EPA, Water Authority and Department of Health using a standard questionnaire in 1992-93.

The extent to which users are satisfied with the Department's response to requests for advice on groundwater contamination.

It is intended to implement an annual survey of organisations such as the EPA, Water Authority and Department of Health using a standard questionnaire in 1992-93.

Efficiency

Cost per environmental impact report on projects assessed by the Department.

Initial costings indicate an approximate cost of $1 900 per report, however, a more accurate assessment will be carried out in 1992-93.

Departmental cost per environmental impact report on projects formally reviewed by the EPA

Initial costings indicate an approximate cost of $1 900 per report, however, a more accurate assessment will be carried out in 1992-93.

PROGRAM 4: COMMUNITY BENEFITS

Effectiveness

Royalties as a percentage of mine-head value.

This will be used as a benchmark and a proxy for 'fair' which can not be objectively defined.

The data to calculate this percentage will be compiled in 1992-93.

The proportion of royalties due, paid by the required date.

1990-91	1991-92
%	%
99.9	99.9

The proportion of royalty paid which has been audited at company offices.

Data from royalty officer audit records commencing with payments for 1990-91. The remainder represents payments which have not been audited either because they are being collected under interim arrangements, the returns were received late from producers, returns were received late in the financial year or there was a backlog of audit work as is the case in the petroleum sector.

1990-91	1991-92
76.1	84.3

Efficiency

The administration cost per company paying royalty.

Costs have been calculated using average salary costs and an allowance for overheads.

1990-91	1991-92
Not available	$5 865

PROGRAM 5: WORKER AND PUBLIC SAFETY

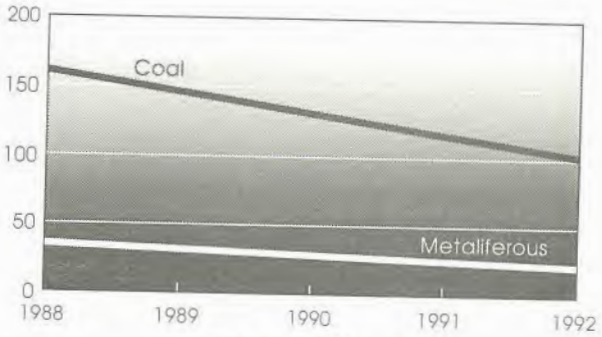
Effectiveness

The frequency of lost time injuries for mining and petroleum operations.

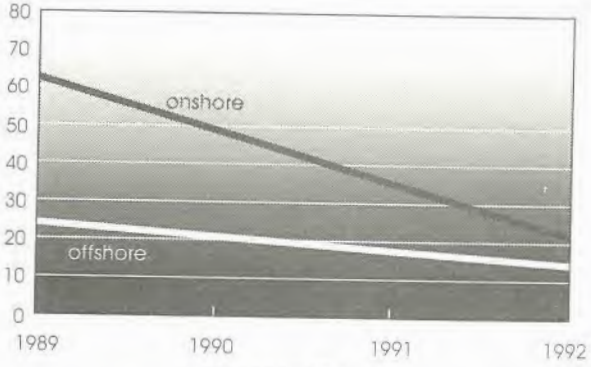
The frequency is the number of occurrences of injury or disease for each one million hours worked as defined in Australian Standard AS1885.1 - 1990.

The rates for coal, metalliferous mining and the onshore petroleum sectors fell during the year, while the rate for offshore petroleum increased. The latter result represents the substantial increase in offshore construction activity. Although the rates for the coal sector are much higher than for metalliferous mining they are comparable with rates recorded for this sector in other States.

	1990-91	1991-92
Coal	115.0	112.0
Metalliferous	25.0	21.0
Onshore Petroleum	44.7	20.5
Offshore Petroleum	13.7	16.1



Western Australian mines
Lost time injury frequency rate trends



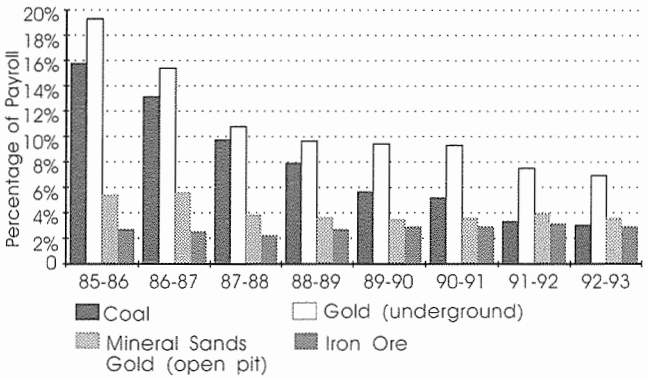
W.A. Petroleum industry
Lost time injury frequency rate trends

Workers' Compensation premium rates for the mining and petroleum industries as a proportion of the employer's payroll.

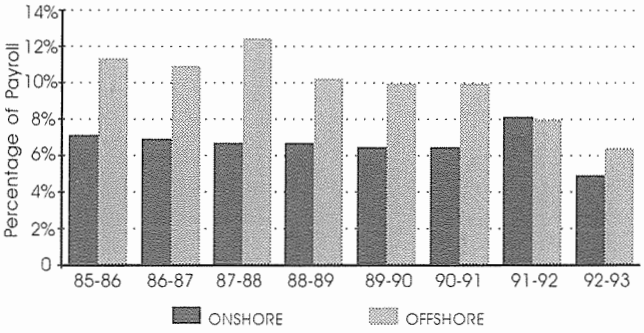
These rates are published in the Government Gazette and are determined by the Premium Rates Committee on the basis of past performance.

The rates generally reflect an improved safety performance.

	1990-91 %	1991-92 %
Coal	5.05	3.33
Gold U/G	9.22	7.51
Gold O/C	3.46	3.93
Mineral Sands	3.46	3.93
Iron Ore	2.81	3.20
Onshore Petroleum	6.50	8.08
Offshore Petroleum	9.89	7.99



Western Australian mines
Workers compensation cost trends



W.A. Petroleum industry
Workers compensation cost trends

The effectiveness of dangerous goods transport inspection as reflected by the proportion of vehicles complying with safety standards.

Compliance levels improved significantly for three measures and very marginally for the other two during 1991-92. The improvements were achieved by deliberate efforts to focus inspectoral activities on areas with low levels of compliance.

	1990-91	1991-92
	%	%
Full Vehicle	22	44
Documentation	57	84
Safety Equipment	70'	73
Emergency Equip.	51	78
Vehicle Load	92	93

Efficiency

The total cost of salaries plus support services for the Department's engineering inspectorates per employee in the mineral and petroleum sectors.

The costs have been estimated using average salary levels and a factor for all Departmental overheads.

	1990-91	1991-92
		$
Mining	NA	185
Petroleum	NA	359

The number of dangerous goods vehicles inspected per dangerous goods inspector in the metropolitan area.

A considerable improvement was achieved with centralised inspection and co-operation from industry.

	1990-91	1991-92
Vehicle/Inspector	144	252

The number of tankers inspected per inspector per day.

Enhanced inspectorate productivity was achieved by using approved third party auditors.

1990-91	1991-92
2.26	16

PROGRAM 6: CHEMICAL SERVICES

Effectiveness

The proportion of the Chemistry Centre's scientific areas which are covered by accreditation procedures that have achieved comprehensive external accreditation.

1989-90	1990-91	1991-92
45 %	54%	64%

A key element in determining the Chemistry Centre's effectiveness is the quality of its services. The quality of Chemistry Centre data and advice can be assessed by the effectiveness of its quality assurance programs.

External accreditation and the results obtained in proficiency programs are relevant performance indicators.

However, although quality assurance programs are in place in all areas, not all have been accredited by an external body. To date, seven of the possible 15 scientific areas have comprehensive National Association of Testing Authorities (NATA) accreditation. Four areas are not yet covered by national accreditation procedures.

Efficiency

Cost of Services

In 1990-91 and 1991-92, CRF funded clients were provided with cost details of their work with each report. In addition, client agencies were provided with monthly cost summaries. These costs were calculated on a full cost recovery basis. Information provided to Government clients has allowed agencies to assess the cost of chemical services essential to the progress of their programs.

It is intended that specific results will be provided in the 1992-93 Annual Report.

Timeliness of Services

The timeliness of provision of results and advice is critical to clients for successful progress of their programs.

Laboratory management information systems which include information on turn-around times are planned for all Chemistry Centre Laboratories. It is planned to implement these systems in all laboratories over the next two years.

It is intended that specific results will be provided in the 1992-93 Annual Report.

CERTIFICATE OF PERFORMANCE INDICATORS

I hereby certify that these performance indicators are based on proper records and fairly represent the performance of the Department of Mines for the year ending 30 June 1991.

D R Kelly
ACCOUNTABLE OFFICER

14 August 1992

OPINION OF THE AUDITOR GENERAL

PERFORMANCE INDICATORS

The Financial Administration and Audit Act 1985 requires accountable officers to prepare and submit performance indicators. Treasurer's Instruction 904 requires that key indicators of effectiveness and efficiency be reported for each program. I am required to audit these indicators and state whether in my opinion, they are relevant and appropriate having regard to their purpose and fairly represent the indicated performance.

As stated in my First General Report for 1992, I am of the view that the stage has not yet been reached where I can form an opinion on performance indicators as required by the Act. However, I have reviewed the performance indcators reported by the Department of Mines for the year ended June 30 1992 in accordance with the developmental approach outlined in my First General Report for 1992.

During my review of the indicators, I have assessed the relevance of the reported indicators to the objectives submitted by the Department based on my knowledge of the Department and have assessed the appropriateness of the indicators for the purpose of assisting users external to the Department to assess performance. Where I have formed the view that the indicators are relevant and appropriate, I have also reviewed the relevant information systems on a test basis to determine whether the information reported in the indicators is verifiable and free from significant bias.

It is my view that the performance indicators for the Programs listed below are relevant to the stated objectives of the Department of Mines.

Audit Assessment

- Program 1 - Minerals and Petroleum Titles
- Program 3 - Environmental Protection and Rehabilitation
- Program 4 - Community Benefits
- Program 5 - Worker and Public Safety
- Program 6 - Chemical Services

The indicators are appropriate for assisting users external to the Department to assess its performance and fairly represent the indicated performance except for those indicators which have not be quantified.

I am aware that the Department is developing effectiveness and efficiency indicators which are intended to illustate the Department's achievements in relation to meeting the objective of Program 2 - Exploration and Development of Natural Resources.

D D R Pearson
AUDITOR GENERAL
7 October 1992

Appendix 1: Legislation

The Department is responsible to the Minister for Mines for the administration of 15 individual Acts of Parliament.

Mining Act

Petroleum Act

Explosives and Dangerous Goods Act

Mines Regulation Act

Coal Mines Regulation Act

Coal Miners' Welfare Act

Mine Workers' Relief Act

Miners' Phthisis Act

Mining on Private Property Act

Mining (Validation and Amendment) Act

Petroleum Pipelines Act

Petroleum (Registration Fees) Act

Petroleum (Submerged Lands) Act

Petroleum (Submerged Lands) Registration Fees Act

Western Australian Coal Industry Tribunal Act

The following Commonwealth legislation is administered in the Western Australian adjacent area by the State and through the Commonwealth/Western Australian Offshore Petroleum/Minerals Joint Authorities:

Petroleum (Submerged Lands) Act

Petroleum (Submerged Lands)

(Registration Fees) Act

Petroleum (Submerged Lands) (Royalty) Act

Petroleum (Submerged Lands)

(Retention Lease Fees) Act

Petroleum (Submerged Lands) (Exploration Permit Fees) Act

Petroleum (Submerged Lands) (Production Licence Fees) Act

Petroleum (Submerged Lands) (Pipeline Licence Fees) Act

Minerals (Submerged Lands) Act

Minerals (Submerged Lands) (Registration Fees) Act

Minerals (Submerged Lands)(Works Authority Fees) Act

Minerals (Submerged Lands) (Production Licence Fees) Act

Minerals (Submerged Lands) (Exploration Permit Fees) Act

Minerals (Submerged Lands) (Royalty) Act

In addition to its responsibilities under the above Acts, the Department undertakes various functions in relation to a number of special Agreement Acts:

Barrow Island Royalty Trust Account Act

Barrow Island Royalty Variation Agreement Act

CHANGES TO LEGISLATION

Mining Act 1978

A minor amendment was made to Section 24 relating to the definition of nature reserves.

The Mining Amendment Regulations (No 4) 1991, gazetted 5 July 1991 provided for approved surveyors to submit a report following the survey of a tenement.

Mining Amendment Regulations (No 5) 1991, gazetted 5 July 1991 amends the fees and charges.

Mining Amendment Regulations (No 6) 1991, gazetted 8 November 1991 amends the Bailiffs fees.

Mines Regulation Act 1946

The Mines Regulation Amendment Act 1990 (No 85/90) was assented to by Parliament on 22 December 1990 but has not yet been proclaimed. The amendment includes occupational health, safety and welfare matters and establishes health and safety representatives and mine site committees and provides for general duty of care covering both employers and employees. (The Amendment Act is awaiting supporting regulations before being proclaimed to come into force.)

Explosives and Dangerous Goods Act 1961

The Explosives and Dangerous Goods (Fees Amendment) Regulations 1991, gazetted 12 July 1991 amended the fees and charges under the:

- Explosives Regulations 191963
- Flammable Liquids Regulations 1967
- Dangerous Goods (Road Transport) Regulations 1983

Petroleum-Commonwealth Legislation

The Primary Industries and Energy Legislation Amendment Act 1992 No 17/92, commenced 10 April 1992, amended section 8H of the Commonwealth Petroleum (Submerged Lands) Act 1967 by rectifying powers for the Joint Authority to delegate routine matters to Commonwealth and State officials.

Appendix 2: Research and Technical Investigations

The Chemistry Centre

The Chemistry Centre provides professional consultancy and analytical facilities for Government instrumentalities, private industry and the general public. During the year it undertook work in the following key areas:

- soil, seed and crop analysis, as well as other aspects of agricultural chemistry;
- the testing of metallurgical processes for mining companies; and
- specialised mineral processing;
- forensic analysis;
- analytical services for the horse and greyhound industries;
- analytical services relating to public health.

Geological Survey

A large part of the work of the Geological Survey Division involves research and development projects to investigate, interpret, and record the geology of Western Australia by relating mineral, petroleum, and groundwater occurrences and potential to that geology. This research provides a platform for the further exploration and development of the State.

For a full listing of current and proposed projects see "Record 1992/1 : Summary of progress of the Geological Survey of Western Australia during 1991-92 and plans for 1992-93 to 1996-97". This publication can be viewed in the Departmental library, or purchased at the sales counter, first floor Mineral House. Some of the highlights of the program are:

Geological mapping in the Pilbara, Kimberley and Rudall River areas.

Regolith mapping in the Eastern Goldfields and Southern Cross region.

Geoscientific investigations in the Eastern Goldfields with particular emphasis on regional controls of gold mineralisation.

Geotechnical studies related to open-pit and underground mining.

Hydrogeological mapping in the Eastern Goldfields and the Murchison.

Hydrogeological studies related to groundwater contamination.

Seismic-horizon mapping in Phanerozoic basins..

Investigation of the geology and petroleum potential of the northern Perth Basin.

Pilot studies of computer-based Geographic Information Systems (GIS) to assist in land-use planning in mineralised areas.

Petroleum Division

The following investigations were completed during the year:

reservoir engineering studies on Wanaea and Cossack fields;

petrophysical appraisal of wells drilled this year, particularly those where hydrocarbons were encountered;

technical evaluation of the Cossack floating platform, storage and off–take vessel development;

technical assessment of new ultra-slimhole drilling techniques;

review of options and recommendations on a State gas flaring policy.

Explosives and Dangerous Goods

The following review of Major Hazard Control Plans were undertaken:

Nufarm Chlorine Plant, Kemerton

(completed to third-party audit and under review);

Tiwest Titanium Dioxide Plant, Kwinana

SCM Titanium Dioxide Plant, Kemerton

(first audit completed and under review);

BP Petroleum Refinery, Kwinana

CSBP Chlorine Plant, Kwinana

(preparation of hazards control plan instigated); and

ELMINA Aluminium Fluoride Plant, Kwinana

WMC Nickel Refinery, Kwinana

(a waiting development of hazard control plan).

Mining Engineering

Projects commenced and continuing include:

survey of tetrabromoethane and bromoform usage in laboratories;

guidelines for mercury vapour exposure in gold plants;

survey of asbestos fibres in underground nickel operations;

blast and environmental noise monitoring program in Kalgoorlie;

guidelines for noise control in mines;

efficiency calibration of gross alpha counting;

systems retention and excretion of Thorium by Mineral Sands Industry employees;

investigation into the availability of low emission diesel fuel for underground diesel engines; and

investigation into methods to reduce particulates in diesel emissions for diesel engines used underground.

Projects completed include:

occupational hygiene assessment of vanadium processing operations;

evaluation of the CRPM dosimetry system;

thorium bioassay of Mineral Sands workers;

MDAS = Mines dose assessment system (software package); and

marple personal cascade impactor calculation database.

Surveys and Mapping

Projects completed during the year included:

the Hamersley Range GIS Project in June 1992. A total of 14 different maps were produced to meet the demands of the projects brief; and

computer-generated, three dimensional colour mine plans. These represent models of mines allowing underground or open cut mine models to be viewed from any direction.

Appendix 3: Publications

The Department compiled or revised publications covering a variety of topics during the year. They included:

The Mining Act and Regulations

Mineral exploration and land access

Geological publications and maps

Mineral tenement maps and various thematic maps relating to mining and other land-use applications in Western Australia

Petroleum exploration, safety and environmental considerations

Explosives and dangerous goods

Accident reports and safety pamphlets

Chemical investigations covering the fields of agriculture, forensic science, environment, public health, the racing industry, materials science, metallurgy and mineral processing

Environmental responsibilities of mining and petroleum companies

Guidelines on mine work practices and radiation.

More details about Departmental publications can be obtained through the Head Office Library (09 222 3330), the public counter at Mineral House, 100 Plain Street, East Perth, or regional offices elsewhere in the State.

Appendix 4: Departmental Directory

Head Office

Department of Minerals and Energy
Mineral House Complex
100 Plain Street (cnr Adelaide Terrace)
EAST PERTH Western Australia 6004
Telephone (09) 222 3333
Fax (09) 222 3430

Metropolitan Offices

Chemistry Centre WA
125 Hay Street
PERTH Western Australia 6101
Telephone (09) 325 5544
Fax (09) 325 7767

Baldivis Explosives Reserve
Stakehill Road
BALDIVIS Western Australia 6171
Telephone (09) 524 1301
Fax (09) 524 1792

Exploration Safety and Drilling
91 Briggs Street
WELSHPOOL Western Australia 6106
Telephone (09) 470 0300
Fax (09) 362 5694

Mineral Processing Laboratory
19 Catherine Street
BENTLEY Western Australia 6102
Telephone (09) 458 9088
Fax (09) 351 8197

Regional Offices

Collie

Coal Industries Council
66 Wittenoom Street
COLLIE Western Australia 6225
Telephone (097) 344 599
Fax (097) 344142

Regional Mining Engineer
66 Wittenoom Street
COLLIE Western Australia 6225
Telephone (097) 341222
Fax (097) 341606

Kalgoorlie

Regional Mining Engineer
Brookman Street (Box 671)
KALGOORLIE Western Australia 6430
Telephone (090) 219411
Fax (090) 213612

Kalgoorlie Metallurgical Laboratory
95 Egan Street (Box 881)
KALGOORLIE Western Australia 6430
Telephone (090) 805120
Fax (090) 912762

Mining Registrar
Brookman Street (Box 364)
KALGOORLIE Western Australia 6430
Telephone (090) 213 066
Fax (090) 912428

Kalgoorlie Explosives Reserve
Piccadilly Street West
KALGOORLIE Western Australia 6430
Telephone (090) 218 246
Fax (090) 913222

Geological Survey of WA Regional Office
Egan Street
KALGOORLIE Western Australia 6430
Telephone (090) 219425
Fax (090) 914499

Karratha

Regional Mining Engineer
Hedland Place (Box 518)
KARRATHA Western Australia 6714
Telephone (091) 868 243
Fax (091) 868251

Broome

Mining Registrar
Court House (Box 28)
BROOME Western Australia 6725
Telephone (091) 921 137
Fax (091) 921 878

Carnarvon

Mining Registrar
Court House (Box 35)
CARNARVON Western Australia 6701
Telephone (099) 411 082
Fax((099) 412779

Coolgardie

Mining Registrar
40 Bayley Street (Box 41)
COOLGARDIE Western Australia 6429
Telephone (090) 266 066
Fax (090) 266204

Kununurra

Mining Registrar
Court House (Box 917)
KUNUNURRA Western Australia 6743
Telephone (091) 681 011
Fax (091) 681103

Leonora

Mining Registrar
Rochester Street (Box 4)
LEONORA Western Australia 6438
Telephone (090) 376 106
Fax (090) 376248

Marble Bar

Mining Registrar
Bohemia Road (Box 7)
MARBLE BAR Western Australia 6760
telephone (091) 761044
Fax (091) 761048

Meekathara

Mining Registrar
Main Street (Box 7)
MEEKATHARRA Western Australia 6642
Telephone (099) 811 008
Fax (099) 811482

Mt Magnet

Mining Registrar
Richardson Street (Box 13)
MT MAGNET Western Australia 6638
Telephone (099) 634 040
Fax (099) 634488

Norseman

Mining Registrar
Princep Street
NORSEMAN Western Australia 6443
Telephone (090) 391 082
Fax (090) 391657

Southern Cross

Mining Registrar
Great Eastern Highway
SOUTHERN CROSS Western Australia 6426
Telephone (090) 491 107
Fax (090) 491431

DEPARTMENT OF MINES WESTERN AUSTRALIA

ANNUAL REVIEW 1991-92

ANNUAL REVIEW

CONTENTS

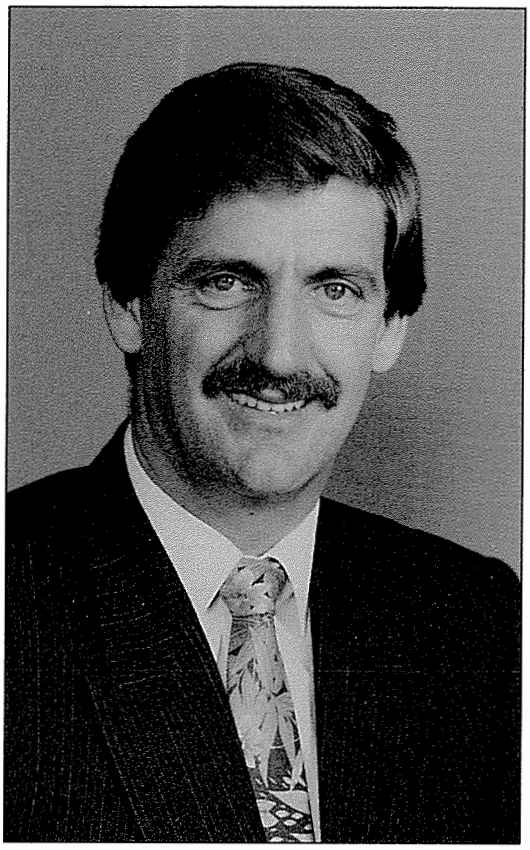
ANNUAL REVIEW

C O N T E N T S

Right: The 18 000 tonne Goodwyn–A jacket under tow from Indonesia to its installation site on the North West Shelf.
Below: Section of one of the three processing trains at Woodside's onshore LNG production plant on the Burrup Peninsula.

MINISTER FOR MINES

FOREWORD



I wish to commend the Department of Mines, and others associated with the minerals and petroleum industry in Western Australia, for another year of achievement.

Major accomplishments for 1991-92 included:

- The continuing buoyant level of mineral and petroleum production in Western Australia at around $12 000 million for 1991-92.
- Petroleum title applications up by more than 50%.
- Mineral title applications up by 12.5%.
- Confirmation of a massive underground water resource in the South West of the State.
- The release of a wide range of new maps, including the first that the Department has produced entirely by computer.
- The launch of new environmental excellence awards for the mining and petroleum industries.
- The collection of royalties and rentals from mining and petroleum companies which exceeded $400 million for the first time.
- The decline in workers compensation premiums for mining companies which reflected an improved safety performance for the industry.
- The development of new safety measures for the transportation of dangerous goods, and the protection of the environment.
- Advanced planning for Stage 1 of a new minerals research centre at Bentley.
- The announcement by the Premier that the Department of Mines would become part of a new Department of Minerals and Energy from 1 July 1992.

The importance of the minerals and petroleum industries to the economy of Western Australia is amply demonstrated in the pages of this Annual Review document and I commend it to your attention.

I am confident that the industry will continue to prosper and I would like to take this opportunity to wish all those associated with the industry a rewarding and successful year ahead.

Gordon Hill
MINISTER FOR MINES

DIRECTOR GENERAL OF MINES

THE YEAR IN REVIEW

The 1991-92 financial year was a challenging one for the Department. Community and industry demands and expectations for the delivery of services continued to increase while resources to supply these services have not kept pace.

While two financial years ago the Department employed an average 793 staff, in 1991-92 the number was 50 lower at 743. Thus, the Department has had to review its priorities, increase its productivity and improve its reporting systems.

In common with the clients we serve, improving our efficiency is being increasingly achieved by automation and computerisation. The trend is thus towards a more capital intensive method of work employing a smaller but more highly skilled and flexible workforce.

All six programs of the Department have been affected.

For the programs concerned primarily with the mining and petroleum industries, conditions in the industries had a significant impact upon our activities. The state of the industry is reflected in the gross value of production where, for the first time in over 20 years, the value of mineral and petroleum production declined. This was despite an increase in production for most commodities which was the logical reaction of producers attempting to maintain their cash flow in a climate of declining world prices.

Production rose in varying amounts across all sectors except heavy mineral sands and nickel where world supplies were considerably in excess of demand.

The depressed conditions have placed greater demands on Government agencies servicing the industry. To remain competitive, companies are seeking to minimise their costs in the exploration, extraction, and processing of the basic mineral commodities. This means that companies seek from Government ready access to Crown land for exploration, improved information to assist in their search, faster processing times for all bureaucratic processes, direct financial support, regulatory reform to allow more flexible working hours and greater co-operation in research and development.

While industry is adjusting to the recession, community expectations are also changing. The past few years have seen a strong trend towards improved environmental management and rehabilitation and an increased emphasis on occupational health and safety issues. Access to land for exploration has also become more difficult with greater restrictions being placed on potential mineral explorers across wider areas of conservation and Aboriginal reserves in Western Australia.

During the year, the number of mineral title applications increased by 12.5%, while there were over 50% more petroleum exploration titles granted. Despite the increase in mineral titles, over 60% were dealt with by the Department within five months of being received.

Access to land for mineral and petroleum development was improved in a number of ways during the year. Agreement was reached with the Department of Conservation and Land Management over standard conditions under which exploration can be carried out on conservation estate land. Further improvements were made to computer systems to facilitate the process of issuing titles. Development of a prototype computerised graphic system supporting an electronic title system was undertaken using special funds allocated by the Government.

The Government also announced that legislation will be introduced to improve access to private land which now comprises 7% of the State's total land area. This will assist in mineral and petroleum exploration in the South West of the State where it has been difficult to reach

agreement with the large groups of land owners necessary for any extensive exploration activities.

Despite the increase in mineral and petroleum title applications, the number of staff devoted to this program remained the same as in the previous year. Industry consultation, however, increased through four industry liaison committees already set up to cover the mining, petroleum and mapping sectors. These groups provide a valuable forum for discussion on ways the Department can improve its services to industry and carry out its activities more efficiently. A user-pay system for the survey of mineral titles was introduced on 1 July 1991 as a means of reducing the backlog and providing a more efficient survey system.

With the aid of a direct Government grant, airborne geophysical data were acquired for the Kurnalpi area in the Kalgoorlie region. The combination of the geophysical data acquisition and a strong mapping program meant that 46 maps were completed and published during the year. Computer–aided map publishing was used to produce the Cheritons Find map. This was a first in Australia and the same techniques are now being used in further map production.

Also during the year, the Department continued to develop its expertise in Geographical Information Systems. This was applied to aspects of land ownership in the Pilbara region. Natural and cultural features were entered into databases designed to assist land–use planning and reduce land-access conflicts.

There was a substantial increase in geological data released to industry to assist in petroleum and mineral activities. A revised policy covering the release of interpretative petroleum exploration reports will make this information available to industry at an earlier stage. The backlog of mineral reports to be entered into the WAMEX database was eliminated. This was a noticable achievement while work continued on the development of another database covering all mines and mineral deposits in WA.

As a part of our groundwater evaluation role, the Scott Coastal Plain groundwater drilling program was completed. This assisted in the definition of an extremely large groundwater resource located in the southern Perth basin. This resource contains an estimated 300 000 million cubic metres of potable groundwater with an estimated annual renewable resource of some 200 million cubic metres which is equivalent to the current amount of water supplied to Perth via the scheme water supply.

To assist the mining sector improve productivity, the Chemistry Centre continued to provide consulting services and test work facilities. Rotary kiln runs were conducted for various clients with ilmenite upgrading being the major area of interest. Gold industry services were active with there being a keen demand for research and development to improve gold extraction.

To ensure that proper attention is given to the protection and rehabilitation of the natural environment, one of the Department's programs concentrates on those activities of the mineral and petroleum sector which impact upon the environment. There has been a substantial improvement in the rehabilitation performance through improved environmental management at minesites. This has been achieved through attitudinal change and a higher commitment to the environment by industry management.

Progressive rehabilitation at minesites has now become the norm, and, to highlight this improvement, the Department's Environmental Excellence Awards for industry were inaugurated. These annual awards will give recognition to those operators who have conducted their activities in an environmentally-sensitive manner. Two

important liaison committees were also established. They include mining and petroleum representatives as well as conservation groups, trade unions, industry and relevant Government agencies. These committees have met on a regular basis to review the Department's policies and activities related to environmental management.

The Transport and Storage of Dangerous Goods Working Party set up by the Department in 1989 to examine the feasibility of prescribing routes for dangerous goods delivered its report. The recommendations made by the Working Party are aimed at protecting important water assets in the South West of the State.

In ensuring that the community receives a fair return from the extraction of the State's mineral and petroleum resources, the Department continued to develop and implement appropriate mineral and petroleum royalty systems. Total payments to Government by producers increased from $358 million to $375 million during 1991-92. Total collections were about 5% higher than in the previous year, with the State's share of collection being $320 million and the Commonwealth share $55 million. Extensive audits were conducted during the year and four petroleum royalty agreements were finalised with producers.

In 1991-92 total payments by the mining and petroleum industries to the State Government exceeded the total stamp duties for the first time. This made the industries' contribution the second most important source of State Government discretionary revenue for the year with only payroll tax providing more.

A major emphasis of the Department's activities continues to be to ensure that all operations in the mining and petroleum industries and activities involving explosives and dangerous goods, are conducted in a manner that is safe for workers and the public. There was a continued improvement in the general trend in lost-time injuries and the industry continues to demonstrate sound occupational health and safety practices. However, the number of fatalities is still a concern and the Department is actively working to improve occupational health and safety by changes to legislation, inspection arrangements and education activities.

Mining inspectorate activities during the year emphasised induction training for all employees. Mining engineering inspectors also audited all underground mines for emergency preparedness with respect to fires and evacuation procedures. Underground diesel equipment was also modified with fixed-fire suppression equipment. As the most effective means of preventing injury or harm to health, some sections of mines were closed by Inspectorates and items of defective equipment taken out of service. Several prosecutions were successfully conducted for breaches of the Mines Regulation Act. Safety education was further boosted by the Department with regular publication of newsletter and safety pamphlets and assistance with a number of industry education initiatives.

Departmental staff gave increased emphasis to the geotechnical and rock mechanical aspects of open pit and underground mines with over 70 individual assessments or reviews being completed. A large proportion of these included field inspections and, in many cases, the advice led to modification of mine design or operating procedures.

Substantial progress is being made in the industry towards reducing the exposure of mine workers to crystalline silica and respirable dust. Progressive reduction of these contaminants is being maintained and compliance is high with about 95% of samples tested being below the exposure standard.

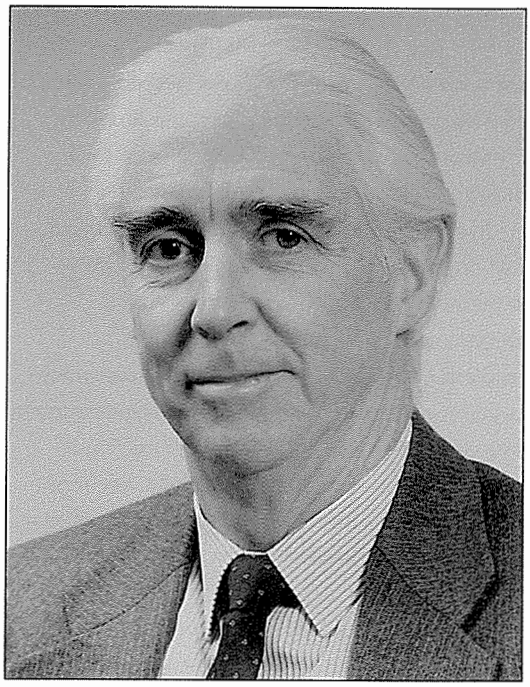
To improve the effectiveness of its services, the Chemistry Centre has progressively embarked upon the installation of more sophisticated and more highly-automated

equipment. For example, in the forensic science laboratory, gunshot residue particle detection is the most recent example of the automation of an otherwise highly labour-intensive operation. A further example has been in the examination of fire debris for flammable accelerants in which ten items can now be analysed on each overnight run. A wide range of chemical services is provided through agricultural,forensic, environmental, health, materials science and racing chemical laboratories.

Initial funding was provided by the Government during the year for the preparation of detailed plans and tender documents for Stage 1 of the Chemistry Centre proposed for a site at Bentley. The Stage 1 Mineral Research Centre will see the housing of the West Australian component of the CSIRO Division of Mineral Products and Curtin University of Technology School of Chemical Engineering adjacent to the Mineral Processing Laboratory of the Chemistry Centre. Stage 2 will see the transfer of the remaining Chemistry Centre laboratory to the Bentley site. The existing Chemistry Centre facilities are very out-dated and new laboratories are a high priority.

With a reduction in Government funding and staffing levels, increasing demands from our clients and the need for further effort in our safety and environmental programs, the Department continues to face a challenging future. It will not do so as a Department of Mines, because after 98 years, it will change its name to the Department of Minerals and Energy on 1 July 1992.

I am confident that the dedication, professionalism and initiative of our staff will be maintained and that the new Department will combine to serve the State of Western Australia as the old one has for so many years.



D R Kelly
DIRECTOR GENERAL OF MINES

THE DEPARTMENT

RESPONSIBILITIES AND OBJECTIVES

BACKGROUND

The Department of Mines was established in the wake of massive interest in mining generated by the discovery of gold at Coolgardie in 1892 and at Kalgoorlie the following year.

The Department was officially established on 1 January 1894 when the mining registration and survey functions of the Lands Department were combined with the Geological Survey of Western Australia.

The new regulatory body set out to ensure the safe and orderly development of mineral resources in Western Australia, and allow the Government and community to benefit from these activities.

These responsibilities have remained an integral part of the Department for the past 98 years.

However, the role of the Department has been expanded over the years to include the Chemistry Centre (WA), plus functions relating to the assessment of petroleum exploration and development, underground water resources and the handling of explosives and dangerous goods.

To carry out these responsibilities the Department employs approximately 743 people and operates on a budget in excess of $45 million.

Its workforce includes geoscientists, mining and petroleum engineers, cartographers, chemists, metallurgists, economists and others who ensure that the duties of the Department are carried out in an efficient and professional manner.

Royalties and rents collected by the Department from mineral and petroleum activity in W.A. during 1991-92 yielded $429 million.

The Department administers 17 Acts of Parliament, the principal ones being the Mining Act, the Mines Regulations Act and the Petroleum Act.

Through the authority of these Acts, the Department oversees an industry which directly employed more than 34 000 people and achieved production valued about $12 000 million during the 1991-92 financial year.

VISION

The Department of Mines will be recognised for its commitment to excellence and quality in meeting the needs of the community, industry and Government in the areas of minerals and science.

CORPORATE PHILOSOPHY

Western Australia is fortunate being endowed with abundant mineral and petroleum resources which are held in trust by the Government on behalf of the community.

Recognising that the community requires mineral and petroleum products to sustain its standard of living, the Department of Mines has been given the responsibility to ensure that the exploration for and development of these resources is carried out equitably, with due care for the environment and worker safety, in the best interests of the community.

The general principles and philosophies fundamental to the Department's role, programs, structure, functions and strategy are:

- The mineral and petroleum resources of the State are owned by the Crown, but are almost entirely explored for, and developed by, private enterprise.
- Exploration and development are undertaken in an organisational framework controlled and directed by Government with appropriate recompense (benefit) to the wider community.
- The mineral and petroleum industries play a major role in the economy of the State and a high level of exploration is essential to identify the mineral, petroleum and groundwater resources which will be required to sustain our economy and maintain our living standards.

THE DEPARTMENT

RESPONSIBILITIES AND OBJECTIVES

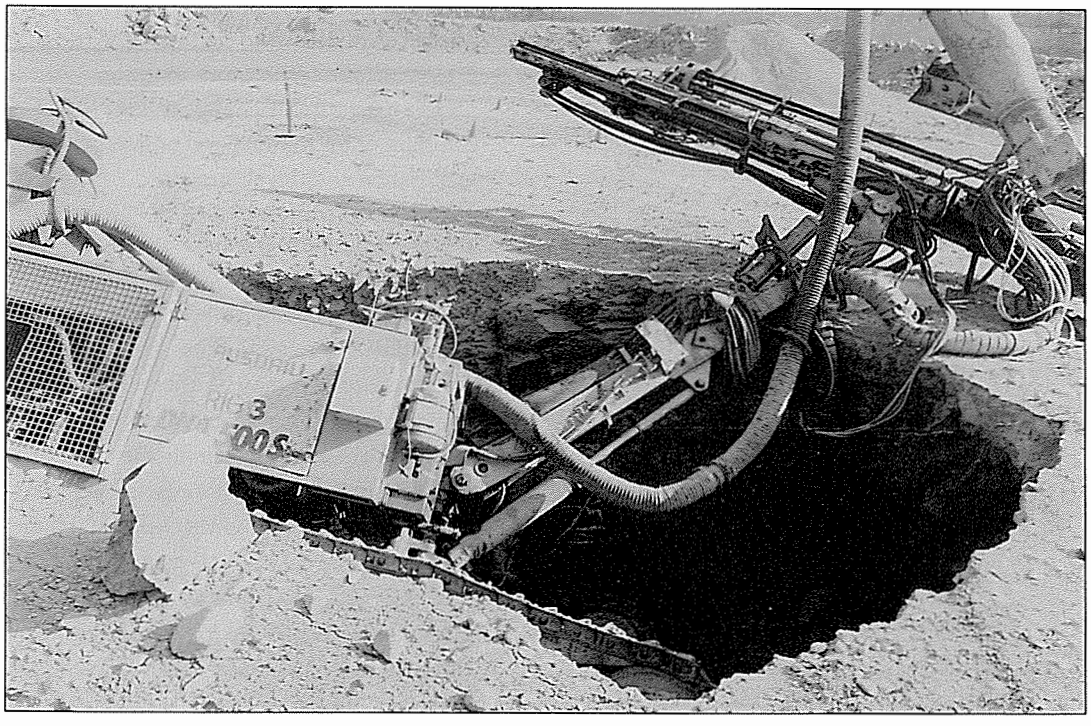
- Mineral and petroleum deposits are almost always difficult and expensive to find, small in size relative to the total land mass, finite, and non-renewable.
- Mineral and petroleum deposits are assets only after they have been discovered and delineated, and the potential for an appropiate financial return provides the incentive to engage in high-risk exploration necessary to find them.
- Mineral and petroleum developments are a temporary land-use and should be integral to the principle of multiple land-use.
- Changes in the economy, technology, and geological understanding will lead to the re-appraisal of previously tested ground; thus the potential of any area can never be totally written off and there is a need to ensure that information is not lost and as much land as possible is made available for exploration.
- Geoscientific data available from studying the geological record are essential for general land-use planning (for planning and designing urban areas, dams, roads, ports and harbours); such information can also assist in understanding and predicting events associated with the Greenhouse Effect.
- Chemical research and services at a high level of confidence and integrity are needed to ensure that independent and standardised information is provided to the community.
- Management and the workforce must work together to create a safe working environment.
- Public safety is of major concern in relation to the transportation, storage and use of explosives and dangerous goods.
- Resources allocated to the Department are to be administered efficiently according to the prevailing principles and standards expected of the Public Service.
- The Department must respond quickly and effectively to changes required by the community through Government.

It is against this background and in this environment that the Department must operate.

The Department has a diverse range of responsibilities, among them checking on the safe handling of chemicals. Here, John Genovese, from the Department's Health Chemistry Laboratory, advises on procedures for an insecticide spill at the Fremantle wharf.

THE DEPARTMENT

RESPONSIBILITIES AND OBJECTIVES



One of the key objectives of the Department is to create a safer work environment within the State's minerals and petroleum industry. The images on this page amply demonstrate that accidents sometimes do occur and that the highest level of safety training is essential for the wellbeing of the 34 000 people employed in the industry in WA.

THE DEPARTMENT

RESPONSIBILITIES AND OBJECTIVES

ROLE

The role of the Department is to ensure that the community of Western Australia:

- receives maximum benefit from the responsible exploration and development of minerals and petroleum with proper regard to the protection of the environment;
- is protected from hazards associated with mineral and petroleum activities, explosives and dangerous goods;
- has access to independent geotechnical, chemical and engineering advice relevant to land-use planning, and the mineral and petroleum industries;
- is provided with information about the geoscientific environment including the distribution of mineral, petroleum and groundwater resources; and
- is provided with independent chemical research, consultancy and analytical services.

PROGRAMS:

To fulfill its role the Department carries out the following programs:

1 ***Minerals and Petroleum Titles Program***
The objective of this program is to ensure that exploration and development titles for minerals and petroleum are issued fairly and without delay.

1.1 ***Titles System Sub-Program***
Provides an equitable system for granting secure exploration and development titles as a basis for petroleum and mineral assessment and production.

1.2 ***Dispute Management Sub-Program***
Minimises potential for disputes over exploration and development titles and facilitates the prompt settlement of disputes when they do arise.

2 ***Exploration and Development of Natural Resources Program***
The objective of this program is to foster and assist responsible mineral and petroleum exploration and development, groundwater assessment, and land-use planning by providing high-quality scientific and technical services and advice to industry, Government and the public.

2.1 ***Geological Data Collection Sub-Program***
Meets the need for geoscientific mapping, research, and resources assessment required to produce up-to-date maps, reports, and advice on the geology of the State and its mineral, petroleum and groundwater resources.

2.2 ***Metallurgical and Analytical Services Sub-Program***
Provides mineral and metallurgical analytical and research services.

2.3 ***Geoscientific Data Dissemination Sub-Program***
Provides timely dissemination of scientific and technical data from company exploration activities and Departmental studies.

2.4 ***Geotechnical and Mining Engineering Advice Sub-Program***
Meets the need for geotechnical, geoenvironmental, hydrogeological, and mining engineering advice and services.

2.5 ***Community Relations Sub-Program***
Fosters a favourable climate in the community for mineral and petroleum exploration and development.

3 ***Environmental Protection and Rehabilitation Program***
The objective of this program is to ensure that proper attention is given to the protection and rehabilitation of the natural environment as it may be affected by mineral and petroleum exploration and development, and to facilitate the protection of groundwater resources. The program also provides chemical services for environmental management plus geological and mineral resource information and advice for planning and management of National Parks and Conservation Reserves.

THE DEPARTMENT

RESPONSIBILITIES AND OBJECTIVES

4 *Community Benefits Program*
The objective of this program is to ensure that the community receives a fair return from the extraction of the State's mineral and petroleum resources. It ensures that royalty collection is carried out in an economically and administratively efficient manner.

5 *Worker and Public Safety Program*
The objective of this program is to ensure that all operations in the mining and petroleum industry, and activities involving explosives and dangerous goods, are conducted in a manner that is safe for workers and the public.

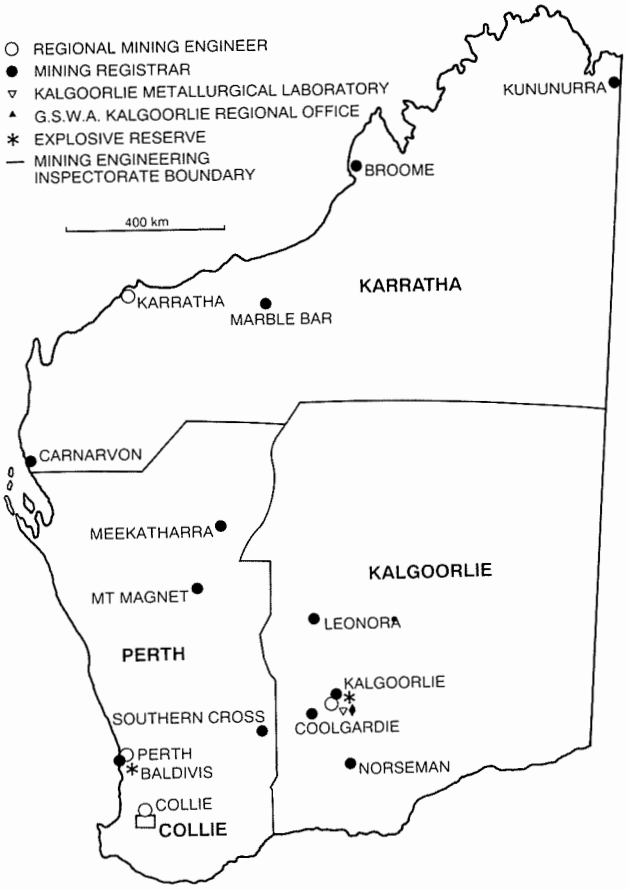
5.1 *Worker Safety and Health Sub-Program*
Maximises the safety and health of workers in the mining and petroleum industry.

5.2 *Management of Dangerous Goods Sub-Program*
Minimises hazards to the public from activities involving explosives and dangerous goods.

6 *Chemical Services Program*
The objective of this program is to enhance agricultural and industrial development, and the protection of community, consumer, environment and health standards by providing high-quality independent chemical services to Government, industry and the public.

7 *Corporate Services Program*
The objective of this program is to ensure that the human, financial and other resources of the Department are used efficiently and effectively to provide a service responsive to the needs of the community, industry and Government.

Regional Operations



THE DEPARTMENT

ORGANISATION STRUCTURE

DIVISIONS OF THE DEPARTMENT

The Department of Mines is structured into nine divisions.

Activities of the divisions are targetted at achieving the objectives of seven programs. The matrix on pages 16 and 17 shows the divisions and the programs into which they have input.

The Geological Survey Division systematically records and interprets the geology of the State and provides this information to Government, industry and the general public in order to assist the exploration, development and conservation of the State's mineral, petroleum and groundwater resources. It evaluates mineral and petroleum resources as a basis for decision-making by Government and assists and advises on a variety of community needs, including urban planning, land-use matters and engineering developments.

The Petroleum Division facilitates the undertaking by industry of geophysical and drilling programs for the identification and exploitation of oil and gas accumulations. It ensures that sound engineering principles and standards are applied to the design and construction of exploration and production facilities and that safety management systems are in place to secure the occupational health, safety and welfare of the workforce. It also maintains an effective title allocation and registration system, and monitors, advises and interprets State and Commonwealth petroleum legislation.

The Chemistry Centre (WA) provides chemical, mineralogical, metallurgical and associated analytical, investigative and advisory services to Government, industry and the public in the following areas: the development of the State's mineral, water and agricultural resources; monitoring and improving public and occupational health, environmental and material standards within the community; and scientific support to law enforcement and racing agencies.

The Royalties and Policy Development Division develops mineral and petroleum royalty systems which are fair and equitable and administers the collection and audit of royalties paid on behalf of the State and Commonwealth. It also provides economic advice on mining and petroleum industry issues, collects and disseminates statistics and assists in the development and co-ordination of general Departmental policies. The Division informs staff, industry and the public about the role of the Department and the importance of the mining and petroleum industry.

The Corporate Development Division provides corporate services for the Corporate Executive and the divisions of the Department whilst responding to the requirements of Government and central agencies. These services include corporate planning, building and purchasing services, computing, typing, records, telecommunications, finance, human resource and auditing activities.

The Mining Engineering Division administers mine safety legislation to safeguard and promote the health and safety of those working in the industry. It provides advice to the Government and to industry on mining engineering matters including deep mining, open-cut mining, quarrying, drilling, the environment and rehabilitation. It monitors exploration safety and administers contract drilling for the Department.

The Explosives and Dangerous Goods Division reviews, formulates and administers laws, regulations and policies aimed at the safe manufacture, storage, handling and transport of explosives and dangerous goods. It provides safety advice on these matters and major hazard control.

The Mining Registration Division receives applications and allocates titles that give legal rights to explore for and mine minerals in Western Australia pursuant to the Mining Act.

THE DEPARTMENT

ORGANISATION STRUCTURE

It maintains a mining tenement registry which records tenement holders, conditions and term of the grant and expenditure details from which the Division monitors compliance with the provisions of the Mining Act.

The Surveys and Mapping Division determines, documents and validates the boundaries of tenements and produces and updates all maps and plans necessary for the operations of the Department. All functions from primary field surveys to final map production are embraced. The range of cartographic activities includes charting, field surveying, computations, mapping reprographics, and maintenance of archival materials as an integral part of the tenement management process.

The officers of the Department are mostly located in Perth, although five divisions — Geological Survey, Mining Engineering, Chemistry Centre, Explosives and Dangerous Goods, and Mining Registration — have staff situated in regional centres. Most of these people work in areas that are large and remote by world standards.

In addition to providing services for land-based operations, the Department is also required to administer State and Commonwealth legislation covering offshore mineral, oil and gas exploration, exploitation, pipeline transportation and royalty payments.

A Department directory listing all offices is included in Appendix 4.

The Department's corporate executive: (standing from the left) Kerry O'Neil, John Clarke (deputising for the Director of the Geological Survey Phil Playford), Bill Phillips, John Hosking, Jim Torlach, Les Annison and Murray Meaton. Seated are Ken Price, Lee Ranford, Des Kelly, Colin Branch and Ian Fraser.

THE DEPARTMENT

ORGANISATION STRUCTURE

DIVISIONAL ACTIVITIES TO MEET CORPORATE PROGRAMS 1991-92

PROGRAM	SUB-PROGRAM	GEOLOGICAL SURVEY	MINING ENGINEERING	PETROLEUM
MINERALS & PETROLEUM TITLES **1** To ensure that exploration and development titles for minerals and petroleum are issued fairly and without delay.	1.1 Provide an equitable system for granting exploration and development titles as a basis for petroleum and mineral assessment and production.	Provide technical advice in relation to administration of Petroleum and Mining Acts.		Award, maintain and monitor rights to explore and develop petroleum onshore and offshore.
	1.2 Minimise potential for disputes over exploration and development titles and facilitate the prompt settlement of disputes when they do arise.	Technical advice or tenement matters.	Technical advice on tenement matters.	Process dealings, assess fees and advise on legislation.
EXPLORATION & DEVELOPMENT OF NATURAL RESOURCES **2** To foster and assist responsible mineral and petroleum exploration and development, groundwater assessment, and landuse planning, by providing high-quality scientific and technical services and advice to industry, Government and the public.	2.1 Meet the need for geoscientific mapping, research, and resource assessment required to produce up-to-date maps, reports and advice on the geology of the State and its mineral, petroleum, and groundwater resources.	Obtain, interpret and evaluate data on all aspects of geoscience and earth-based resources (mapping, data, collation, evaluation).	Administer contract drilling to support resource assessment.	Provide technical and advisory services to ensure efficient and effective oil-field practice in exploratory and development drilling, testing and production.
	2.2 Provide mineral and metallurgical analytical and research services.			
	2.3 Provide timely dissemination of scientific and technical data from company exploration activities and Departmental studies.	Publish information and maintain geoscientific databases.	Publish reports and guidelines.	Provide information and statistics on petroleum exploration and development.
	2.4 Meet the need for geotechnical, geoenvironmental, hydrogeological, and mining engineering advice and services.	Provide advice and prepare special maps.	Ensure that effective mining engineering advice is available as required.	Advise on oil and gas volumes, field behaviour and production techniques to ensure optimum production and conservation of resources.
	2.5 Foster a favourable climate in the community for mineral and petroleum exploration and development.	Inform and advise Minister, and liaise with industry. Aboriginal and other community groups.	Ensure mineral exploration and mining operations meet community standards.	Develop strategies to encourage a strong and active oil and gas industry.
ENVIRONMENTAL PROTECTION & REHABILITATION **3** To ensure that proper attention is given to the protection and rehabilitation of the natural environment as it may be affected by mineral and petroleum exploration and development, and to facilitate the protection of groundwater resources.	• Ensure protection and rehabilitation of the natural environment as it may be affected by mineral and petroleum exploration and development.	Review and advise on environmental and/or rehabilitation aspects of exploration and mining proposals.	Ensure protection and rehabilitation of the environment as it may be affected by mineral exploration and development.	Implement audit procedures to ensure industry commitment and compliance with environmental requirements.
	• Facilitate the protection and rehabilitation of groundwater resources.	Provide hydrogeological advice on groundwater contamination.	Ensure drilling and tailings dams are managed to minimise groundwater contamination.	Ensure oil drilling operations do not pollute underground water resources.
	• Provide chemical services for environmental management.			
	• Provide geology and mineral resource information and advice for planning and management of National Parks and conservation reserves.	Provide geoscientific advice for landuse planning.		Advise on petroleum prospectivity and possible development methods for environmentally sensitive areas.
COMMUNITY BENEFITS **4** To ensure that the community receives a fair return from the extraction of the State's mineral and petroleum resources.	• Ensure that royalty collection is carried out in an economically and administratively efficient manner.	Provide geological advice to assist royalty determination.	Inspect mineral projects to assist with royalty determination and collection.	Ensure standards are met for oil and gas metering systems, and for the measurement of petroleum quantity and composition.
WORKERS & PUBLIC SAFETY **5** To ensure that all operations in the mining and petroleum industries, and activities involving explosives and dangerous goods, are conducted in a manner that is safe for workers and the public.	5.1 Maximise the safety and health of workers in the mineral and petroleum industries.	Provide geotechnical advice relating to mine safety.	Ensure compliance with the Act and Regulations by regular inspections, training and advice in mineral exploration and metalliferous and coal mines.	Carry out audits and safety inspections of petroleum operations; provide technical advice on exploration and development proposals and plant modifications.
	5.2 Minimise hazards to the public from activities involving explosives and dangerous goods.		Ensure public safety at abandoned mines.	Ensure the design, installation and operations of licenced petroleum pipelines comply with approved safety standards.
CHEMICAL SERVICES **6** To enhance agricultural and industrial development, and the protection of community, consumer, environmental and health standards, by providing high-quality independent chemical services to Government, industry and the public.	• Agricultural chemistry services; • Forensic science services; • Environmental chemistry services; • Public and occupational health chemistry services; • Materials and consumer protection scientific services; • Racing chemistry services.			

THE DEPARTMENT

ORGANISATION STRUCTURE

CHEMISTRY CENTRE W.A.	EXPLOSIVES & DANGEROUS GOODS	MINING REGISTRATION	SURVEYS & MAPPING	ROYALTIES & POLICY DEVELOPMENT
		Award, maihtain and monitor rights to explore and mine minerals onshore and offshore.	Provide and maintain maps depicting all mining and petroleum tenure and other land tenure; provide public searching facilities; record and certify position and other land tenure status of tenements; and manage surveying operations to establish tenement boundaries.	
		Operate Warden's Court and process Ministerial Appeals, Monitor effectiveness of legislation.	Provide a means of resolving conflict arising in respect to tenement boundaries, positions or markings.	
Provide chemical, mineralogical, analytical and advisory services on minerals and water.		Monitor performance of tenement holders in the submission of geoscientific reports.	Provide supporting geographical information systems.	
Provide chemical, extractive metallurgical and mineral processing advisory services and undertake investigations to enhance the processing of minerals.				
		Record and publish tenement data for industry.	Provide a cartographic and map preparation facility.	
Provide analytical and advisory services on groundwater, ores, mining and mineral processing.			Provide a cartographic and map preparation facility.	
Develop and monitor new technology appropriate to further processing of minerals.		Liaise with industry.		Inform Government and community.
Inspect, investigate and advise on environmentally sensitive areas, including mine wastes.		Issue and monitor titles with due regard to protection and rehabilitation of the environment.	Provide a graphical index and record of environmental themes.	
Provide chemical advice on the protection and rehabilitation of groundwater.	Ensure that dangerous goods are transported in a manner that provides maximum protection to the environment.			
Analyse and identify contaminants and natural constituents in air and water. Provide soil testing services for soil conservation projects.				
Provide chemical and mineralogical analytical services on geological materials.			Monitor changes to Environmental Reserve boundaries and maintain graphical systems.	
			Support the site location data base.	Collection of royalties and statistics.
Inspect, test, investigate and advise on occupational health matters.			Provide a repository for information concerning plans of mines and minesites.	
Inspect, test, investigate and advise on chemical aspects of dangerous goods, handling, storage and transport.	Provide a high level of assurance of public safety at places where explosives and dangerous goods are manufactured, stored or transported.			
Undertake investigations, solve problems and provide scientific support, for agricultural research and regulatory programs; for law enforcement and drug free racing; for protection of community health, consumer and environment standards, and for the support of chemical industry.				**CORPORATE SERVICES** **7** To ensure that the human, financial and other resources of the Department are used efficiently and effectively to provide a service responsive to the needs of the community, industry and Government. (Affects all programs.)

THE MINING AND PETROLEUM INDUSTRY

THE YEAR IN REVIEW

INTRODUCTION

The total value of mineral and petroleum shipments in Western Australia declined for the first time in two decades. A drop of 2% or $270 million was recorded from the previous financial year, in a total value of nearly $12 000 million (Table 1).

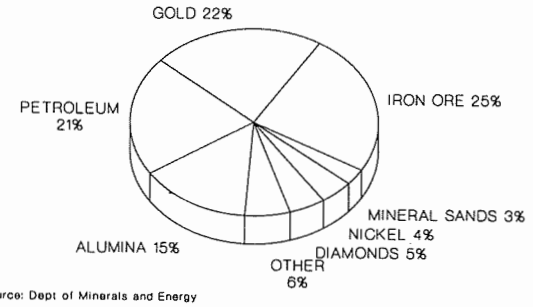
While iron ore continued to contribute to growth, the three other major commodity sectors gold, alumina and petroleum each showed reduced revenue despite increased levels of output (Table 2). Together these four sectors of the industry make up 82% of the total value of production. Of the other significant commodities produced in the State, only nickel and natural rutile recorded a decline in production; all others posted increased or at least similar levels of output.

These are surprising results considering the dependence of the State's minerals industry on world market trade during a continued period of global economic recession. The financial strength of its base, resilience, improved reliability and increased competitiveness of the State's mining sector have all played a part in achieving such results. Additionally, while the recession bit hardest on traditional customers in Europe and North America, it was only in the latter part of the period that Japan suffered significant effects. In the State's newer and increasingly important growth markets of South East Asia the effect has been much less and has perhaps had a cushioning effect.

Whereas production levels were maintained, commodity prices did not hold up in the face of the recession, locations of the price-fixing markets and added products dumped on the market as a result of the break up of the former USSR. In all but iron ore, unit prices were significantly reduced. This is reflected in the much lower levels of company profitability across the board, and none more so than in the alumina industry where profit levels have been almost halved over the 12 month period. The negotiated price for iron ore, taking effect for shipments after March 1992, now brings lower prices for this commodity into line with the overall trend. This effect will not become apparent until the forthcoming years results.

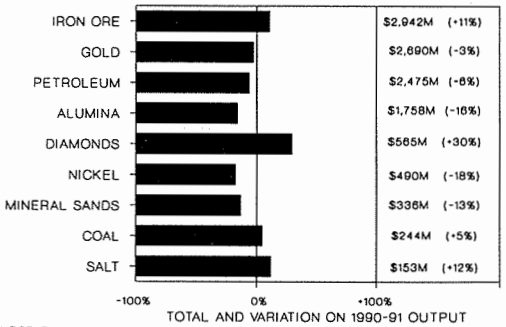
The prolonged recessionary period, in the Australian economy has had some benefits to the industry. These include lower debt servicing costs with the lowering of interest rates, low inflation maintaining only small production cost increases and a lower exchange rate against most of our major trading partners. These factors together with further increases in productivity and a significantly upgraded industry-base for the most part, leave the industry well placed to take advantage of any upturn in the market. Economic forecasts are

1991-92 VALUE OF MINERAL & PETROLEUM PRODUCTION
TOTAL: 11,998 MILLION (est)



Source: Dept of Minerals and Energy

CHANGE IN VALUE OF PRODUCTION
1991-92 (MAJOR SECTORS)



SOURCE: Dept of Minerals and Energy

Table 1. Quantity and Value of Mineral Production 1991-92

		Units	Quantity	Value $ Millions	
Iron Ore		Mt	11		2 942
Gold		t Au	182		2 699
Petroleum	• crude oil	x 10^3 Kl	5 432	941	
	• condensate	x 10^3Kl	1 997	339	
	• natural gas	M m^3	3 769	349	
	• LNG	x 10^6 MM Btu	220	846	
		Total			**2 475**
Alumina		Mt	7.1		1 758
Diamonds		M cts	47.5		565
Nickel	• nickel	Kt Ni	50.6	490	
	• by-products			38	
		Total			**528**
Mineral Sands	• ilmenite	Kt	975	83	
	• rutile	Kt	47	27	
	• synthetic rutile	Kt	305	153	
	• zircon	Kt	227	61	
	• monazite	Kt	7.4	2	
	• others		-	10	
		Total			**336**
Coal		Mt	5.5		244
Salt		Mt	6.9	153	
Base Metals	• copper	Kt Cu	3.2	6	
	• lead	Kt Pb	21.7	7	
	• zinc	Kt Zn	142.9	126	
	• silver	t Ag	13.3	2	
		Total			**141**
Manganese		Kt	395	72	
Other			-	84	
		Total			**11 998**

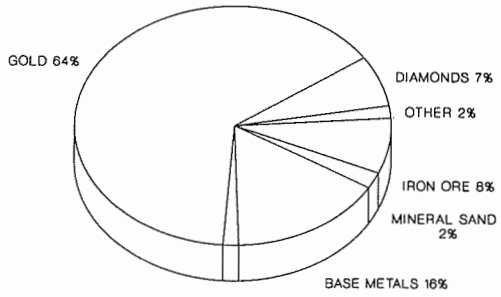
suggesting a general steadying in the market for 1992–93, with perhaps a modest growth beginning in early to mid 1993.

While there has certainly been a slowdown in project commitments since the heady days of the late 1980s, there was a very significant commitment to project investment of around $1.4 billion in 1991–92. This is on top of about $3.3 billion in projects already under construction. The diversity of these projects is wide, covering gold, nickel, iron ore, alumina, salt, petroleum and others. It augurs well for the long-term future of the industry.

Exploration, the base on which the future relies, is normally the first area to suffer in any recession. However, a degree of stability has been evident in mineral exploration over the last three years with levels of expenditure around $320–$330 million per annum being maintained. Gold exploration at 63% of the total remains steady and continues to be the major focus of activity, while a $10 million drop in base metal activity was counter balanced by the surge in iron ore exploration where a number of projects were being evaluated for development.

Estimates of petroleum exploration expenditure indicate a decline following the surge in 1989 and 1990. At around $200 million Western Australia captures around 50% of the Australian total. Development activity continues at a very high rate in the petroleum industry.

MINERAL EXPLORATION EXPENDITURE
1991-92



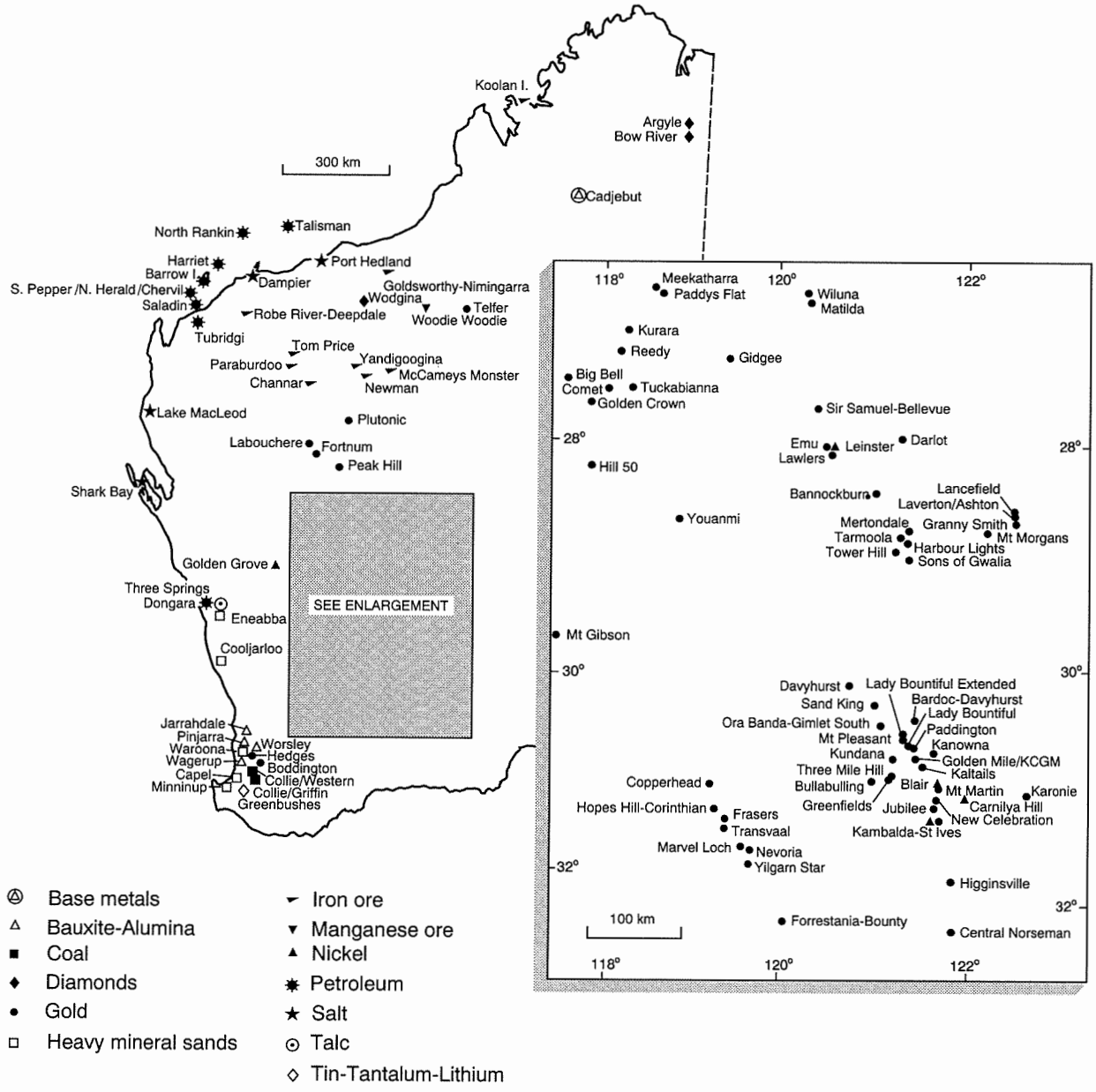
SOURCE: ABS Private Mineral Exploration Expenditure

Table 2. Change in Quantity and Value of Production

			1991-92 against 1990-91	
		% of Total Revenue	Quantity %	Value %
1.	Iron Ore	24.5	+3	+11
2.	Gold	22.5	0	-7
3.	Petroleum	20.6	+4 to +19	-6
4.	Alumina	14.7	+5	-16
5.	Diamonds	4.7	+58	+30
6.	Nickel	4.4	-7	-13
7.	Heavy Mineral Sands	2.8	-27 to +16	-13
8.	Coal	2.0	+5	+5
9.	Salt	1.3	+8	+12
10.	Base Metals	1.2	-	+83
11.	Manganese	0.6	+186	+227

MAJOR MINERAL AND PETROLEUM PROJECTS IN WESTERN AUSTRALIA

WITH AN ANNUAL VALUE OF PRODUCTION IN EXCESS OF $10 MILLION



THE MINING AND PETROLEUM INDUSTRY

THE YEAR IN REVIEW

COMMODITY AND OPERATIONS REVIEW

The following sections analyse the major commodities produced in Western Australia and review the main operations.

Iron Ore

The level of shipments of iron ore continued at a high rate, particularly in the first half of the year, but significantly more difficult conditions were being experienced towards year-end.

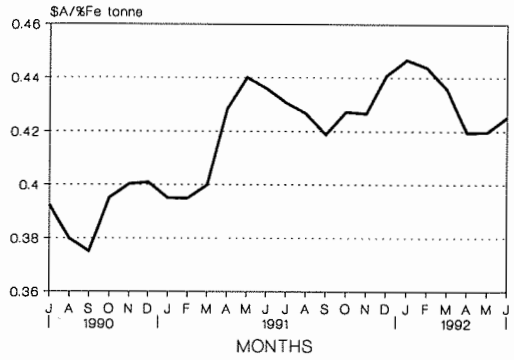
Shipments exceeded those of the previous year by 3% to achieve a record 111.1 million tonnes, valued at $2 940 million. This is an 11% rise in revenue as a result of negotiated price rises of 6-8% for the 1991-92 ore year. However, the downturn in steel demand and increasing difficulties experienced by the Japanese and European steel industries has painted a gloomier picture for the future, with a 5.5% price drop taking effect from April 1992 and another being forecast for the coming year.

Offsetting these factors has been the increasing market diversification to the major growth areas of South East Asia and the slow but progressively changing trade pattern to Eastern Europe and the C.I.S. The latter countries are emerging from their internal central planning regimes to free market consumers and producers.

While the existing mines of the Pilbara have served this sector well for 25 years, the industry has realised that, to maintain market share, expansion plans need to be gradually phased-in as existing resources move towards depletion. As a result, new developments with a combined investment of $140 million were brought into production in 1991–92, while upgradings costing over $300 million are in progress, and advanced-stage evaluations for new mine developments with total investment of perhaps $1 000 million are taking place. To add to this, a number of iron and steel development studies

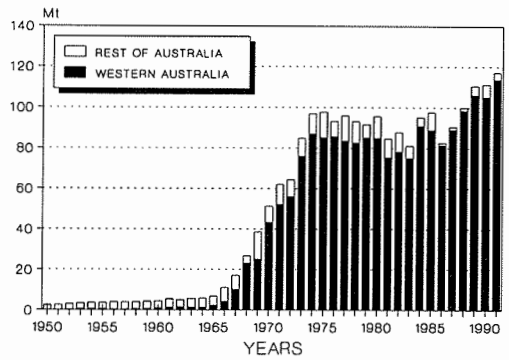
Iron ore worth $2 940 million was shipped out of WA during the year. Part of it was exported via Robe River's port facilities at Cape Lambert.

IRON ORE PRICES



SOURCE: HIGH GRADE FINE ORE PRICES.

IRON ORE PRODUCTION



SOURCES: DOME, BMR & ABARE

were announced during the year, together with the release of the Government's Steel Study Report to develop strategies and promote development of a downstream sector in the State.

Hamersley Iron Pty Ltd made record shipments during the year of over 48 million tonnes from mining operations at Tom Price, Paraburdoo and its joint venture with China Metallurgical Import and Export Corporation at Channar. Additionally production commenced in June 1992 from the *Brockman No 2 Detritals* project, 54 km northwest of Tom Price, to supplement the high quality lump ore from the existing operations.

A significant exploration effort continued by Hamersley Iron to assess the detrital ore potential as high quality bedrock supplies become progressively depleted.

The *Marandoo* project, however, still forms the major replacement development of Hamersley Iron. Planned to come on-stream in the mid 1990s it will progressively replace the ore from Tom Price over a 15-20 year period. After two years of extensive environmental studies by the company, the findings of the EPA should be released shortly. The project is very significant in the long term, being the first major development of the 'second generation ores' from the Pilbara (the Marra Mamba Formation). Also it will provide the first stage of an access corridor through the Karajini National Park from the west to link up the major undeveloped iron ore deposits of the Central Hamersley Ranges.

Following the purchase of its partners share in the Goldsworthy Joint Venture in the previous year, the *BHP Iron Ore Group* continued its acquisitions taking over Hancock Mining Ltd and hence securing the McCameys or Jimblebar mine and deposits under its ownership. Shipments from mines now owned by the BHP Iron Ore Group were over 36 million tonnes from its Pilbara operations plus a further 3.4 million tonnes from the shortly to be depleted Koolan Island operation in Yampi Sound. The Pilbara operations include the northern, Goldsworthy areas where *Nimingarra* is the main focus of the 6 million tonnes per annum output. At the Mt Whaleback operation at *Newman* 110 million tonnes of material were moved in a major strip-back exercise, while other production came from Orebody 29 (Marra Mamba), Orebody 25 (detritals) and Jimblebar, which moved from a detrital operation to a small bedrock mine.

February 1992 saw the commencement of production from BHP's latest development; *Marillana Creek*. This is an $80 million investment, initially for 5 million tonnes per annum output, but scheduled to progress to 10 million tonnes of limonitic pisolite ore. The mine is linked to the Newman Port Hedland rail line via a northern rail spur through

Fig Tree Gully. This again could be a further start of the link to the Central Hamersley deposits.

To facilitate this development and cater for capacity output from the Newman area mines, BHP has embarked on a $200 million materials handling expansion at Nelson Point in Port Hedland. This will allow a ship handling capacity of 45 million tonnes per annum.

The *Robe River Joint Venture* is similarly undertaking an expansion programme from 24 to 32 million tonnes per annum, at a cost of $80 million. Integral to this expansion is the development of the Deepdale Mesa J deposit, the longest of the higher grade mesas remaining undeveloped. Shipments by the Robe River Joint Venture were 2.2 million tonnes down on the record of 1990-91, to 21.8 million tonnes for the year.

Developments in the industry over the last two years have shown an evolution in planning for the long-term future of the Pilbara industry and a realisation that the developments of 20–25 years ago cannot last indefinitely. After an initial exploitation based on high-grade low-phosphorus Brockman ore, a wider range of developments is taking place, including Marra Mamba, pisolitic limonites and detrital ores to more equitably exploit the 15 000 million tonnes market-acceptable, resource-base.

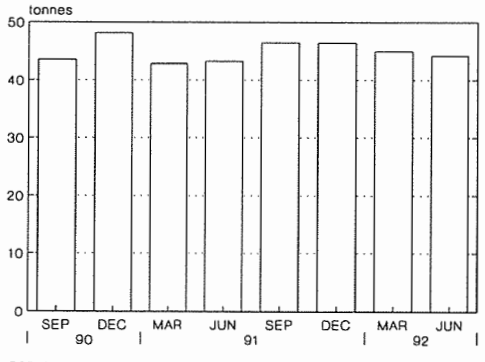
Additionally, moves to assess the viability of an iron and steel industry within and out of the State, particularly mini-mill developments, are attracting renewed interest in some of the small and/or low grade deposits. Such interest spreads from Southdown, in the south of the State, through Koolyanobbing and Tallering Peak in the Yilgarn, to the Fortescue BIFs in the North West. While only the $140 million HISMELT pilot project has progressed to a significant investment at this stage, a number of the other groups are confident of bringing a project to fruition over the next couple of years.

Gold

The exponential growth in gold production since the early 1980s reached a hiatus in 1991-92, with production estimated at 182 tonnes, which is marginally above last year's level. The gradual depletion of easily-won ore by many of the State's producers resulted in a number of closures and lower production levels, particularly among medium-sized operations. Production difficulties were experienced as a result of a combination of harder ores, increasing metallurgical difficulties, higher stripping ratios, deeper pits and depletion of resources. This was counter-balanced by two of the largest producers, KCGM on the Kalgoorlie Golden Mile and Telfer, where increased bulk, low grade ore treatment added a combined 5t of gold to the output. Further efficiencies in the rationalised centres of production helped to maintain output levels. By comparison to previous years the number of new developments was few. There were no really large projects with only Yilgarn Star, Mt McClure, Bannockburn and Mt Monger emerging as significant medium sized producers.

Since 1989 the gold price has fluctuated within a fairly narrow band between $Aus 450 and $Aus500/oz.; a far cry from the high but

QUARTERLY GOLD PRODUCTION



SOURCE: Dept of Minerals and Energy

widely varying levels throughout most of the 1980s. The industry, having grown through the 1980s, has had to adjust to a more stable, less lucrative and certainly less speculative attitude. While at around $Aus 500/oz., the average 1990-91 spot price, the industry was generally cushioned from the break-even price. At $Aus 460/oz., as the average for 1991-92, there is certainly a less comfortable margin as costs increase. A number of operations have been sustained through forward selling contracts at significantly higher prices.

Overall the levelling off of production and lower average gold price has resulted in an estimated 7% decline in the average value of production to $2 700 million for the year. However, in value terms of minerals produced, gold still ranks highly at number two, with 22.5% of the total value of production.

A figure of 53% of total gold production (97t of fine gold) is sourced from the Eastern Goldfields province, with just under half of this in the *Kalgoorlie-Coolgardie* region and areas immediately to the north and northwest.

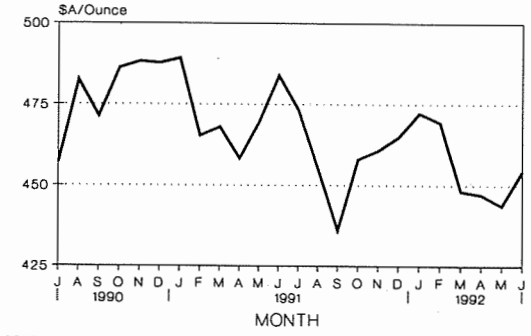
KCGM's integrated operation at *Kalgoorlie* consolidated its position as the State's largest producer with a yield of nearly 21t of gold for the year. Rationalisation of the operations was again a significant feature of the year with the curtailment of the Fimiston underground operations as well as the Mt Percy pits to concentrate efforts on the expanding Golden Mile Superpit and the highly mechanised Mt Charlotte underground mine.

A further 17 operations to the north west of Kalgoorlie combine to produce an equivalent output to that of KCGM. Many of these operations pioneered the 1980s gold boom and have or are now approaching a stage of depleted economic resources. Some have successfully moved underground, such as at Bayley's in Coolgardie, and others are planning to develop underground, such as at Ora Banda.

The same can be said of the mines between *Kalgoorlie and Norseman*. Norseman is back to underground mining, a significant part of the Kambalda-St Ives 6.4t of gold output is now from underground mines at Junction and Revenge, while New Celebration is progressively increasing its output from underground to eventually form the base of its longer term future.

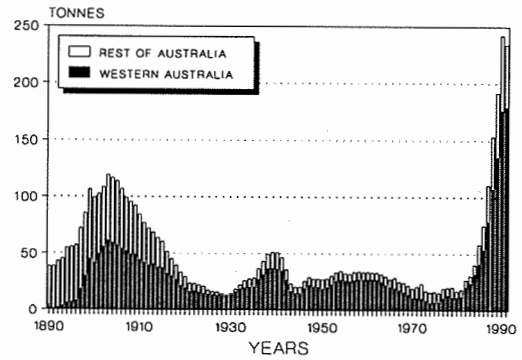
The *Northeastern Goldfields*, including the Laverton and Leonora areas, remains essentially a region of open pit gold mines, with only a couple of notable exceptions, Bellevue and Emu Leinster. Most operations are well established, with only a few medium-sized new mines being developed during the year at Mt McClure and Bannockburn. Total production from the region was 36.4t, headed by Granny Smith at 5.4t and Wiluna, Mt Morgans, Bellevue and Emu

GOLD PRICES



SOURCE: LONDON GOLD PRICE, MONTHLY AVERAGE OF WEDNESDAY PRICES.

GOLD PRODUCTION



SOURCES:DOME, BMR & ABARE

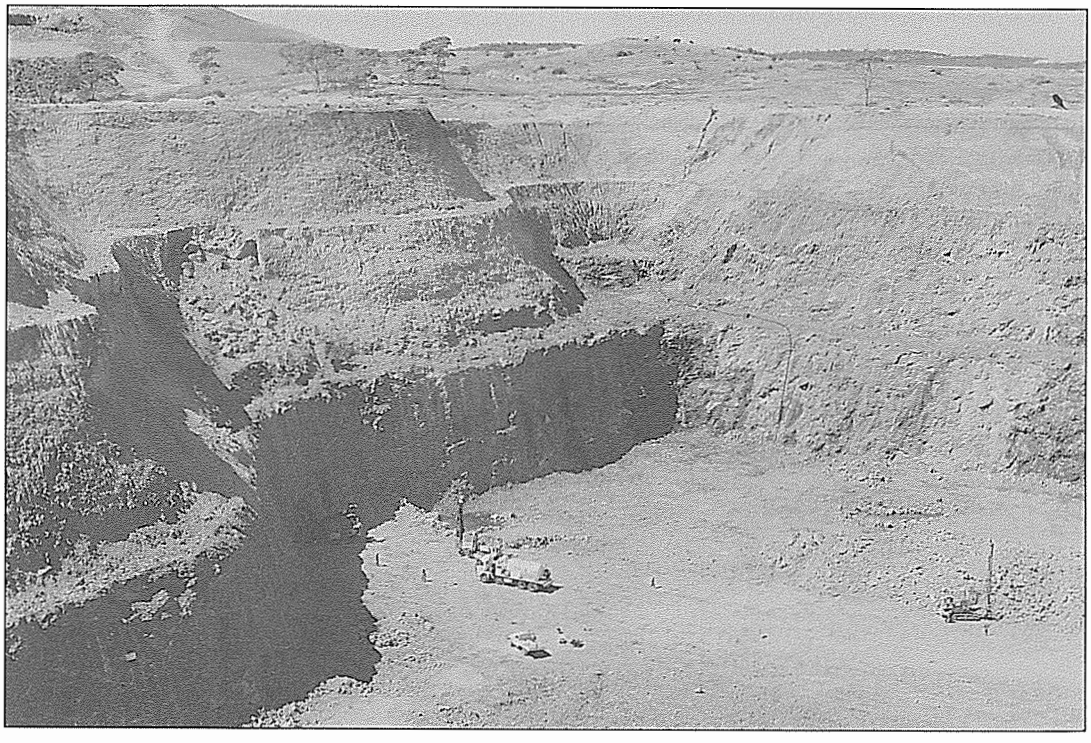
Leinster each producing over 3t of gold in the year. A further nine operations exceeded an output of over 1t of gold.

With the gradual development of deeper pits, into sulphide zone material, it is significant that bacterial leach processing is being tried in the region as an alternative to processing by roasting. The Harbour Lights pit at Leonora has been redeveloped by introducing this processing prior to CIP treatment, while Wiluna has committed to a $26 million development to treat refractory/sulphide ores by the bioleach processing route in preference to committing to a roaster. At Wiluna it is planned that about 400 000 tonnes per annum of ore will be processed by this method.

Evaluation continued on one of the most significant gold discoveries in recent years, the *Kanowna Belle* deposit, 18 km northeast of Kalgoorlie. Demonstrated resources were increased to 59t of contained gold and a decision to go-ahead with Stage 1 of the development is imminent. This is expected to cost $78 million for a 1.25 million tonnes per annum open pit with CIP/CIL and refractory processing installations to produce around 5t of gold per annum. Kanowna Belle is the only significant new gold development on the horizon in this State, which only five years ago was boasting about 20 new large to medium sized stand-alone gold projects.

The *Murchison Goldfield* continues as the State's second largest province of gold production, with 30.6t of fine gold produced in the year. A series of well established multi-pit complexes operate in the Mt Magnet, Meekatharra, Yaloginda (Bluebird), Reedy, Tuckabianna, Mt Gibson, Gidgee and Youanmi areas, with a single large pit at Big Bell and underground operation at Golden Crown making up the bulk of the output.

The two operations on the *Boddington* orebody in the *South West*, Boddington and Hedges, produced a combined 17t of gold in 1991-92 from very low grade lateritic ore. The Boddington Gold operation is the second



Coolgardie Gold NL's Lindsay Pit near Fly Flat (Coolgardie) where the first gold on the Eastern Goldfields was found in 1892.

Table 3. Regional Distribution of Gold Production 1991-92

	Production (kg)	*% of total*
Eastern Goldfields Province		
South	17 629	
Kalgoorlie-Coolgardie	42 747	
Leonora-Laverton	21 919	
Northeastern Goldfields	14 497	
Total	96 792	53
Southern Cross Province	13 125	7
Murchison Province	30 563	17
South West	16 937	9
Peak Hill-Marymia Dome	1 474	6
Pilbara	11 660	6
Others (undifferentiated)	2 488	-
TOTAL - STATE	**182 110**	

Table 4. Major gold producers 1991-92

		Production (kg)
1.	Golden Mile Kalgoorlie/KCGM	20 953
2.	Boddington	11 558
3.	Telfer	11 100
4.	Kambalda-St Ives	6 416
5.	Hill 50 Mt Magnet	5 941
6.	Granny Smith	5 419
7.	Hedges	5 379
8.	Plutonic	5 164
9.	Big Bell	4 930
10.	New Celebration	4 442
11.	Bounty	3 784
12.	Wiluna	3 644
13.	Mt Morgans	3 506
14.	Meekatharra/Dominion	3 353
15.	Paddington	3 165
16.	Bellevue	3 145
17.	Emu-Leinster	3 028
18.	Bluebird	3 002
19.	Marvel Loch-Southern Cross	2 789
20.	Peak Hill	2 788
21.	Gidgee	2 758
22.	Laverton/Ashton	2 508

largest producer in the State, with 11.6t of gold produced in the year. A copper recovery circuit was added to the plant in the year with 5 500t of flotation copper concentrate recovered for sale. This now allows exploitation of the supergene-enriched zones of mineralisation to be progressed and also plans were made to investigate an underground development.

The Bounty mine at Forrestania is the biggest of the *Southern Cross province* operations. The mine has successfully transitioned to full underground operations and, helped by higher grade ores being treated, has increased output to 3.8t of gold. A further $45 million expansion has been committed to increase ore production from 520 000 to 750 000 tonnes per annum and gold output to 4.7t. This involves a deep shaft development to exploit a large resource (5.12 million tonnes at 7.2 gms/tonne) and should be operational by late 1994.

The other five significant operations in the Southern Cross province have less of a long term resource base and indeed most have had to move further afield from their original development-base, to exploit 1-2 year life orebodies to sustain the levels of mill feed. Reynolds Yilgarn Gold Operations is the largest of the producers with mines operating between Marvel Loch and Southern Cross. The others include Hopes Hill, Frasers, Copperhead (Bullfinch) and Yilgarn Star. In total the province produced 13t of gold.

The area to the north of the Meekatharra covering the *Peak Hill* and *Marymia-Dome* districts has become a significant production centre over the last few years, with 10.5t of gold being produced in 1991–92. The low gold price resulted in closure of the Fortnum operation in the last quarter, but this was offset by a continuing strong performance from Plutonic in the Marymia Dome (5.2t) and the opening of a second project, Marymia, just before year-end.

Telfer continues to be the only significant producer in the Pilbara region. While a far cry from the very high grade operation (around 17 gms/tonne) in the mine's early life, the project continues to be a very significant producer, but also a large processor of low grade ore (1.7 gms/tonne). An expansion of the already large dump leach plant was completed in June 1992 increasing ore treated by this plant from 6 to 10 million tonnes per annum and gold output by 1.4t. Total output from Telfer in 1991-92 was 11.1t of fine gold, ranking it number three in size.

Overall, while Telfer, the Golden Mile, Boddington, Wiluna and some other operations may have a reserve-base to sustain production well into the next century, there are a number of producers reaching the limits of their reserve life. Only Kanowna Belle has been discovered recently as a significant new replacement and it is likely that the peak in the State's production has been reached with a gradual decline in output predicted to the turn of the century. Much of the current gold exploration expenditure, at $208 million for 1991-92, is required to sustain existing output levels, although it is encouraging to see a stabilisation of expenditure over the last three years and not the massive decline forecast by some.

Alumina

The downturn in the aluminium industry experienced from early 1991 continued. A further rapid decline occurred in aluminium prices to the end of 1991, followed by a slight recovery, through to the end of the financial year. Alumina prices closely follow those of aluminium, usually with a timing offset. Over the last two years alumina prices have fallen by 35%. Much of the problem is a result of rising inventories caused by depressed demand, increased capacity and increased supplies into the world market from the CIS as it attempts to gain as much revenue and foreign exchange as possible.

Despite difficulties in the market, Western Australia's production has been maintained at

high, near capacity levels at each of the four refineries. In fact, with the completion of the expansion at Worsley, total alumina production rose 5% on the previous year to 7.1 million tonnes. However, revenue was down some 16% to $1 760 million. In terms of Alcoa's company profits, the 1991 results were half the previous year.

The $300 million expansion of Alcoa's Wagerup refinery is progressing to schedule with production likely to commence early in 1993. This will give a further 650 000 tonnes of alumina capacity per annum and maintain the State's position as the premier world alumina supplier at 23% of western world marketed product. Most of the product is smelter grade but consideration is being given to increasing Alcoa's hydrated alumina production three-fold to 800 000 tonnes per annum. Plans have also been mooted to further increase the Worsley capacity from 1.6 million tonnes per annum to 2.25 million tonnes, but until a sustained improvement in the market becomes evident it is unlikely that a commitment will be made.

By world standards, the State's alumina industry is a modern, low cost producer, with a large resource-base to sustain its long term future. The industry is well placed to compete in the market and take further advantage as demand improves.

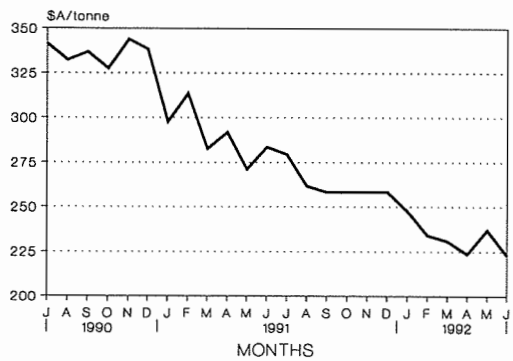
The 10 000 tonnes per annum fused alumina plant at Kwinana was commissioned in September 1991 to supply refractory and abrasive grade product to Japan. The success of the plant may be the catalyst for attracting a wide range of fused materials industries to the State.

Petroleum

Shipments of all petroleum products increased in 1991-92 over the previous year; by 19% for liquefied natural gas (LNG) and between 4% and 7% for each of the other products of oil, condensate and natural gas. However, overall price reductions, of 12% to 16%, resulted in a net revenue drop of 6%. The total value of $2 475 million included $941 million from oil, $846 million from LNG, $349 million from domestic sales of natural gas and $339 million from condensate.

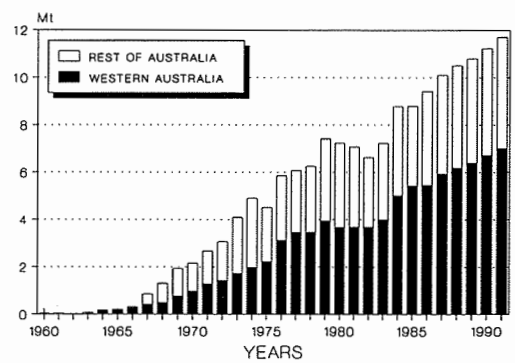
This State continues to be the focus of a large proportion of the country's exploration and development activity in the petroleum sector. While the exceptional successes in discoveries on the North West Shelf between 1989 and 1991 have not been sustained, the high prospectivity and relatively low maturity in terms of exploration efforts continues to attract exploration investment, with expenditures of $230 million and $180 million estimated for 1991 and 1992 respectively. This equates to

ALUMINA PRICES



SOURCE: DERIVED FROM L.M.E. & A.B.S.

ALUMINA PRODUCTION



SOURCES: DOME, BMR & ABARE

about 50% of the declining, total petroleum exploration expenditure in Australia. Two new discoveries were made in 1991-92; an oil discovery at *Skate*, adjacent to the large *Roller* field near the Onslow coast, and a small oil and gas discovery at *Tanami*, near Varanus Island, the site of the storage facilities for the Harriet project.

A total of 26 new field wildcat holes were drilled, mainly in the Carnarvon Basin (14), but also in the onshore Canning (2), offshore Bonaparte (5) and Browse (1) and the Perth Basin (4). In the Perth Basin an offshore hole was the first for many years, although it was abandoned as being dry. The 12 extension test wells, all in the Carnarvon Basin, resulted in successful results for the *Roller*, *Wanaea* and *Cossack* fields, although Cossack reserves have been drastically downgraded, while the drilling at Wandoo allowed appraisal to be made of the estimated in-place oil resources.

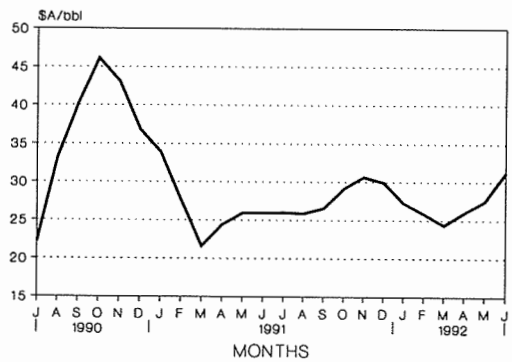
There was a five-fold increase in the level of seismic survey activity in the State in 1991-92. A total of 226 000 line km was shot, almost all offshore and a large percentage involving detailed 3-D surveys (184 000 line km). There was also an increase in the number of exploration permits in force at year-end from 96 to 114, with new permits widely spread across the Carnarvon, Perth, Canning, Bonaparte and Browse Basins. The level of this activity augurs well for the future, with drilling expected to pick up further over the next few years as a result of this work.

The number of development wells drilled dropped sharply from 44 to six over the previous year. However, the ongoing feasibility and engineering studies based on previous drilling and appraisal, the development decisions announced and major ongoing construction work all highlight a very active sector during the year and reinforce the view Western Australia will becoming the premier petroleum producer in Australia by the mid-1990s.

Carnarvon Basin

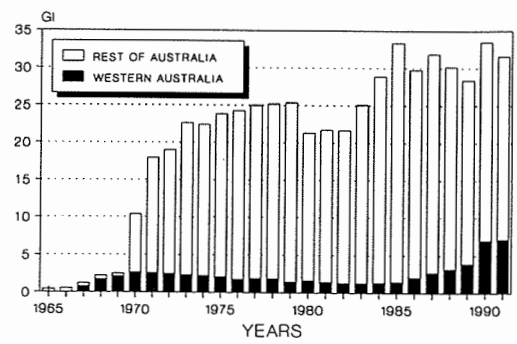
The Carnarvon Basin continues to be the dominating focus of exploration, development and production activity and will remain so for the foreseeable future. With a 1991-92 value of $1 503 million, the *North West Shelf Joint Venture* already contributes 61% to the total value of petroleum shipments. As the third LNG train is brought into production late in 1992 and the condensate-rich Goodwyn field in October 1993, this percentage will further increase. The magnitude of investment in the *North West Shelf*

CRUDE OIL PRICES



SOURCE: BRENT SPOT, MONTHLY AVERAGE.

PETROLEUM PRODUCTION
(including CONDENSATE)



SOURCES: DOME, BMR & ABARE

project, dwarf's anything previously undertaken in the industrial sector in Australia.

Domestic gas sales remained at similar levels to last year, while LNG shipments increased by 19% with the fifth specially developed tanker being brought into service during the year to supply the Japanese power utilities. By 30 June 1992 a total of 176 cargoes of LNG had been shipped to Japan. Meanwhile, construction of the third LNG processing train at the Burrup plant is ahead of schedule with start-up planned for November 1992. The project's sixth LNG ship will commence operations about the same time.

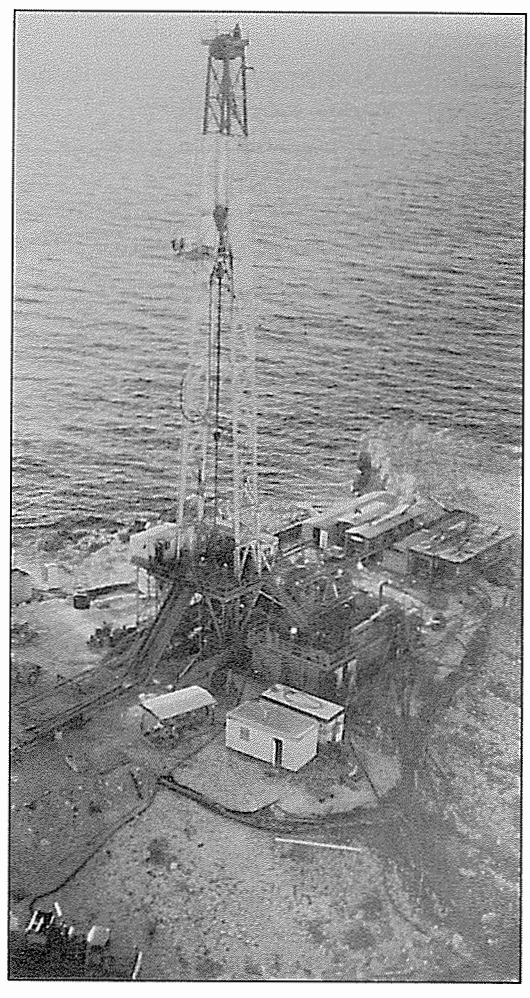
Fabrication of the Goodwyn A platform components was 69% complete at the end of June, and installation of the platform substructure is scheduled to commence in October/November 1992, prior to the onset of the cyclone season.

When the $1.7 billion platform comes on stream at the end of 1993 it will be used primarily for condensate production, with most of the associated gas being recycled back into the reservoir. Significant quantities of sales gas will not be produced from Goodwyn until 1995.

Until then the North Rankin platform will continue to provide the bulk of the gas used for LNG and domestic gas production.

Production of condensate from the North Rankin platform increased 7% during 1991-92, largely as a result of recycling condensate-rich gas from the North Rankin West field. A total of 3.2 billion M^3 of gas, from which condensate had been removed, was reinjected back into the reservoir during the recycling operation.

In addition to the North Rankin, North Rankin West and Goodwyn gas/condensate accumulations, there are other fields such as Echo, Yodel and Angel, on the Rankin Trend which could progressively be brought into production in the longer term. However the most significant area of activity on the Trend is in an assessment of development options for the major 1989 and 1990 oil discoveries of *Wanaea and Cossack*. With a combined recoverable reserve of 28 million Kl these oil fields form the biggest remaining reserve thus far identified in the State. Initial plans were for Cossack to be developed first with a floating production storage and offloading facility (FPSO). However further appraisal of the recoverable reserves in April 1992 drastically reduced the figure from 13.2 to 4.9 million Kl. Alternative development options are being evaluated with the likelihood that Cossack will now be developed jointly with Wanaea. A development decision on Wanaea is expected shortly for a $500 million project to start construction in 1993-94 and production from late 1995. The development has the



The scene at Hadson Energy Limited's successful drilling operation (Tanami #1) on Varanus Island.

potential to be the biggest oilfield outside of Bass Strait, with a production of between 80 and 100 000 bbls per day.

Marathon Petroleum Australia Ltd's *Talisman* field, the only oil producer on the Rankin Trend at present, produces from an FPSO with moored tankers. In 1991-92 shipments totalled 364 000 Kl of oil. The field has continued to produce long past its estimated life, but production is estimated to be suspended in the third quarter of 1992.

The *Harriet* field held its position as the second largest oil producer in the State in 1991-92 with 872 000 Kl. However, with the commissioning of its $120 million gas gathering project in July 1993, the project will be the first offshore gas development since the *North West Shelf* Domgas phase in the early 1980s. In addition to gas being recovered from the *Harriet* and *Rosette* oilfields, two new offshore platforms will be producing from the *Sinbad* and *Campbell* gas fields, to the north of *Harriet*. Developments at the *Bambra* field and newly discovered *Tanami* (July 1991) may eventually feed into the oil handling and gas separation systems on Varanus Island. The development has been made possible through the signing of a ten-year contract with SECWA for 140 petajoules (PJ) with an option for a further 65 PJ. Development will commence at 30 terrajoules (TJ) per day, but the development has been designed with an ability to double capacity.

WAPET celebrated its 40 years of existence in 1992. The *Barrow Island* field, its first and long time mainstay of the State's oil production, continued to ship at a steady rate of 859 000 Kl of oil in 1991-92.

WAPET's Thevenard Island oil handling facility, based on the *Saladin* field supplemented by *Yammaderry* and *Cowle*, is the State's biggest oil producer, with an output of 2.672 million Kl in 1991-92. Production has substantially exceeded predictions. Remaining recoverable reserves are 9.1 million Kl, which includes over half from the yet undeveloped 1990 *Roller* discovery and a small amount from the 1991 *Skate* discovery. The go-ahead to initiate design for development of these two fields was given in June 1992 with final approvals expected in August as the feasibility study is completed. The expected development cost is $150 million involving five production wells from three monopods for Roller and two wells from one monopod for Skate. Production is expected to be scheduled from the third quarter 1994, with output peaking at around 68 000 bbls per day.

The final oil producer in the Basin is Western Mining Corporation from its Airlie Island storage and shipping facility serving the small fields of *South Pepper, North Herald* and *Chervil*. Total shipments in 1991-92 was 614 000 Kl of oil. Gas lift capability has been increased at Chervil and South Pepper to allow fuller extraction, while reservoir simulation studies have been instigated on South Pepper, the field with the largest remaining reserve.

BHP Petroleum's oil discoveries of *Griffin, Chinook* and *Scindian*, located approximately 60 km to the west of Onslow, were given go-ahead for development in May 1992. The recoverable reserves are estimated at 19.8 million Kl of which 75% are in the Griffin field. The development estimated at a cost of $600 million will involve Australia's biggest FPSO, with an additional $80 million to incorporate a gas-gathering facility for gas which would otherwise have been flared. There has been an immediate start to development with production scheduled from March 1994 at around 80 000 bbls of oil and 40 TJ gas per day. The gas will be linked to the onshore *Tubridgi* gas project.

The $23 million Tubridgi project, to the southwest of Onslow, was commissioned in August 1991. Gas is produced from six wells and sales in 1991-92 amounted to 155 million m^3 of gas. The project was developed on the

basis of a 15TJ per day SECWA contract and has subsequently entered a supply contract with Alcoa. In total about 22.5 TJ per day are supplied to the Dampier pipeline from the project.

Ampol's *Wandoo* discovery made in 1991 is the remaining field with potential for development. Further appraisal drilling is scheduled before any decision is made on development plans. The oil differs from most Shelf oils in that it is a heavy crude. The development has an advantage in that it occurs in relatively shallow water and the oil accumulation is at shallow depth.

Canning Basin

The Canning Basin only attracted a small amount of exploration interest in 1991-92. A total of 2 019 line km of seismic surveys was shot and two dry exploration wells drilled.

Production continued from the *Blina, Boundary, Sundown/West Terrace* and *Lloyd* fields with a combined output of 19 400 Kl for the year. No production took place from *West Kora*, although production testing is planned by the new operators.

North Perth Basin

Nearly all prospective acreage is now under licence in the offshore North Perth Basin, with releases over the last 18 months. A total of 5 897 line km of seismic surveys were undertaken mainly in these offshore areas. The one offshore hole, off Rottnest Island, the first in the basin for many years, was dry. A further three unsuccessful holes were drilled onshore.

WAPET's long standing gas and condensate production, largely from the *Dongara* field, was at reduced output for the year at 65 million m^3 of gas and 5 900 kl of condensate and oil.

Mt Horner was the main oil producer in the Basin, be it at a comparatively small level of 27 000 Kl. In addition to Dongara, gas was also produced at *Woodada* (67 million m^3) and *Beharra Springs* (46 million m^3). After a period of operation from test and temporary facilities, the permanent plant facilities at Beharra Springs, 250 km north of Perth, were commissioned in May 1992 at a cost of $8.9 million. The plant utilises low temperature expansion technology to remove condensate and water and semi-permeable membrane to extract hydrogen sulphide and carbon dioxide. The development is based on a 15 TJ per day supply to Alcoa's Kwinana alumina refinery.

Other Basins

A total of 15 643 and 3 713 line km of seismic survey was shot in the offshore Bonaparte and Browse Basins respectively. Six unsuccessful exploration wells were drilled, five of which were in the Bonaparte Basin.

Nickel

The optimism being expressed from late 1991 of an imminent recovery in the international nickel market has yet to eventuate. There is a continued unpredictability in supply from the former Communist Block, which produces about 35% of the world's refined nickel, together with the prolonged recession affecting growth in the stainless steel sector. Although nickel demand has been relatively constant, with China providing a significantly increasing market, the increased levels of supply of some 25% between the CIS and Cuba has exacerbated the situation and put any recovery at this stage on hold.

Prices have been relatively steady throughout the year, but with a small downward trend from around $US3.75/lb to $US3.30/lb by year-end. A strengthening of the market is not expected before early 1993.

In Western Australia many of the projects rejuvenated by the 1988 and 1989 surge in nickel prices still remain under consideration and there is a quiet confidence that they will be well placed as prices and the market picks up.

Western Mining Corporation (WMC) and Outokumpu, with already a major world market presence have already displayed this confidence with expansion plans and a new project under development. From a long term production base of around 50 000 tonnes per annum of contained nickel, plans are in place for expansions to 75 000 tonnes and advanced stage proposals to almost double this level if market outlets can be secured.

Mine production in 1991-92 was 50 600 tonnes of contained nickel in concentrates, a drop of 7% on last year. The value of this production together with cobalt, copper, palladium, platinum, silver and gold by-products was 13% down to $528 million. All nickel concentrate is converted to matte which contained 49 900 tonnes of nickel, part of which was processed to nickel metal at Kwinana where a record 30 400 tonnes was produced for the year.

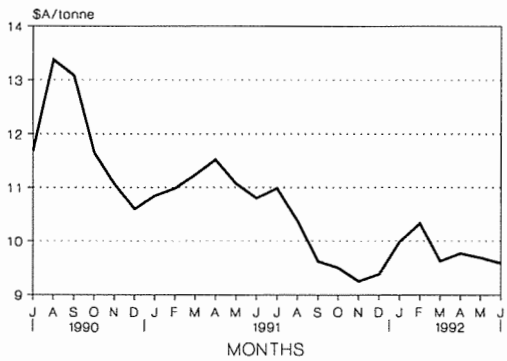
All but two small operations are managed and operated by WMC and one of these, the *Spargoville* operation, sells its concentrates to WMC. The other operation, a new development at *Radio Hill*, south of Karratha in the Pilbara, produced for less than three months before being put on care-and-maintenance pending an improvement in nickel prices.

WMC's *Kambalda* operations recorded a 19% drop in output during the year as a result of industrial disruption early in 1992. The current Kambalda Dome, Widgiemooltha Dome, St Ives, Blair and Carnilya Hill operations were supplemented by a new high grade development at Schmitz, which marginally improved the overall head grade. Most operations have now replaced the traditional shaft mining by access to underground positions by decline. A new nickel discovery was made at Miitel, about 6 km north of the Mariners mine on the Widgiemooltha Dome.

As part of an overall $300 million expansion and upgrade plan by WMC throughout its operations, the $105 million allocated for Kambalda has been put on hold pending resolution of new work practices with the Government. The expansion is to include construction of a modern treatment facility and mine developments to sustain an output of 35 000 tonnes per annum from Kambalda.

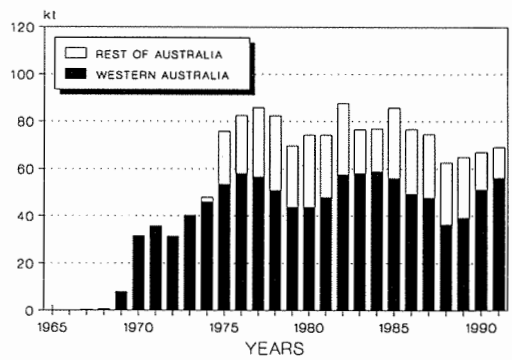
The *Leinster* operations increased output of 16% on the previous year. Ore production came from the Perseverance and Rocky's Reward open pits, the mining of the latter being completed in January 1992. Underground development continued on the main Agnew (Perseverance) mine with a schedule for ore production from December 1992 and installation of underground crushing by December 1993. A decline from the Rocky's Reward pit was also progressed. The

NICKEL PRICES



SOURCE: L.M.E CASH, MONTHLY AVERAGE

NICKEL PRODUCTION



SOURCES: DOME, BMR & ABARE

$127 million expansion plan also involves doubling treatment capacity to 2 million tonnes per annum.

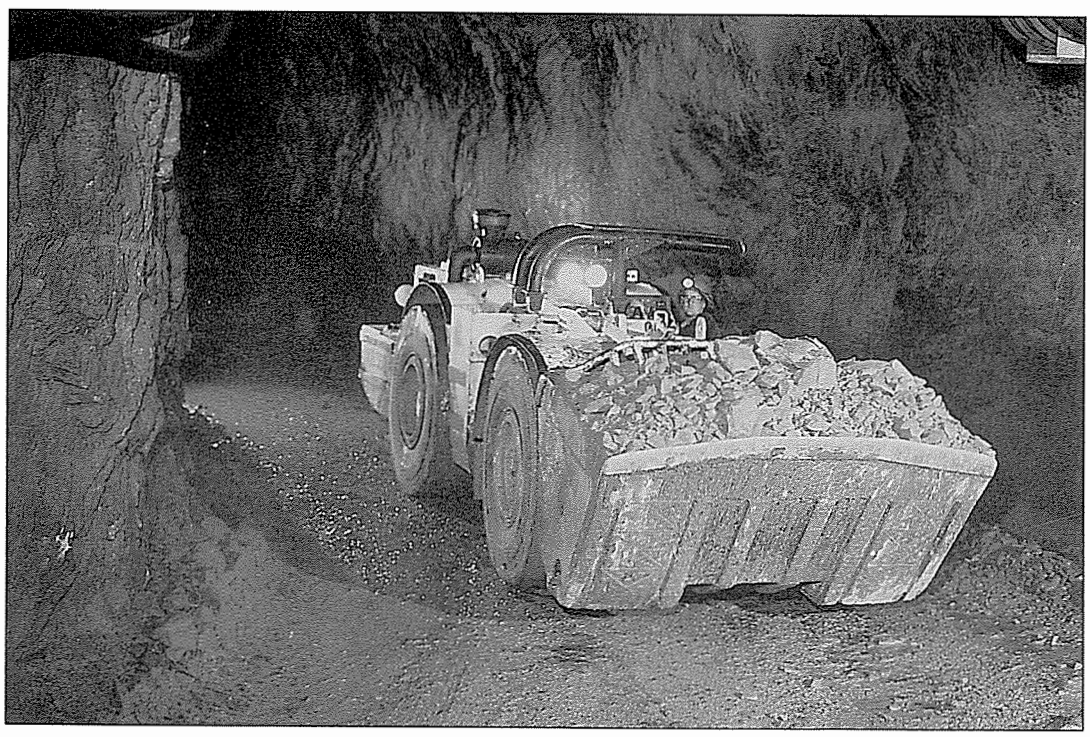
At *Windarra* the South Windarra open pit was closed in July 1991, but nickel ore processing continued with ore being trucked from Perseverance at Leinster.

The rest of the WMC expansion plan involves the *Kalgoorlie Nickel Smelter* and *Kwinana Refinery*. The $101 million expansion plans are now proceeding to increase product output capacity to 65 000 tonnes of contained nickel per annum.

In addition to the expansion plans at existing operations, WMC is also managing joint ventures on two new nickel projects, at Bulong and Mt Keith. At *Bulong* bulk sampling and testing is being undertaken on a nickel–cobalt laterite. A $10 million expenditure is planned over the next three years to assess the feasibility of sulphuric acid leaching, using the sulphur dioxide emissions from the nickel smelter to produce the acid.

At *Mt Keith* to the north of Leinster, WMC manages a 50:50 joint venture with Outokumpu. A revamping of the feasibility study has been completed for a 6.6 million tonne per annum ore production from a low grade, sulphide deposit to give around 26 000 tonnes of contained nickel in high grade concentrates. The development cost is estimated at $450 million. At present the partners are taking 6 months to review their market possibilities and decide on whether they wish to proceed with development at this stage.

A similar scale development and stage of appraisal has been made by Dominion Mining Ltd for *Yakabindie Six Mile*, about 30 km to the south of Mt Keith. All legal hurdles have received approval, including aboriginal issues, but the development decision is dependent on an ability to secure long term contracts and a firming up of nickel prices. Dominion would be



Underground at the Blair nickel mine, near Kambalda.

interested also in attracting a joint venture partner.

While the above projects are not yet committed, Outokumpu has proceeded with construction of its $100 million *Forrestania* project, scheduled to commence production before the end of 1992. The development involves one open pit at Digger Rocks and two underground mines, Cosmic Boy and Flying Fox, to be scheduled over a few years. Concentrates containing 7 500 tonnes of nickel per annum will be produced at the Cosmic Boy processing plant and shipped from Esperance for consumption at in the company's Finnish operations.

Other small developments are proceeding gradually at *Carr Boyd Rocks* and *Black Swan*. These are likely to supply relatively small tonnages of concentrate for sale to WMC.

Overall, the State's nickel industry plans to substantially increase the level of production from the 50 000 tonnes per annum level which has been in place for nearly 20 years. Decisions and timing are dependent on price improvements and the ability of the promoters to secure, what is seen to be, a significant growing market in the long term.

Base Metals

Base metals, including nickel, continue to attract a significant percentage of exploration expenditure, with $44 million spent in 1991-92. Exploration is spread throughout the State, with zinc–lead activities concentrated in the Halls Creek Province and Canning Basin and zinc-copper and copper prospects in the Pilbara, East Pilbara-Rudall area, Bangemall Basin and to a lesser extent the Yilgarn.

The ownership of the State's biggest producer, the *Golden Grove* project, changed hands with the takeover of ACM by Normandy-Poseidon. However, this did not affect production where the operation built up to capacity levels in the second year of operation. A total of 205 000 tonnes of zinc concentrates and 10 000 tonnes of copper concentrates were sold in the year. Significantly higher proportions of copper than envisaged are being encountered from the Scuddles underground mine and consideration is being given by the joint venturers to develop a substantially upgraded copper circuit.

The *Cadjebut* zinc-lead mine, in the Fitzroy Crossing area, continued to produce at capacity with shipments of 107 000 tonnes of zinc and 28 000 tonnes of lead concentrates made in the year. Consideration is being given to further developments in the area, when Cadjebut resources are depleted within the next three years.

The former gold-copper mine at *Horseshoe Lights* was reopened after eighteen months of closure, while copper circuits have been installed at the *Telfer* and *Boddington* gold operations. In total these three operations produced 4 300 tonnes of contained copper in concentrates and high grade ore. A further 5 700 tonnes of copper was produced as a by-product of nickel mining.

WMC has announced plans to develop the Nifty copper deposit in the East Pilbara region. The initial phase will involve open pit mining of the oxide zone (4 million tonnes at 3% Cu), to be treated by solvent extraction and electrowinning to produce 12 500 tonnes per annum of copper cathode. The development cost is estimated at $56 million. The larger primary zone copper (17 million tonnes at 4.9% Cu) could follow the initial phase after 89 years, with production of flotation concentrates the likely treatment route.

The State in general has never been a major player in copper, lead or zinc industry, but does have the prospectivity to significantly increase its level of importance. With a shipment value of $141 million in 1991-92, it makes up only

1.2% of the total value of the State's mineral and petroleum production.

Diamond

The monopolistic hold which the De Beer's owned Central Selling Organisation (CSO) has had on the world diamond market has perhaps never been so challenged as it is at the present time. While the CSO for the last eighteen months has held back sales in an attempt to stabilise prices in a difficult market and thus built-up a massive inventory, the flood of illegal diamonds on the market from Angola (estimated at $3 million a week) and only marginally controlled supply from the new CIS has undermined the situation quite dramatically. So much so that the CSO has given an advance notice of a 25% deferment of purchases from the Argyle operation in the last quarter of 1992. However, while unit values were down in 1991-92, there was a massive increase in sales from Argyle (+60%) as inventories were adjusted downwards and additional sales recorded in the year within the standard CSO schedule. Total sales from the two operations in the State amounted to 47.5 million carats at an estimated total value of $565 million.

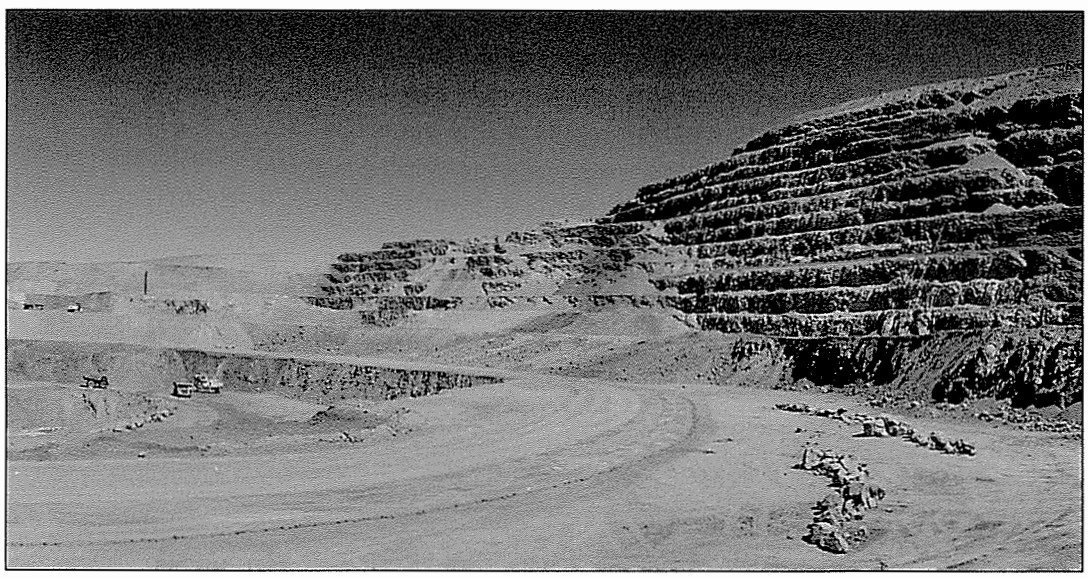
Production for the year from *Argyle* was a record 35 million carats, consisting of 33.4 million carats from the AK1 pipe and 1.6 million carats from the redeveloped alluvial operation. The lower concentrations with depth in the AK1 pipe has resulted in a doubling of the treatment plant operation, since start up in 1985, to 6 million tonnes per annum. Consideration is being given to a further increase to 8 million tonnes per annum in order to maintain output above 30 millioncarats per annum.

Poseidon's *Bow River* operation also produced record levels at 1.1 million carats for the year; a 14% increase on the previous year. Extra output resulted from additional ore feed plus retreatment of tailings.

On the exploration front, a steady expenditure level of $25 million was sustained with a number of encouraging announcements of diamond and indicator minerals, but no significant resources were defined. These were as far afield as the Kimberley, both onshore and offshore, the Nabberu Basin and Nullagine area.

Heavy Mineral Sands

For the second year running the heavy mineral sands industry was tested by a very



Argyle Diamond's expanding AK1 pipe in the Kimberley.

difficult trading environment. This, after a major expansionary phase, has resulted in new and expanded projects gearing themselves towards capacity output levels. As a consequence, most operations have attempted to maintain a steady output at former or only slightly increased levels, with adjustments to their production options to supply as near a product blend as the market dictates.

In addition to the general economic downturn, the difficulties for the heavy mineral sands markets have been created as a consequence of the unprecedented boom for almost five years through the latter half of the 1980s. During this period many expansions and new projects were developed with a major increase in mine capacity leading to the current over supply. Also the very high prices demanded during this period have resulted in some substitutions, particularly in respect to zircon.

Apart from rutile, where shipments dropped by 27%, shipments from Western Australia were maintained or slightly increased in ilmenite (+1%), synthetic rutile (+16%), zircon (+9%) and monazite (+7%). However these levels need to be considered in the context of significantly increased capacity. For instance, synthetic rutile shipments were less than 60% of installed capacity, with Renison Goldfields Consolidated Ltd (RGC) only operating one of its Narngulu lines for much of the year.

While there was only a slight drop for ilmenite and synthetic rutile products, the dramatic reduction in zircon and monazite prices (45% and 63%) contributed to an overall drop in value of total heavy mineral sands products by 13% to $336 million for the year.

RGC's operations at *Eneabba* continued to adjust production levels between its three operations at the North, South and West mines to reflect changing demand and stocks of the different products. Even the new, high capacity Eneabba West dredging operation was suspended for an extended period; while for much of the year only one line of the expanded Narngulu synthetic rutile capacity was in production.

At the company's *Capel South* operation, shipments of ilmenite were slightly increased. Significantly during the year the company picked-up most of Simto's prospective tenements adjacent to its operation, including the Wonnerup deposit, which Simto was proposing to develop as a stand alone operation just over a year ago. These acquisitions provide a long term base for RGC's continued operation in the region.

Westralian Sands Ltd continued to produce synthetic rutile at a near capacity level from *North Capel*, but recorded a 20% increase in ilmenite shipments, as a significant supply of feedstock to the synthetic rutile plant was sourced from third party producers. Production continues at below capacity at *Yoganup North* and *North Capel* mines. The company proceeded to gain environmental approvals for a second synthetic rutile line at Capel and presumably will commit to development as the market improves.

Increased output levels were recorded from the Tiwest Joint Venture's *Cooljarloo* mine and *Muchea* processing plants as the new operation built-up its production-base since start-up in 1990. The third phase of the project, the *Kwinana* titanium dioxide pigment plant, was commissioned in the early part of the year to complete development of the $370 million integrated operation.

Cable Sands production is sourced from mines at *Waroona South* and *Busselton East*. As production is supplied to open market consumers (as opposed to parent consumers with some other operations) levels of output were reduced, reflecting the market situation. Final approval continues to be delayed for its

new South Coast mine at Jangardup, although there is a strong indication that construction will commence before the end of 1992. Controlled exploration is continuing in the surrounding area of the D'Entrecasteaux National Park and proposed extensions, under the rules of the Government's National Parks policy of November, 1990.

The remaining producer in the State, ISK Minerals Pty Ltd, continued operations at its mine of *Waroona South*, adjacent to Cable Sands operation, and dry plant at *Picton*. The mine is expected to be depleted by early 1993, and approvals have been sought to develop a new mine at *Dardanup*, nearer to the Picton plant.

Although the long period of consultation, negotiation and environmental approvals process has now largely been finalised and resolved with Mineral Deposit Ltd's *Beenup* project, near Augusta, the current market for low titania ilmenite has meant that the go-ahead for development is being delayed. A trial pit and pumping tests have been undertaken and a further bulk sample is now planned to test the market and review process options.

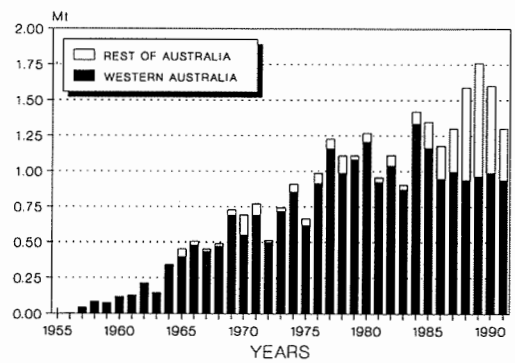
The surge in large resource base developments over the last five years, and the development of operations to supply high titania feedstocks gives the Western Australian heavy mineral sands industry a strong postion, to further penetrate the world market when demand improves.

Salt

Western Australia, together with Mexico, share the position of the major trader in seaborne salt supplies to the world's chemical industries.

Taking advantage of buoyant conditions in South East Asia, the State's industry embarked on expansion plans starting in 1990 at *Lake*

ILMENITE PRODUCTION



SOURCES: DOME, BMR & ABARE

A dredge at Tiwest's Cooljarloo mine near Cataby, north of Perth.

McLeod and more recently at the two Pilbara solar salt operations of *Port Hedland* and *Dampier*. The main expansion at Dampier cost $23.5 million and was completed in March 1992. Cargill's Port Hedland expansion is almost complete. The total installed export capacity at four operations, when completed, will be 7.5 million tonnes per annum.

In 1991-92 production increased by 8% to be 6.9 million tonnes valued at $153 million. The year marked the twentieth anniversary of Dampier Salt Ltd as a producer and the fiftieth million tonne of high grade salt shipped by the company.

A more difficult market situation is being experienced from early 1992 as economic activity has slowed down and new competitive suppliers challenge the State's traditional markets. A new solar salt proposal by Gulf Holdings at *Onslow*, which has been planned for some time, is still awaiting a firm commitment to proceed.

Coal

Coal production was reasonably evenly split between the two *Collie* producers, Griffin Coal Mining Co Ltd and Western Collieries Ltd. Production for 1991-92 increased (+5%) to 5.5 million tonnes valued at $244 million.

The Collie area received a tremendous boost with the Government announcement on 1 May 1991 that it had selected a privately-owned and operated coal-fired power station at Collie to provide the next base-load power supply.

Both companies are planning new mines if they secure the supply contracts for the new power station. These are the Ewington mine for Griffin and the Premier mine for Western Collieries.

Other Minerals

The *Woodie Woodie manganese* joint venture of Portman Mining/Hancock Mining in the East Pilbara region continues to take advantage of a reasonable metallurgical grade manganese market. A series of small, high grade pits have been developed in the area and shipments increased by almost 20% on last year, to record 395 000 tonnes valued at $72 million. The nature of the deposits indicates that the high grade lenses are likely to be small, and proposals have been put forward by the proponents to install a beneficiation plant to allow operations to be sustained by upgrading lower grade siliceous ores.

Tantalite production from *Greenbushes* and *Wodgina* continues to maintain the State's premier position in world market supplies. Production showed an 11% increase, attributed to Greenbushes, and the total value of production was $25 million. The development for exploitation of the massive hard rock tantalum and lithium resources at Greenbushes is progressing with two deep open cuts, one for tantalite and one for spodumene, and a rationalised and expanded central processing facility. The cost of the development is initially $24 million, with over $40 million being earmarked over a five year period.

There are a number of *other industrial mineral* producers in the State supplying both export and domestic markets. Most notable export commodities are talc, spodumene, attapulgite and garnet. In total the value of production of all of these commodities exceeded $60 million in 1991-92.

Other new projects under evaluation or planning include rare earth extraction, vanadium pentoxide, aluminium fluoride, graphite and dimension stone.

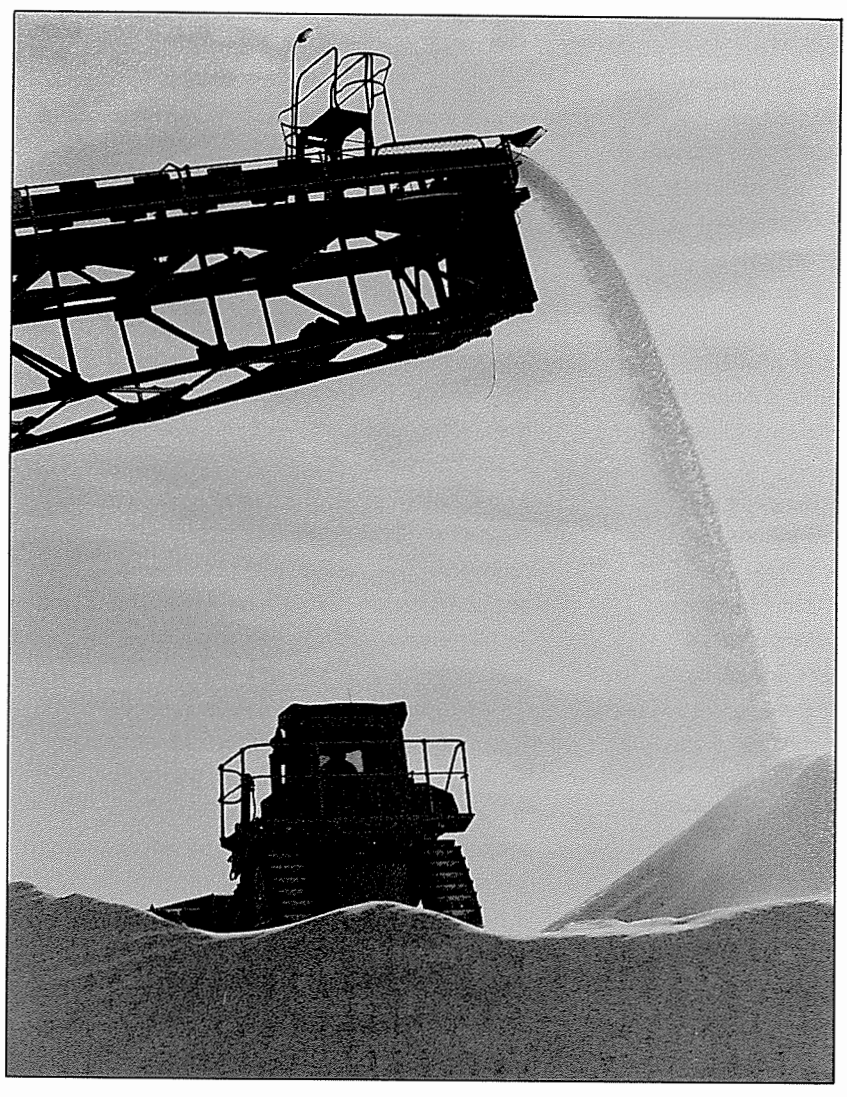
The *Mt Weld* project is being planned for 1994 start-up. It will involve monazite concentration at the mine site near Laverton, with a staged rare earth extraction at an industrial site near Northam. The project is estimated to require an investment of $70 million.

The $60 million *Windimurra* titaniferrous magnetite project, located to the east of Mt

Magnet, is planned to produce 3 700 tonnes per annum of *vanadium pentoxide* for the export market. Environmental approvals have been given and the proponent has indicated very favourable advantages of this project compared to existing world suppliers. However the current depressed world market will need to be considered before any firm commitment is made to develop the operation.

A $16 million development of high carbon flake *graphite* at *Munglinup*, between Ravensthorpe and Esperance, has been assessed to the feasibility study stage.

Various *dimension stone* enquiries continue to be made. The *Fraser Range granite* project is being developed to supply 'verde austral' granite for a major building construction project in Sydney.

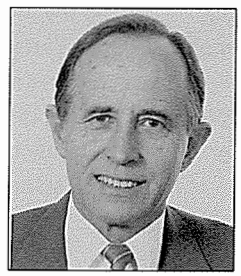


Stockpiling for export at Dampier Salt's loading facility at Dampier.

New Technology and Sustainable Development

" ... development that properly considers and integrates economic, social, and environmental principles."

In the search for the mineral resources that we need to support and improve our standard and quality of life, geologists today are faced with problems not encountered by the explorers of the past. Society as a whole is acutely aware of the need to preserve our natural environment and there has been mounting concern about the potentially deleterious effects of mining on the environment. The concept of sustainable development has arrived and been embraced by governments across Australia, and the world.



Dr P E (Phil) Playford, BSc (Hons), PhD
Director, Geological Survey of WA

The Director of the Geological Survey, Dr Phil Playford, described sustainable development as "development that properly considers and integrates economic, social, and environmental principles".

He said the quest for sustainable development had resulted in changes in the way government and industry explore for mineral resources.

"There is increasing pressure to use non-invasive exploration methods," Dr Playford said.

"These are techniques that generate vast amounts of data and require powerful computers for management and analysis."

An example of this type of exploration is the use of high-resolution aeromagnetic data. The Geological Survey has been using this method in its mapping program in the Eastern Goldfields. The major advantage of this technique is that it allows geologists to see through the superficial cover of soil, sand, salt lakes, and other material, and predict and plot the presence of different rock types and structures in the subsurface. This is achieved without any disturbance to the surface.

The Geological Survey has also purchased computer equipment to allow detailed analysis of these data.

Dr Playford said that community concern about environmental impacts has also meant that many and diverse sets of data need to be analysed.

"Exploration and development can no longer rely only on the definition of an exploitable orebody. Consideration has now to be given to the natural environment — native flora and fauna, groundwater, ecological systems — and on the human environment".

To properly integrate these different sets of data, computers once again come to the fore and, in particular, the use of Geographical Information Systems (GIS). During the last year the Geological Survey completed a GIS project in the Hamersley Range iron-ore province. This project successfully integrated known iron-ore resources with exploration and mining tenement data, conservation estate boundaries, and the location of roads, railways, and towns — all necessary data for effective land-use planning.

The use of non-invasive remote-sensing techniques, and of Geographical Information Systems to analyse the varied data sets required in the pursuit of ecologically sustainable development, are an important and growing component of the Geological Survey's work program, and will continue to be in the future.

GEOLOGICAL SURVEY DIVISION

THE YEAR IN REVIEW

INTRODUCTION

The past 12 months have seen a continued period of high productivity and stability for the Geological Survey. A comprehensive work program was undertaken, with staff being increasingly aware of the need to meet programmed objectives in a timely and efficient manner.

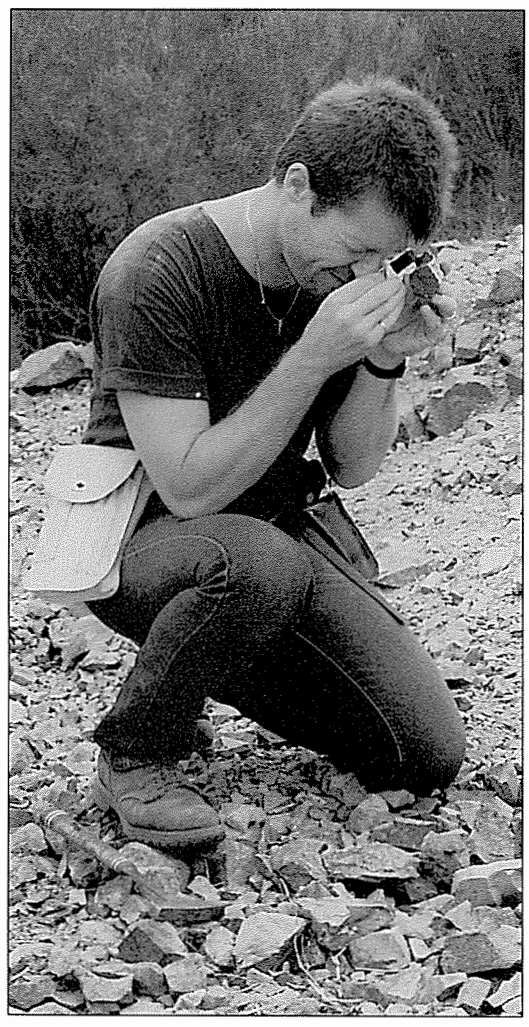
The National Mapping Accord continued satisfactorily with joint mapping programs with the Bureau of Mineral Resources (BMR) in the Eastern Goldfields, East Kimberley, and Canning Basin.

Some aspects of funding of the Geological Survey improved significantly during the year, with the allocation of special funds from the Government to assist in the purchase of aeromagnetic data, the funding of the Geological Survey's contribution to the *SHRIMP* microprobe facility based at Curtin University, and the recruitment of a one-year-contract task force to eliminate the backlog in release of M-series reports. The allocation of additional funds is a direct result of the level of support given to the Survey by industry groups, with a special liaison committee playing a significant role.

In spite of the increase in staff numbers over the past five years, there is no doubt that the Geological Survey continues to be under-resourced in relation to the needs of the State's exploration and mining industries, which have expanded greatly in recent years. However, it is equally clear that under prevailing economic circumstances there is little likelihood of a significant increase in permanent resources, particularly in the short to medium term. Consequently, it is essential that the Survey ensures that the best use is made of existing resources. In this regard the replacement of each vacant position created as a result of resignation and/or retirement is considered carefully in light of program and industry priorities.

The Survey has the opportunity from time to time to obtain special budget allocations to employ temporary staff in priority areas. It was successful in this regard during the present financial year in obtaining contract staff to clear the M-series backlog, and there are hopes that a similar allocation can be obtained next year for the S-series.

The previous year's trend of increasing the level of the average number of days spent in the field by each staff member continued. However, it is clear that it will be difficult to maintain this level in the longer term given the necessity for staff to become increasingly involved in office-based studies to service industry requirements.



Department environmental geologist Laz Leonhard assessing the mineral potential of an area proposed for an extension of the Fitzgerald National Park near Ravensthorpe.

GEOLOGICAL SURVEY DIVISION

THE YEAR IN REVIEW

The expansion in the use of computing within the Survey continued, with desk-top publishing facilities and a local area network being established. The Survey is also moving more into the use of digital data for airborne geophysics and remote sensing and has recently purchased hardware and software suitable for this purpose. It is hoped that by next year the necessary hardware will be available to process such data in Kalgoorlie.

At the same time, development of the various Geological Survey databases is proceeding efficiently with further development of *Minedex*, and upgrades for *Wamex* and *Wapex*. The Survey's oldest database, *Rockmin*, was reviewed during the year and plans are being finalized for a PC-based replacement system to be introduced in the near future.

Dr Phil Playford who retired recently after 20 years with the Geological Survey.

It seems likely that future staff attrition in the Survey will be dominated by retirements, given the ageing staff profile, with a current median age of about 47 years. A number of senior staff, notably Drs Cockbain and Libby, two of the Survey's longest-serving staff members, retired during the year and will be sorely missed.

The Director, Dr P.E. Playford, also announced his retirement during the year following five-and-a-half years service as Director and over 20 years in various senior positions with the Survey.

A brief review of the Geological Survey Division's activities is presented below using the Department's Corporate Plan program and sub-program headings.

MINERAL AND PETROLEUM TITLES

Titles Systems

The Mineral Resources Section provided geological advice in support of various tenement dealings covering exemptions from expenditure commitments, extensions of term, exemptions from drop-off conditions, transfers of first-year exploration licences, and alienations of land.

Proposed revisions to the Mining Act have been prepared which will standardize requirements for mineral-exploration reports submitted annually on mining leases, exploration licences, and prospecting licences. Proposed legislative changes that also received attention were the creation of retention leases under the Mining Act, and regulations for the Commonwealth's Minerals (Submerged Lands) Act.

Other ongoing advice was provided for various Mining Act matters discussed by the

Mining Industry Liaison Committee, Special Agreement Act issues, and releases of Ministerial Temporary Reserves for iron ore.

The Basin and Fossil Fuels Section provided technical advice to the Petroleum Division with particular reference to industry exploration programs and to applications for petroleum tenements, and to the Mining Engineering Division on matters relating to coal resources.

The Environmental Geology Section provided continuing advice on Mining Act tenements with respect to conservation and Aboriginal issues as well as the coordination of Geoscientific Permits. General advice was also provided on Petroleum Act matters with respect to access to exploration and development in areas with conservation value, particularly Marine Parks and Reserves. The section also had significant input in the development and finalization of the new Government policy in relation to petroleum exploration and development in Marine Reserves.

EXPLORATION AND DEVELOPMENT OF NATURAL RESOURCES

Geological Data Collection

Geological mapping in the Eastern Goldfields Province of the Yilgarn Craton at 1:100 000 scale was carried out in conjunction with the BMR through the National Geoscience Mapping Accord.

The coloured version of the Davyhurst 1:100 000 map sheet was published and line compilations for the Norseman and Kurnalpi 1:100 000 sheets were released. Mapping continued on the Riverina, Mulline and Gindalbie 1:100 000 sheets. Fieldwork was completed on the Mulgabbie and Pinjin 1:100 000 sheets. Fieldwork commenced on the Edjudina and Roe 1:100 000 sheet areas and on the western side of the Kalgoorlie 1:250 000 sheet.

Collection of various samples for ongoing geochemical and geochronological studies continued along with the geochemical study of granites in the Kalgoorlie area. The results of these studies, including 1:250 000 and 1:500 000 maps and a report, are in the final stages of completion.

A report was written on a study of Archaean mafic and ultramafic volcanic rocks and their associated mineralization between Norseman and Menzies. A similar study on the acid volcanic rocks continued.

Staff from the Kalgoorlie Regional Office contributed to the planning and interpretation of the BMR seismic traverse across the Kalgoorlie greenstone belt.

Two successful geological excursions were run on the Kanowna and Kurnalpi 1:100 000 sheets. Talks on the geology of the Eastern Goldfields were given to industry and student groups.

Sampling of laterites in the Leonora area was completed as part of the wider study of valley-fill laterites.

In the Southern Cross Province a 1:100 000 scale geological map of Cheritons Find was published. Field work is continuing for two 1:100 000 scale maps of the Ravensthorpe area.

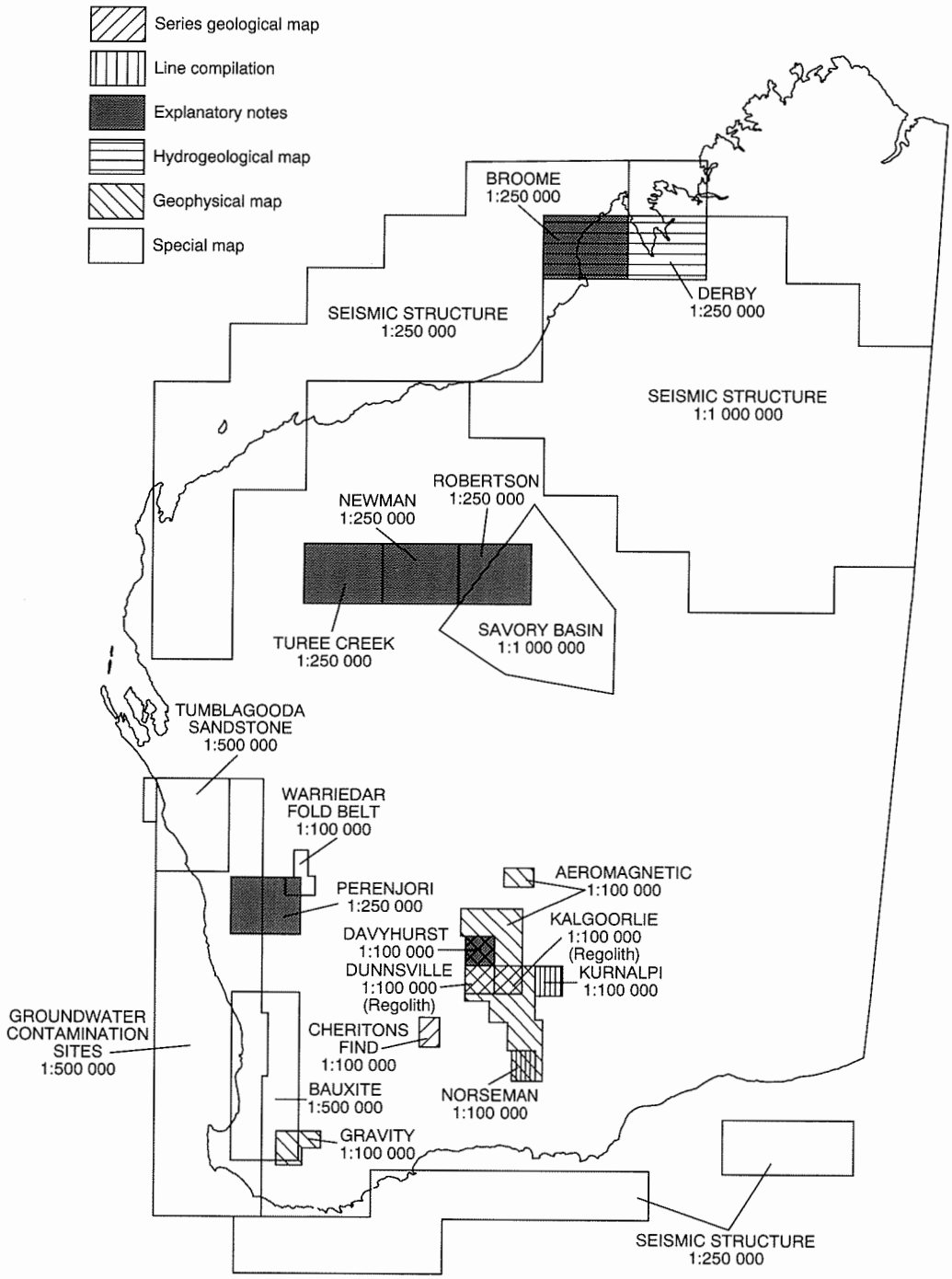
In the Pilbara Craton an excursion was taken to the southern margin of the Pilbara Craton in association with the Geological Society of Australia. Papers were presented to a meeting of the Geological Society's specialist group on structural geology.

In the Hamersley Basin work continued on compiling a map and report on the geology and mineral potential of the Karijini (Hamersley Range) National Park.

A bulletin was written on the Fortescue Group and another on the Woongarra Volcanics. Field work commenced for the second edition of the Mount Bruce 1:250 000 sheet and continued on the Braeside and Isabella 1:100 000 sheets.

A chemical and mineralogical study of the Weeli Wolli Formation in core WW1 was

MAPS AND EXPLANATORY NOTES PUBLISHED IN 1991-92



completed and published. An external report, prepared jointly with industry geologists, on the stratigraphy of the Marra Mamba Iron Formation was submitted for publication.

In the Albany-Fraser Orogen explanatory notes were written for the Esperance 1:1 million sheet and further geochronological studies were completed on rocks from the orogen.

Fieldwork on the 1:100 000 Rudall Sheet in the Paterson Orogen continued, although delays were experienced in gaining access to the Rudall Aboriginal Exclusion Zone.

A report on the Jillawarra area in the Bangemall Basin, and accompanying 1:50 000 and 1:100 000 maps, was completed.

A bulletin on the Savory Basin, which included both a 1:500 000 geological map and a 1:1 million structural interpretation map of the basin, was completed.

The second edition of the Yampi 1:250 000 sheet was published.

A joint NGMA mapping project with the BMR continued in the Halls Creek Orogen, with field work being carried out on the Halls Creek, Tunganarry, and McIntosh 1:100 000 sheets.

Petrographic support to the mapping of Precambrian areas was provided through 25 Petrology Reports describing 385 samples, mainly from the Yilgarn Craton and Bangemall Basin.

Regional gravity mapping of the southwest Yilgarn Craton continued. A Bouguer gravity anomaly map of the Dinninup 1:100 000 map sheet was published. Gravity data acquisition on the Darkan 1:100 000 map sheet was completed.

Seismic horizon mapping in Phanerozoic basins continued with the publication of

The Department is progressively developing more computer-generated maps. Here, department geoscientists Jutta Pagel and Bill Preston are pictured analysing the results of such a map relating to the Pilbara iron ore province.

1:250 000 subsurface structure maps for the Bremer and Eucla basins. Seismic maps were also prepared for the central and northern portions of the Carnarvon Basin.

A detailed study of the geology and geophysics of the northern Perth Basin continued, in parallel with geological mapping of the area. A GSWA Record was prepared covering Jurassic sequences in the southern North West Shelf.

Reviews of selected petroleum wells were carried out for subsurface mapping projects in the northern Perth Basin and southern North West Shelf.

A paper on stromatolites and one on the stratigraphy of the Glengarry Group were completed. Other work was carried out on stromatolites from the Earaheedy Group.

Macrofossil material from the Nanutarra Formation was prepared in readiness for systematic study, but the project on Quaternary molluscs was abandoned following the retirement of a staff member who was not replaced.

Groundwater Resources

The drilling program on the Scott Coastal Plain, which had been suspended when the Drilling Branch was closed, was completed. Twenty-five bores were drilled by a private contractor at thirteen sites to an aggregate depth of 1 638 metres. The drilling confirmed the existence of large groundwater resources and outlined an area of exceptionally low salinity groundwater.

To assist in defining recharge areas and rates of groundwater movement of the large groundwater resources of the southern Perth Basin, a program of groundwater sampling has commenced. Carbon-14 methods will be used to determine the age of the groundwater. One hundred and two samples have been obtained and the age determinations are being made by the Geological Survey, in the Isotope-Hydrogeology Laboratory in the Chemistry Centre. The work is being partly supported by the Water Authority of Western Australia.

A census of farm bores on the Dumbleyung 1:250 000 sheet was completed.

Compilation of the Perth 1:100 000 hydrogeological map, the first in a series of hydrogeological maps of the Perth Basin, is well advanced.

A report reviewing the hydrogeology and groundwater potential of the Wilga and Boyup Basins, and 12 other 'basins' in the southwestern Yilgarn Craton, has been completed. The 'basins' may be important local sources of fresh and brackish water for public supply and industry. Exploratory drilling has been recommended.

A regional review of the groundwater resources in the Murchison region has been completed. A similar review of the groundwater resources in the northeastern Goldfields is in preparation.

A report based on drilling carried out in the 1980s on the fresh groundwater resources of the Fortescue Plain, near Mardi, has been prepared and will be released after final editing and approval.

Biostratigraphic reports were written in support of groundwater investigations in the Leeman area and on the Scott Coastal Plain.

Fossil Fuel Resources

Previously-completed seismic mapping of the Cossack and Wanaea fields on the North West Shelf was revised, incorporating additional data, to assist the Petroleum Division in updating the Department's estimates of petroleum reserves.

Geological advice was provided on various aspects of the Collie coalfield. Publication of the report on coal resources of the Collie Basin has

been delayed pending final versions of the many detailed illustrations and a review by industry of the draft document.

Mineral Resources

Details of all mineral deposits and occurrences on the Albany 1:1 million sheet were entered into a database prior to compilation of a report. A preliminary plot of deposit locations was prepared using computer graphics.

Samples representative of mineralized areas and selected stratigraphic horizons from the Nabberu Basin were collected for geochemical analyses. Information on regional controls of mineralization in the Nabberu Basin was compiled from M-series reports.

As a precursor to work on an Iron Ore Resources Bulletin, utilising the *Mininform* database, a GIS project was carried out for the Pilbara region. Data captured for the project included cadastral information, mining tenements, company ownership, railways, iron-ore geology, iron-ore deposits and resources, and National Parks. These were plotted in various combinations to develop a series of maps. These maps are intended to assist in long-term development strategies for the iron-ore industry, tenement rationalizations, National Park issues, and for general public information.

A report describing the styles and controls of gold mineralization between Menzies and Kambalda was completed.

Fieldwork on a study of gold in the Leonora belt was delayed due to the higher priority given to mapping in the Rudall River area. Samples collected during earlier fieldwork were analysed for their content of gold and a range of trace elements.

Report 33 on bauxite mineralisation in the Darling Range was completed and will be published in August.

A report on the gypsum resources of the State was finalized.

Support Services

During the year there were 12 862 visitors to the library, representing a 9% increase from the previous year. There was a dramatic (40%) increase in usage of microfiche reading and printing equipment with a total of 1 885 users during the year. The installation of two new microfiche reader/printers assisted in coping with increased demand.

In response to public requests, library staff conducted 55 online searches of the *Wamex* database, and 42 searches of the *Wapex* database. During the year a terminal was installed to allow members of the public direct online access to *Wamex*.

Nine Palaeontology Reports were written, and reports for the years 1988-1990 were issued on microfiche. Work on the biostratigraphic fossil reference collection continued. Compilations of all Devonian, Carboniferous, Triassic, Jurassic, Cretaceous, Tertiary, and Quaternary fossils recorded from Western Australia were issued on microfiche.

Geophysical logging of 27 boreholes totalling 5 100m was carried out. Vertical electrical soundings were carried out at the proposed waste-disposal site at Mindarie as part of an ongoing project with the CSIRO.

Geoscientific Data Dissemination

Editing and Publishing Services

A total of 99 publications were released during the year. These included two Bulletins, three Reports, 13 Records, five Explanatory Notes and 71 maps. Reprinting of two previously released maps was also completed.

Exploration Data

During the year the Exploration Data Subsection received about 2 200 exploration reports bringing the total number to about 35 000 volumes, representing 9 300 projects.

Of these, 21 700 volumes on 4 700 projects involve, wholly or in part, exploration for gold.

GEOLOGICAL SURVEY DIVISION

THE YEAR IN REVIEW

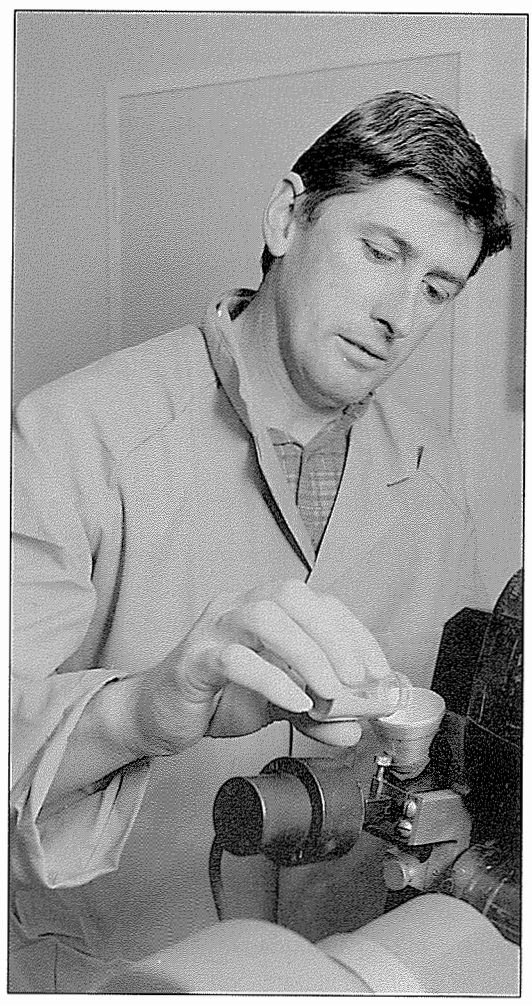
During the period 3 054 volumes were released on microfiche, bringing the number of open-file reports to 15 000, representing 5 900 projects.

In January 1992 the Departmental Module of the new *Wamex* database was brought into production. The Industry Module, providing open-file access only, was made available in June 1992.

Project Database

The Mineral Resources and Commodities Subsection was primarily engaged in various aspects of the *Minedex* mines and mineral deposits database. Data maintenance of the *Mininform* mineral resources inventory subsystem and care of the base system continued as a prime responsibility, with resource estimates supplied in response to various enquires. A summary of all mineral resources in Western Australia was provided for a Chamber of Mines and Energy publication.

Additional responsibility was given to the Subsection for the coordination of the *Minedex* system across a number of Divisions of the Department. An audit of various data sets was undertaken prior to proposed in-house release of *Minedex* for general inquiry purposes. The *Minedex* system now holds data on around 2 750 deposits or mine sites on 1 500 integrated mineral projects.



The Geological Survey collects and analyses thousands of mineral samples every year. Here, Carlisle-based laboratory technician, John Williams, feeds a powdered sample into a Frantz magnetic separator prior to analysing the material.

Minerals Database

Rockmin was updated in April 1992 with the addition of about 3 000 new entries. Chemical analyses can now be entered directly from disks supplied from the Chemistry Centre. Compilation of a user manual is near completion and the implementation of a PC-based version is being considered.

Petroleum and WAPEX Databases

The Petroleum Resources Subsection received a total of 309 reports from industry, and placed a total of 1 191 reports on open file.

The big increase in the open-file reports is a consequence of the revised policy covering the release of unedited reports.

Geophysical Data

The Gravity database, and the Geophysical Well Log and Aeromagnetic data indexes were updated and made available to the public on request.

Hydrogeology

A bibliography of hydrogeological publications by Geological Survey staff (excluding unpublished Hydrogeology reports) in Geological Survey and external publications has been prepared.

GEOLOGICAL SURVEY DIVISION

THE YEAR IN REVIEW

Land and Geographic Information

The Hamersley Range GIS was completed and is being used on a regular basis to assist in land-use planning, particularly in relation to the Karijini National Park.

The *Pertech* pilot study was completed and evaluated with a view to the establishment of a larger scale database of this type.

Geotechnical and Engineering Advice

Geotechnical Investigations

The Engineering Geology Section provided geological advice to the Mining Engineering Division of the Department, the Water Authority, Westrail, and the Main Roads Department. Geotechnical and rock mechanics advice was provided to the Mines Inspectorate in the areas of openpit and underground-mine safety, as well as for the design, operation, and rehabilitation of tailings dams. Cooperative research programs with industry, University of W.A., and Curtin University have continued to address a range of aspects of mine safety. Advice given to the Water Authority includes technical advice during the construction of the Conjurunup Pipehead Dam, assessment of contractual claims in relation to the construction of the New Victoria Dam, site investigations and preparation of tender documents for the proposed North Dandalup Dam, and the investigation of potential damsites at Margaret River and Wellstead. In addition, investigations of foundation conditions were carried out for pumping stations and sewerage transfer stations at Bickley and Lower King. For the Main Roads Department, advice has been given on proposed rock cuttings at Tom Price, Norseman, Madura, Eucla, and Dunham Hill (Jump-up). A brief reconnaissance assessment has been provided for a damsite at Dunham Hill (Jump-up), and assessments of quarries and quarry sites at McPhee's Creek, Nillibubbaca and Oscar Range have been completed.

Seismic refraction surveys were conducted for the Main Roads Department along the alignment of the proposed rock cuttings on the Tom Price North Road.

Advice was given to the Collie Shire on subsidence associated with underground mining.

To assist the Main Roads Department, a map showing the location of asbestiform minerals was produced as an overlay to the state geological map.

Hydrogeological Investigations

During 1991-92 three hydrogeologists have been on secondment to the Water Authority and a further three hydrogeologists have worked on Water Authority matters. The Hydrogeology Section has continued to provide groundwater advice relating to management and licensing and has supervised and assessed results of drilling for Perth, Exmouth, Carnarvon, Leonora, Nullagine, Horrocks Beach, Mt Magnet, and Gibson town water supplies.

A survey commissioned by the Water Authority is being carried out for radon in groundwater-based water supplies in the State. The facilities of the Isotope-Hydrogeology Laboratory of the Chemistry Centre are being utilized in this work, with technical support from the Water Authority.

Limited work has continued on the location of bore sites for Aboriginal water supplies. Desk-top or field inspections have been made for about ten communities in the Pilbara and Central Reserves. Work in the Kimberley region is in abeyance pending the outcome of negotiations between the Water Authority and the Aboriginal and Torres Straits Islanders Commission.

Frequent advice relating to the location and management of landfill sites has been provided to the Public Health Department. Advice on

ground water contamination beneath Fremantle Prison) has also been provided to the Public Health Department and Environmental Protection Authority. Numerous bore sites for road construction have been selected for the Main Roads Department in the Kimberley, Pilbara, Goldfields, and Southwest.

The Hydrogeology Section continued to provide extensive advice to other Government agencies, consultants and the general public. During the year a total of 416 telephone enquiries, 195 counter enquiries and three inspections for bore siting were dealt with.

Mineral Resources

The Mineral Resources Section provided input on various issues relating to mineral deposits and mining developments, of which the more significant were the WA Steel Task Force, Pilbara 21 Study, and Cape Range Limestone. Further advice on State mineral developments was given to a number of overseas trade delegations and local trade groups. Geologists at the Kalgoorlie Regional Office provided ongoing advice to the public on various commodity, mineral potential, mineral exploration and development matters.

A pamphlet was prepared on the geology of the Bungle Bungle National Park.

The Basins and Fossil fuels Section provided general advice to industry throughout the year.

A field excursion to the Carnarvon Basin for industry representatives was organized in association with the 1992 APEA conference, held in Perth. Various divisional publications were displayed at this conference, and members of the section were present to liaise with the public.

The Publications and Information Section responded to numerous enquiries on a wide range of topics. Areas covered included information and assistance for prospectors, urban geology for landowners, mining and its environmental implications, and educational geology for teachers and students. Enquiries were received at a rate of approximately 100 per month over the year.

The museum was visited by eight classes of geology students during the year, and treated to one hour lectures from geoscientists.

A total of 37 rock and mineral specimen sets were prepared and distributed to schools.

Community Relations

Aboriginal Liaison

The Aboriginal Liaison Officer continued to provide advice in relation to Aboriginal issues. Regular communication has commenced between the Aboriginal Affairs Planning Authority and the Geological Survey in order to develop a better ongoing working relationship to assist in the resolution of potential conflict in relation to land access and mineral exploration.

ENVIRONMENTAL PROTECTION AND REHABILITATION

Exploration and Mining

The Environmental Geology Section provided advice on land-use studies for the Department of Planning and Urban Development, and for regional planning exercises by the Department of Conservation and Land Management.

The Section also represented the Department on the Coastal Management Coordinating Committee, the Gnangara Mound Technical Group, and the Integrated Catchment Management Group.

Assistance and general advice and the technical appraisal of environmental assessment documents was undertaken in conjunction with the Environmental Protection Authority.

Groundwater

Two ground water contamination maps with accompanying explanatory notes covering the Perth Basin were completed.

A study on the quality of road run-off and its affect on groundwater quality beneath infiltration basins has been completed and has shown that infiltration basins have a substantial effect on the salinity and chemical characteristics of the unconfined groundwater.

A study of groundwater quality in private bores near existing or former landfill sites has detected several significant pollution plumes. The work is being compiled together with guidelines for the location of landfill sites for the Public Health Department.

Studies quantifying the input of nutrient from groundwater into the Swan Estuary and Leschenault Inlet have been completed. The studies have found that the input from groundwater is minimal compared with surface water inputs.

The results of groundwater level and salinity monitoring of the Ord River irrigation area were reviewed and a major paper contributed at a conference to mark the 50th anniversary of irrigation research on the plains along the Ord River.

A review of deep-well injection practices throughout the world, and identification of some areas in Western Australia where deep-well injection could be achieved, was completed for the Environmental Protection Authority.

COMMUNITY BENEFITS

The Mineral Resources Section provided geological and mine economics advice to assist in the negotiation and collection of mineral royalties.

WORKER AND PUBLIC SAFETY

Geotechnical Studies Related to Health and Safety

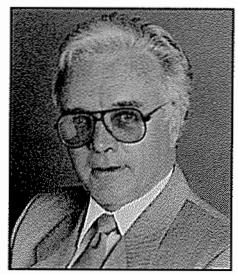
Specialist geotechnical advice was provided to the Mines Inspectorate. Studies and assessments were provided on numerous openpit and underground mines, and on both proposed and operating tailings dams. In addition to advice on geotechnical matters, research programs on the long-term stability of openpits, and methods of ground support design in underground mines continued. Interim guidelines on the safe design and operating standards for tailings storages were released, while draft guidelines on openpit mining through underground workings, and underground-mine ground-control procedures were prepared.

The Engineering Geology Section gave several technical presentations on rock mechanics, the geotechnical aspects of openpit and underground mines, and aspects of openpit mining in China. A number of short courses in underground-mine design and ground control were given at the Brodie-Hall Research and Consultancy Centre, Kalgoorlie.

Conservation and Development — Striking the Balance

" ... impact assessment studies and monitoring provide the State with valuable environmental information."

Valuable petroleum resources exist in onshore and offshore areas which are of enormous economic importance to Western Australia. The most productive oil area is the North West Shelf where a number of offshore oil fields (Harriet, North Herald, South Pepper, Chervil, Saladin, Cowle and Yammaderry) have been brought into production over the last decade. Many of these fields are in environmentally-sensitive localities that support major coral and mangrove habitats and fishing grounds. The State Government has recognised their importance and taken initiatives to protect them through its Marine Parks Policy, statutory procedures for environmental impact assessment and environmental investigations.



Mr I (Ian) Fraser, BSc (Hons) Director, Petroleum Division

The Director of the Petroleum Division, Mr Ian Fraser, said the petroleum industry had a good environmental track record and had conducted its operations without any major mishap since the first offshore exploratory well was drilled in the 1960s.

Oil company activities, environmental impact assessment studies and monitoring provide the State with valuable environmental information, he said.

To ensure that the petroleum industry continues to conduct its business in an ecologically sustainable manner, the Petroleum Division's environment management strategies include stringent environmental regulations, rehabilitation requirements and adherence to comprehensive codes of environmental practice. It also takes a proactive role in encouraging oil companies to present their environmental management program for review prior to approval and implementation of exploration and development proposals. Further, it acts as a co-ordinator and liaison point between the oil companies, decision-making authorities and interested groups. The ensuing consultative process and information transfer enhances confidence-building between governments, industry and the public.

Recognising that some of the State's most cherished possessions are its national and marine parks and marine nature reserves, the State Government's Marine Parks Policy places a high level of protection against the potential effects of oil industry activities. This protection extends to a depth of 100 metres beneath the seabed.

However, subject to technical assessment and approval of the Environmental Protection Authority, it also:

- allows holders of petroleum tenements to explore marine parks and marine nature reserves;
- allows pipelines and other marine structures in marine parks and marine nature reserves;
- allows directional drilling beneath the seabed of marine parks and marine nature reserves from sites outside the park or reserve;
- allows seismic surveys within marine parks and marine nature reserves where they are undertaken to gain an understanding of the geology to define prospects that are outside the reserves or for the purpose of directional drilling; and
- ensures that an area proposed as a park reserve can be assessed for its petroleum and biological importance following Ministerial Council endorsement and public review prior to Parliamentary approval.

The Marine Parks Policy therefore provides a safeguard for the environment not only today but also into the future.

PETROLEUM DIVISION

THE YEAR IN REVIEW

INTRODUCTION

During the year exploration drilling increased, seismic activity was strong, construction and commissioning of new developments continued and confidence in future production rose with the submission of new development plans.

New records were set for seismic surveys with over 225 000 line kilometres of data being acquired. This is more than five times the amount for the previous fiscal year and was concentrated on the evaluation of previous discoveries. The number of exploration wells also increased, from 33 to 38, which compares favourably with annual drilling figures over the past decade.

Exploration successes during the year included an oil discovery at Tanami-1 by Hadson in TL/7 (drilled from EP207) and a small gas and oil discovery at Skate-1 by WAPET in TP/3.

The Tubridgi gas field was brought on stream and the permanent Beharra Springs processing plant was commissioned. By the end of the year, construction was close to complete for the Hadson gas gathering project and certain modules of the Goodwyn platform. Plans for developing the Cossack field, later altered due to re-estimates of reserves after post-appraisal drilling, and the Griffin, Chinook and Scindian fields, are under consideration.

A brief review of the Petroleum Division's activities is presented below using the Department's Corporate Plan program and sub program headings.

PETROLEUM TITLES

Titles System

At the end of the year there were 170 petroleum titles in Western Australia, 114 exploration permits, 25 production licences, five retention leases, one petroleum lease and 25

The dynamic petroleum industry, as reflected by this image of "tailing pipe" on the Maersk Valiant. The value of petroleum production in WA during the year was in excess of $2.4 billion.

pipeline licences. Administration of these titles includes documentation of all company interests and their transfer, approval of activities and review of title conditions (work or financial commitments).

A total of 18 areas were advertised inviting applications for exploration permits comprising 14 discrete areas offshore and four quarterly releases onshore. Twenty five new exploration permits were granted comprising 12 onshore and 13 offshore titles.

During the year four retention leases were issued to West Australian Petroleum Limited covering the Gorgon, Spar and West Tryal Rocks gasfields. The Retention Lease is a form of title that enables the holder to retain title over discoveries that are not currently economically or technically feasible to develop.

The first Access Authority for deviation wells under the Petroleum Act 1967 was granted to operate deviated wells into the Production Licence No. TL/4 located within area of Pipeline Licence No. 15 on Thevenard Island.

A petroleum tenement data base reflecting the day-to-day changes of new titles, renewals, relinquishments, transfers and changes of name has been developed. This data base is used for production of the title information for the quarterly editions of "Petroleum Exploration and Development Tenements" booklet and the biannual issue of "Petroleum in Western Australia". It is also used in the day-to-day administration of petroleum tenements and answering public enquiries.

Dealings and Fee Collection

To be recognised under the various Petroleum Acts, title dealings and transfers must be approved and registered at the Department of Mines. This assists in minimising disputes over title interests. During 1991-92 the Division registered 285 dealings and transfers of interest documented in the title registers. Some 427 title searches of these legal records were undertaken during the year.

The system of fee collection ensures that consistent and appropriate rates are applied. Fees calculated and requested include those for applications of all types, registration of dealings and transfers, and annual title fees.

The Division advises on petroleum legislative matters and clarifies interpretation and policy. It also recommends changes to legislation where appropriate.

EXPLORATION AND DEVELOPMENT OF NATURAL RESOURCES

The Petroleum Division encourages responsible exploration for the State's petroleum resources, ensures that exploration and development practices are efficient and effective and provides information on the State's petroleum geology and resoures.

Geological Data Collection

The Division collates exploration, development and production data. These are analysed to improve knowledge of the State's petroleum resources.

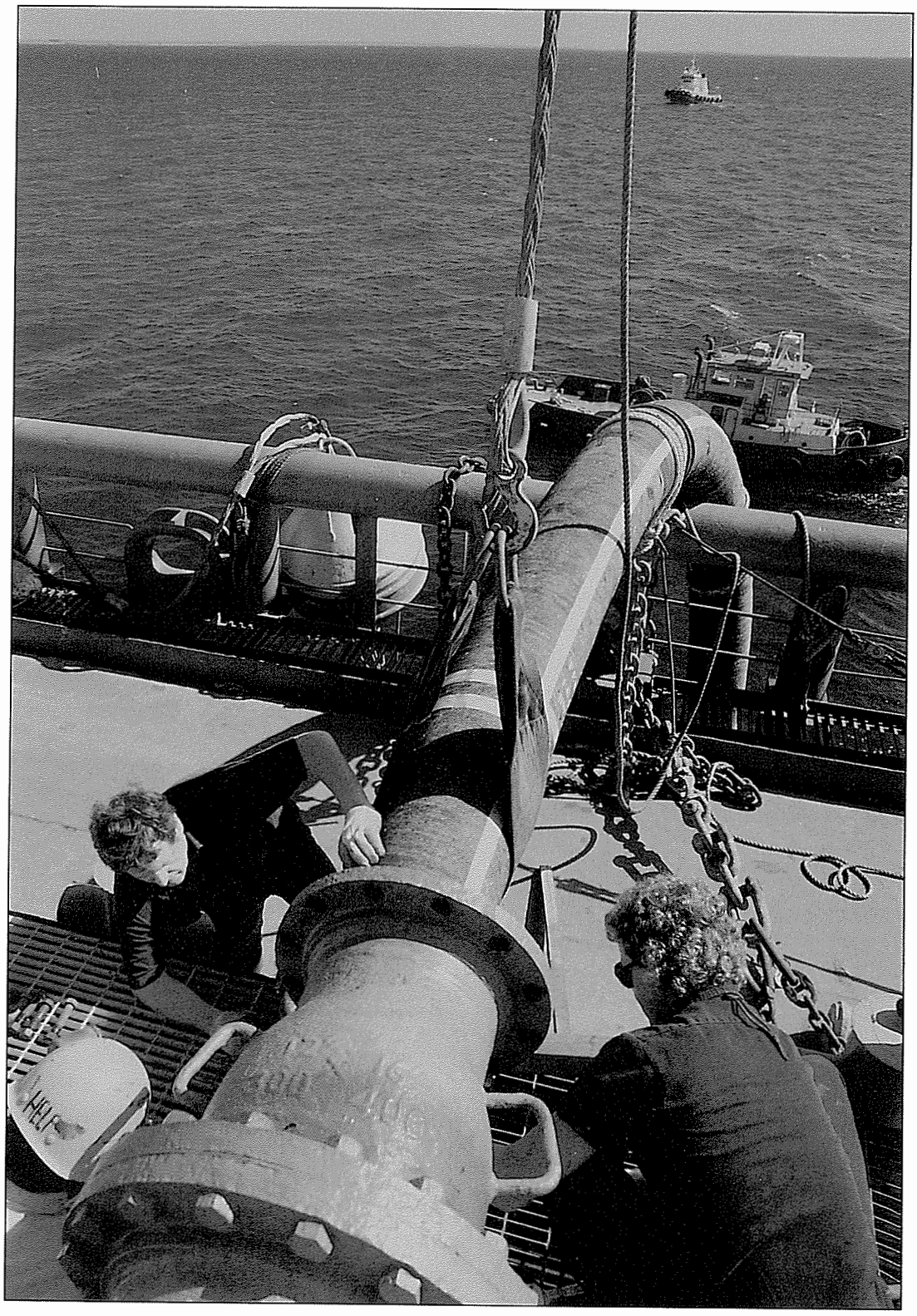
Data this year included those from daily reports for 43 petroleum wells drilled during the year (38 exploration and five development), petrophysical analyses of well logs, field reservoir models, and production reports from the 23 fields in the State which are on-stream.

Geoscientific Data Dissemination

The Division continued to provide information to the State Government, industry and the community about the exploration and production industry and its activities. As well as answering ad hoc queries, the Division published "Petroleum in Western Australia", which is a full colour magazine released twice each year. This provides general background information on legislation, taxes and so forth; reviews and forecasts of seismic surveying drilling, development and production; editorial

PETROLEUM DIVISION

THE YEAR IN REVIEW



The loading of crude oil aboard a tanker off Barrow Island.

comment; plus technical papers and other data for national and international circulation.

Geotechnical and Engineering Advice

The Petroleum Division co-ordinates and provides technical advice for the approval of all title and operation applications. The number of applications for operational activities (mainly seismic surveys and wells) continued at a steady rate.

Operations are assessed for safety, technical merit, formation evaluation procedures and environmental management against the Acts and regulations and "good oilfield practice". This evaluation is used to set and ensure compliance with conditions and to provide advice on alternative pracitices where necessary.

As operations.proceed they are monitored by reporting and inspections and advice is available for completion and testing programs, such as independent petrophysical analyses.

Similar independent assessment is also undertaken of development and production plans and performance. These assessments are directed at ensuring application of good reservoir management practices to maximise long-term return on the State's petroleum resources. Specific studies are also undertaken. This year's studies included independent assessments of production and reservoir engineering studies on the Wanaea and Cossack fields, an evaluation of new ultra-slimhole drilling techniques and a review of options and recommendations on a State gas flaring policy.

ENVIRONMENTAL PROTECTION AND REHABILITATION

Strategies and projects implemented during 1991-92 to promote minimal environmental impact from petroleum operations included the following:

- implementation of an environmental audit program to assess the degree of environmental impact by onshore seismic surveying operations in the Perth, Carnarvon and Canning Basins for the period 1985 to 1991;
- improved co-ordination between relevant decision making authorities, the petroleum industry, interest groups and the community in regard to environmental impact assessment and approvals. This was achieved through the provision of advice and guidelines by the Department of Mines and the formation of the Petroleum Environmental Liaison Committee;
- provision of advice to the Government and the petroleum industry regarding exploration in marine parks;
- the initiation of a study on the impact of petroleum exploration and development on the North West Shelf marine environment. The case study froms part of the Murdoch University School of Environment MSc. program; and
- improved turn around time for environmental approval of petroleum proposals.

WORKER AND PUBLIC SAFETY

The Petroleum Division has responsibility for ensuring that petroleum exploration, development and producing operations are carried out in a manner which ensures the occupational health and safety of the workforce and safety of the public.

Worker Health and Safety

In September 1991 the Consultative Committee on Safety in the Offshore Petroleum Industry (COSOP), on which the Petroleum Division was represented, issued its report to the Commonwealth Minister for Resources concerning the implications of the findings of the UK enquiry into the Piper Alpha disaster in the North Sea to operational safety in Australian waters.

One of the major recommendations was the adoption of the Safety Case concept for Australian offshore petroleum operations. The Safety Case will require the operator of a facility to formally document how safety is to be managed to demonstrate that the major hazards of the installation have been identified and appropriate controls provided, and that adequate provision has been made to ensure safe evacuation, escape and rescue in the event of an emergency. The Safety Case, as prepared by the operator and approved by the regulatory authority, will constitute the primary means of identifying the measures taken for ensuring that installations are operated in a safe manner.

Another major recommendation was that objective setting rather than prescriptive regulations should be adopted whereby the onus of responsibility for the management of offshore safety rests clearly with the operator.

The objective approach to offshore legislation represents a significant change to the existing system and will therefore take time to implement.

Other recommendations of major importance were:

- that the Commonwealth Occupational Health and Safety (OH&S) provisions should be applied in State adjacent areas where no current OH&S provisions apply;
- the establishment of a single point of contact and responsibility in each State for the administration of safety in offshore petroleum operations;
- the provision of adequate and on going training programs for all personnel working offshore; and
- adequate resourcing and training of State authorities to enable them to develop expertise within their inspectorates for the assessment of safety cases.

The Petroleum Division's Assistant Director (Construction) Khalil Ihdayhid inspecting the Tubridgi gas plant near Onslow.

In endorsing these recommendations the Minister for Mines acknowledged that their implementation will require significant changes in the way in which safety is administered by the regulatory authority. However, he expressed confidence that such changes will ultimately result in even higher standards of safety performance being achieved by the industry.

The Petroleum Division is working with the Federal Authority and the other States in drafting the necessary legislation to introduce these new concepts in the offshore petroleum industry.

Approvals and Inspections

Activities which are monitored to ensure that procedures and equipment meet safety standards include seismic surveying, well drilling, pipeline laying, underwater diving, production operations and new field developments. All applications for operations presented this year were assessed and advice provided where necessary. As these operations proceeded, inspections or other audit methods were applied. The prevention of well blowouts is of primary concern. Standards for courses in blowout prevention have been established and industry participation in the courses is required.

During the year 45 inspections were carried out by the Division inspectorate, compared with 53 in the previous year. This reduction in inspections was primarily due to fewer inspectors being available.

Safety Record

The petroleum industry continues to show positive trends in its safety record. While the workforce hours increased by 17% the number of lost-time injuries (LTIs) actually decreased by 9%. This resulted in an improvement in the LTI frequency rate of 21% over the 1990-91 result.

The improved result was due to a dramatic improvement in the onshore results, where there was a 54% reduction in the LTI frequency rate. Factors which resulted in this improvement include the issuing of the new Schedule of Onshore Exploration and Production Requirements, increased focus on onshore activities by the inspectorate, and a shift in activity from exploration drilling to production operations.

A significant increase in offshore construction activities was a contributing factor in the 18% increase in the offshore LTI frequency rate. Future offshore developments will be required to provide a Safety Case assessment which should result in improvements in the offshore industry's level of safety.

Public Safety - Pipelines

The Division continued to monitor the inspection and maintenance of existing and planned pipelines and production facilities to ensure that risks to the public are minimised. In general, petroleum pipelines represent a low area of risk to the general public, but annual post-cyclone surveys of offshore pipelines were carried out by all operators. This resulted in certain remedial measures being taken, such as Woodside's $60 million retrofit to its 134 kilometre pipeline from the North Rankin A platform to the LNG plant at the Burrup Peninsular to improve its stability on the seabed during cyclones.

Stringent design requirements were implemented on the new pipelines which were built this year. A new draft Schedule of Specific Requirements as to the Design, Construction and Operation of Petroleum Pipelines, previously issued for industry review, will be issued next year.

PETROLEUM DIVISION

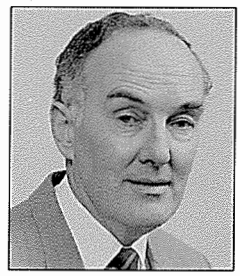
THE YEAR IN REVIEW

WAPET employees Jamie Holloway and Tom Twentyman checking their work schedule during the Saladin 5 and 6 workover project on Thevenard Island.

FORENSIC FIBRE EXAMINATION

" There is considerable potential for contamination of fibre evidence. "

Fibre evidence can be vital in identifying possible offenders and for use in corroborating statements says Dr John Hosking, Director of the Chemistry Centre. He was commenting on the fact that Police statistics show that violent crime has increased threefold over the last ten years and consequently, investigating such crimes is now of major public importance.



Dr JW (John) Hosking MSc PhD, FAusIMM, FRACI Director, Chemistry Centre

A most important form of evidence, which might associate a suspect with a victim of violent crime, is contact trace fibre evidence. During any violent physical contact, it is likely there will be an exchange of fibres. Fibres can also be transferred by contact with surfaces which have been in contact with clothing (secondary contacts). A major problem for forensic scientists in dealing with contact trace evidence is the possibility of contamination. Consequently, it is vital that all exhibit material from the suspect is kept isolated from that of the complainant. The potential for contamination begins with procedures used by police. For example, if the same car or office is used to transport or interview both complainant and suspect, it is quite possible that fibres could be exchanged by secondary contact and not during any alleged offence. To try to avoid this problem Forensic Science Laboratory staff participate in Police training programs and pay particular attention to this topic.

"There is considerable potential for contamination of fibre evidence. Consequently all police and laboratory personnel must be aware of the contamination problem and ensure they take all the necessary precautions," commented Dr Hosking.

Microscopy is the cornerstone of forensic fibre examination and a great deal of information can be derived from single fibres. Polarised light microscopy enables broad identification of fibre types (e.g. acrylic, nylon, polyester etc). Comparison microscopy enables simultaneous, side by side comparisons of features such as size, colour, shape, delustrant density, surface morphology, and fluorescence characteristics. Microspectrophotometry enables spectra and colour coordinates to be compared objectively.

Dr Hosking said facilities at the Chemistry Centre have been used to good effect in casework. In one well known bombing case, offenders entered and departed from a restaurant via a hole cut in a cyclone wire fence. A few fibres were caught on the cut wire and these were submitted for comparison with various items of clothing from a suspect. The fibres from the fence and a jumper comprised a wool-acrylic blend. The acrylic matched in polymer composition (acrylonitrile-PVA copolymer), cross sectional shape, size delustrant density, birefringence, colour, fluorescence, absorption spectrum, and dye composition. The wool fibres matched in size, colour, fluorescence, absorption spectrum and dye composition. A survey was carried out on a large number of similarly coloured and styled jumpers and numerous civilian styled items of clothing. The only match was with a jumper of the same brand and batch and which was not in wide circulation. It was therefore possible to conclude with confidence that the fibres on the fence originated from the same brand and batch as the suspect jumper, and very probably, from that jumper.

CHEMISTRY CENTRE

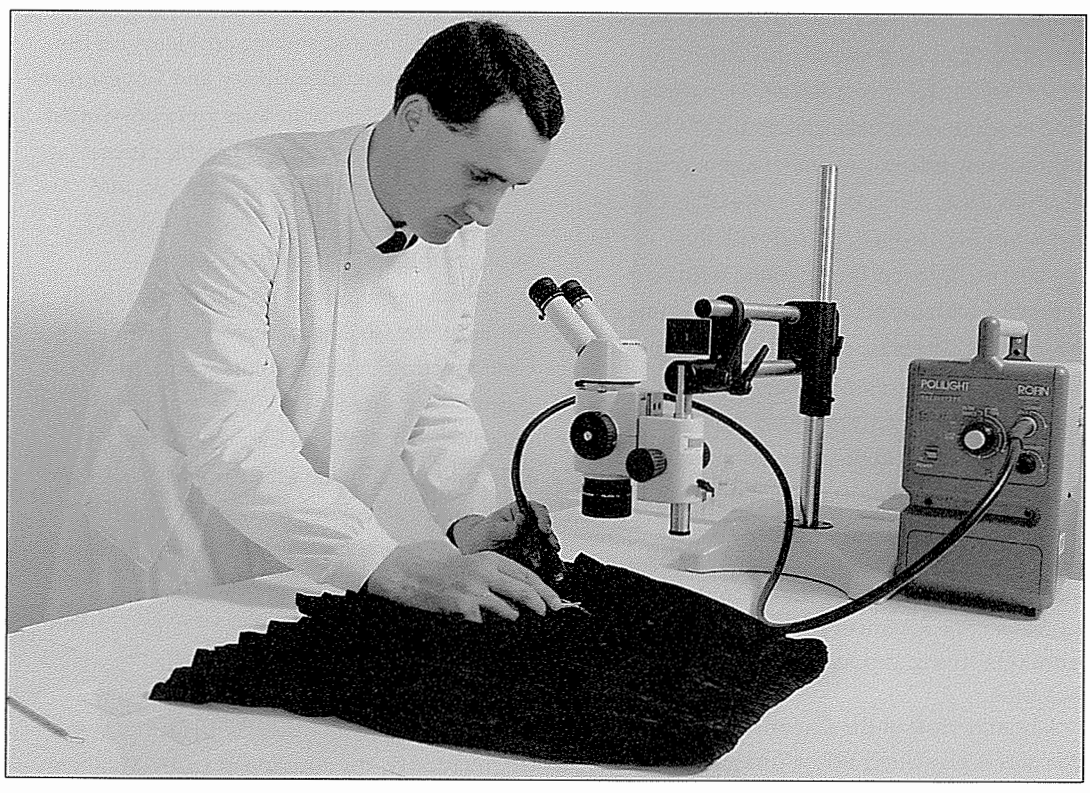
THE YEAR IN REVIEW

INTRODUCTION

The Chemistry Centre continued to provide chemical, metallurgical and mineralogical information and advice and undertake scientific investigations for some 30 Government agencies, industry and members of the public. The Centre has thus supported many government programs in the development of the State's mineral, water and agricultural resources, the monitoring and improvement of public and occupational health and environmental and materials standards within the community as well as assisting the law enforcement and racing agencies.

The Centre is committed to providing high quality independent scientific support to all clients. Significant scientific contributions continue to be made by staff in all of the Centre's diverse range of statutory and support responsibilities. Evidence of this is seen in the range of scientific publications, industry supported investigations and formal collaborative projects with other government agencies, universities, CSIRO and industry. Several staff are also actively involved in national scientific organisations. During the year the Chemistry Centre's extensive range of chemical tests accredited by the National Association of Testing Authorities (NATA) was extended to the Racing Chemistry Laboratory; a new area for NATA.

In the 1991-92 year Dr Neil Rothnie came from the State Chemistry Laboratory in Victoria to lead the Agricultural Chemistry Laboratory and Dr Geoff Richardson was promoted to lead the Materials Technology Laboratory. Management staff changes also occurred as part of the process of creating larger operating units within the Laboratories. The Food Chemistry Group of the Health Chemistry Laboratory was moved to the Agricultural Chemistry Laboratory and the Occupational Health group of the Health Chemistry Laboratory was moved to the Environmental



Senior chemist and research officer Dr David Honey examining fibre evidence.

CHEMISTRY CENTRE

THE YEAR IN REVIEW

Chemistry Laboratory. This restructure also involved reducing the number of management groups in Environmental Chemistry.

Planning and documentation for Stage 1 of the Chemistry Centre Bentley Complex were nearly complete at the end of the year. Stage 1 will see the transfer of the Mineral Processing Laboratory to the new site which is adjacent to Curtin University of Technology. Stage 1 also includes buildings for the CSIRO Division of Mineral Products, for Curtin University's School of Chemical Engineering and temporary library and canteen facilities. Although some renovations were made during 1991-92 to the Hay Street Laboratories to overcome some overcrowding and occupational health concerns, these problems cannot be resolved without major and expensive building renovations. The relocation in Stage 2 is the only economic solution.

Progress has been made in the upgrading of the Chemistry Centre's financial systems to give greater financial responsibility to the Laboratories which are the effective business units. The Chemistry Centre purchased in 1991-92 Laboratory Information Management Systems for two Laboratories and will progressively introduce similar systems to all Laboratories as funds become available. Clients have continued to be supplied with the Chemistry Centre costs associated with each report and with monthly statements. As most government clients have little appreciation of their full costs, it has been necessary for Chemistry Centre staff to spend time explaining the Chemistry Centre costs.

As part of the planning process the Chemistry Centre has prepared a booklet 'Directions 1992-1996' and adopted the theme 'Making Chemistry Work for Western Australia'. The Chemistry Centre will continue to provide strong support to Government programs.

A brief review of the Chemistry Centre's activities is presented below using the Department's Corporate Plan program as sub-program headings.

EXPLORATION AND DEVELOPMENT OF NATURAL RESOURCES

Mineral Science Laboratory

A significant increase in the number of requests for analysis, an increased demand for quantitation of more complicated analyte mixtures and an increase in the complexity of sample matrices submitted for analysis, provided the environment for a challenging year for the Laboratory. Accurate analytical and mineralogical data, provided on time, giving the client the required information as cost effectively as possible, were the theme for the year's Laboratory Quality Improvement Initiative. The success of this initiative was confirmed by the positive responses from all major clients.

The Laboratory continued to improve its role in advising and solving problems for the mining and minerals industry and Government Departments. New initiatives were developed in the areas of occupational health, process mineralogy, geochemical exploration, and forensic mineralogy areas were developed. Many of these initiatives resulted in co-operative projects being undertaken with industry, the Geological Survey Division, the Gold Stealing Detection Branch and the Australian Police Force. The range of analytical equipment available to the staff of the Laboratory facilitated active improvement of analytical methodology. The advantages of these developments were publicised to, and recognised by, client organisations. A significant number of papers were presented, and well received, at both national and international conferences.

The capability of the ICP-MS facility was augmented by the addition of Laser Ablation,

enabling solid sampling to be undertaken. The facility was successfully commissioned for routine analysis of gold, silicate minerals, glass, metal, plastic and biological samples, thus significantly increasing the range of analyses available to client organisations.

Geochemistry Section

A Laser Ablation Inductively Coupled Plasma Mass Spectrometer (LA-ICP-MS) was commissioned during the year. The system has state-of-the-art hardware and software, the latter operating under the OS/2 computer environment. This configuration allows simultaneous data acquisition and manipulation and considerably streamlines method development and sample analysis. The ICP-MS facility has been successfully used in a variety of applications including pigment, urine, blood, water, gold, metal and alloy, mineral, rock and ore analyses. Detection limits are in the parts per trillion region and the system has been tuned to a level of performance three times better than factory specifications.

A collaborative exercise with the Mining Engineering Division (MED) enabled the development of an X-ray fluorescence spectrometric technique for the determination of uranium and thorium in geological samples. The technique gives excellent agreement with the conventional gamma spectrometric technique but is considerably less costly, quicker (minutes as opposed to days) and more accurate. The expertise of the Department's staff and availability of sophisticated instrumentation has enabled MED to establish a Minerals and Energy Research Institute of Western Australia (MERIWA) funded project to monitor the ingestion of radioactive dusts by occupationally exposed workers. The Section's analytical capabilities have meant that this project can now be undertaken entirely within Western Australia without requiring analytical assistance from the Eastern States.

Mineralogy

Asbestos was, once again, a major concern, with the Section providing specialist advice to the Neville Parliamentary Enquiry on Wittenoom. Assistance was also provided in a number of cases of industrial dispute, where asbestos was an issue.

Mineralogical initiatives, involving sophisticated analytical and petrological techniques, greatly increased during the year and now cover a wide variety of ore and process mineralogical products. In many of these initiatives, support was given to projects being undertaken by other Chemistry Centre Laboratories. An increase was experienced in the Section's involvement with the WA Police Gold Stealing Detection Branch which was assisted in their investigations into major cases of gold theft.

The Simpson Mineral Collection was augmented by the addition and cataloging of several hundred new samples. Following an active publicity campaign the Collection received increased productive usage from a broad cross-section of the industrial and private community. It continues to be a unique and invaluable scientific reference base for mineral exploration of the State.

Mineral Processing Laboratory

Demand for the Laboratory's range of metallurgical testwork capabilities remained high despite the depressed state of the economy. In-house development work resulted in the establishment of a number of new test methods which have been utilised by clients. Collaborative research and development projects maintained the Laboratory's excellent working relationships with tertiary institutions, CSIRO and industry sponsors. The Laboratory is devoting significant resources in planning for its new building adjacent to the Curtin University campus which is expected to be ready for occupancy some time in 1994.

Development of New Testwork Capabilities

Many gold ores are not amenable to conventional extraction techniques. The gold in these ores is termed refractory. There are many types of refractory gold ores. For example gold particles may be physically enclosed within other minerals such as pyrite and quartz or be combined chemically with tellurium. A diagnostic procedure was developed which identifies the nature and location of gold in a refractory ore. This procedure involves the sequential attack of the ore by a series of chemical reagents combined with some physical treatment steps. Several gold ores were submitted by a client for assessment using this procedure. The results of the tests assisted the client in establishing whether gold recovery could be improved by modifying current processing methods.

The Laboratory has facilities to produce bulk samples of reduced ilmenite using the pilot scale rotary kiln. Further processing using Becher Process aeration leaching or acid leaching to remove metallic iron has, up until now, only been carried out on a small scale. Through the efforts of scientific and workshop staff the Laboratory is now able to leach significant quantities of reduced ilmenite. Larger scale operations result in cost savings to clients and provides more uniform bulk samples for market appraisal or for ongoing evaluation.

Mineral Testwork

Activated carbon in the form of approximately 2mm sized granules is used to recover gold from cyanide solutions in the Carbon-in-Pulp (CIP) process. This process is now installed in most of Australia's gold mines. A major gold producer asked the Mineral Processing Laboratory to evaluate a number of commercial activated carbons as likely replacements for its current brand. Nine carbon samples were submitted for a series of tests

Chemistry Centre Curator of Minerals, John Lewis (left), is pictured assisting farmer, Murray Anderson, with a feasibility study to assess the commercial viability of a chroysoberyl (Alexandrite) discovery on Mr Anderson's Dowerin wheat property.

designed to measure size distribution, activity, mechanical hardness/attrition resistance and density. Most of these tests are unique to this laboratory and a new test was developed which simulated the pumping of carbon slurries in pipes as is carried out in practice. One carbon appeared to be superior to the others in most of its properties based on the results of eleven different measurements. This type of investigation is particularly important as the initial inventory of carbon for a medium/large gold CIP operation can be as much as 50 tonnes. Cost of the testwork was less than $7 000. Because activated carbon ranges in price from $2 000 to $5 000 per tonne, the results of the tests have the potential to make the client's operation far more cost effective.

The Laboratory was approached by the Geological Survey Division to make a preliminary assessment of a large local deposit of gypsum. The deposit is located below a salt lake and consequently needs to be washed to lower the salt content to acceptable levels. Bench scale testwork indicated this was possible using local bore water although a final wash with near-potable water may be necessary to achieve the desired salt levels.

Funded Research and Development Projects

Excellent progress was made with an industry funded MERIWA project investigating the electrolytic recovery of gold and copper from cyanide solutions. This project is a joint venture with Murdoch University and has $40 000 funding from four industry sponsors. The investigations have defined conditions under which gold can be selectively recovered from solutions contaminated with excess copper. The project is due to be completed in November 1992.

The Laboratory along with the Mineral Science and Kalgoorlie Metallurgical Laboratories is involved with the newly established A.J. Parker Co-operative Research Centre in Hydrometallurgy and its officers will collaborate with staff from Curtin University, Murdoch University, Australian Mineral Industries Research Association (AMIRA) and CSIRO on a range of projects, including leaching of reduced ilmenite and hydrometallurgical treatment of complex and refractory gold ores.

An automated on-line gold analyser is currently being evaluated and a cyanide analyser is being developed within a project funded by the Commonwealth Government. A local company, which manufactures and exports on-line analysis equipment is using the Laboratory's expertise in gold and cyanide chemistry to support this program. A prototype gold analyser has been operating for six months under simulated industrial conditions in the Laboratory's pilot plant building in order to establish its reliability, accuracy and precision. A similar instrument to measure cyanide is being developed and should be ready for testing before the end of 1992.

The AMIRA Cyanide Project Final Report to its sponsors was completed in April and published in bound form. The 12 volume report comprised:

- a review of cyanide - chemistry and environment/management issues;
- analytical methods available and developed during the project's life;
- soil and site studies; and
- nine Site reports detailing investigations at the sponsoring companies' tailings dams.

Lysimeters containing gold tailings from three sites continue to be run to study the fate of cyanide during accelerated weather cycles. This is designed to simulate many years of tailings deposition and weathering in a small fraction of time. It is hoped that this lysimeter work will allow predictions to be made of long term behaviour of gold mine tailings.

Kalgoorlie Metallurgical Laboratory

The Laboratory was actively involved in carrying out testing and research work for

industry on a range of minerals and metallurgical processes applied to various gold and base metal ores.Work included ore characterisation, bullion purity, process optimisation and plant surveys with a view to developing new mineral resources and improving existing processes.

Staff members were involved with supporting seminars, practical training, Mining Expo '91 and other professional activities during the year.

AusIMM Regional Conference

Laboratory staff were involved in organising the Australasian Institute of Mining and Metallurgy Regional Conference entitled "Geology, Mining and Metallurgical Practices in the Eastern Goldfields", in December. This was held at the Western Mining Corporation Conference Centre, WA School of Mines, and attracted an impressive audience of 140 delegates. In addition to the keynote address, 35 technical papers were presented in three parallel streams of geology, mining and metallurgy by experts in these fields. Laboratory staff presented a paper at this conference and the Laboratory was open for delegates to view the facilities and talk to staff.

Training Courses

For the first time the Laboratory embarked on a "hands on training program" for mining personnel from foreign countries and accommodated ten technical staff from Ethiopia and Iran over a one week period. Laboratory staff provided practical training in the areas of metallurgical testing, bullion analysis, fire assaying, analytical methods, calcining, roasting, smelting and refining of gold bars.

Funded Research Project

The MERIWA funded research project on "Column Flotation Studies of Sulphide Ores of Western Australia" commenced at the beginning of the year. One of the sponsors of this project has problems of magnesium

Chemists Dr David Allen and Sophia Sipsas sampling soil during a Department of Agriculture fertiliser field trail.

oxide (MgO) contamination in their concentrates. As part of the project, the Laboratory has embarked on a program to reduce MgO in the concentrate using its 7cm diameter column flotation unit. The initial results on this separation were encouraging.

A new 20cm diameter, 6m high column flotation unit has been designed. This larger column will run in parallel with 400cm diameter column at a local gold mine in order to generate data for the scale-up of column flotation. The use of this 20cm column flotation is essential to avoid diameter effects on the scale-up.

ENVIRONMENTAL PROTECTION AND REHABILITATION

Work continued for several major Western Australian gold producers into the disposal of cyanide residues around gold mine tailings dumps.

A collaborative project with Murdoch University investigating rehabilitation of tailings areas by revegetation was commenced in mid 1992. This work will include laboratory work, pilot scale lysimeter trials and field trials to assess the impact of revegetation on the stability of the tailings. Analytical work to date has enabled development of a basic understanding of tailings dam chemistry. The next stage is to investigate the combined effects of plant growth, fertiliser application and soil conditioning on the stability of cyanide and metal species in the tailings. An eventual aim of this work is to return the tailings dumps into service for forestry or pasture.

CHEMICAL SERVICES

Agricultural Chemistry Laboratory

The Agricultural Chemistry Laboratory undertook a major review of its activities during the year as part of an on-going program to extend both the range of its specialist research and consultancy services and to improve the efficiency of its analytical service delivery through more effective use of modern instrumentation acquired in recent years.

This review was undertaken in recognition of the changing priorities of Government, in particular the Department of Agriculture and the community. Particular emphasis was given to the identification of areas where specialist chemistry expertise could be provided in support of the Department of Agriculture's efforts to increase both the value and the sustainability of agricultural production, and add value to agricultural produce beyond the farm gate.

In this respect the reorganisation of the Laboratory reflected the restructure of the Department of Agriculture, where emphasis has been given to the organisation of multi-disciplinary program teams to address industry-driven concerns.

The Laboratory also made a concerted effort to forge links with the recently established Cooperative Research Centre for "Legumes and Sustainable Agricultural Production in Mediterranean Environments" between the University of Western Australia, Department of Agriculture and CSIRO. These steps were taken in recognition of the scarcity and cost of specialist analytical instrumentation not available to the CRC and the contribution that chemistry could make to its research and development programs.

The year also saw the dissolution of the Health Chemistry Laboratory and the subsequent transfer of the Food Science Section to the Agricultural Chemistry Laboratory. It is anticipated that the specialist expertise within the Food Science Section will be used to support the Department of Agriculture's efforts to add value post farm gate and to improve the post harvest storage of produce.

The major activities of the Laboratory during the year are summarised as follows:

Sustainable Agricultural Production

The Laboratory has continued to support the Department of Agriculture's research efforts to

improve the efficiency of fertiliser usage, particularly in the production of vegetables. Western Australia is the premium vegetable exporting state. Most of these export crops are grown on the sands of the Western Australian Coastal Plain and use water from the unconfined aquifer.

Since these sands have low nutrient and water holding capacities, leaching of fertilisers (especially phosphorus and nitrogen) has been implicated in the pollution of ground and surface waters of the Plain. Accordingly, unless more efficient irrigation and fertiliser practices which minimise the leaching of nutrients can be developed, there is a danger that future production and export of vegetables from the State may be restricted. As a consequence of this, considerable effort has been given to the support of Department of Agriculture's research projects in this area. At present growers have no suitable soil tests which can predict the ability of soils to hold phosphorus. Research at the Laboratory has concentrated on the development of such tests. In particular the phosphate retention index shows promise and as an additional benefit has been used to assist in the development of models concerned with the minimisation of nutrient loss in groundwater and waterways. Details of this test were also provided to industry to assist in the development of housing and recreational facilities with minimal environmental impact.

The significance of this work has been recognised by industry and resulted in the funding of three major collaborative projects (in excess of $500 000 over three years) with the Department of Agriculture by the Horticultural Research and Development Corporation and Alcoa of Australia. These projects included:

- phosphate, nitrogen and irrigation management in potatoes;
- the management of cadmium levels in potatoes and other vegetables; and
- vegetable production and water pollution on the Western Australian Coastal Plain.

Plant Nutrition

Lupin production has increased considerably in recent years with more than 900 000 tonnes being produced in Western Australia. This provides export earnings of over $175 million to the State. As a legume, lupins also have an important role in adding nitrogen to the soil for the following crop, and in disease control by providing a break between wheat crops. In most areas of the State, low soil phosphorus levels limit lupin production, and fertilisers such as superphosphate have been applied in recent years. Consequently, the Laboratory has analysed large numbers of lupin grains and lupin tops for phosphorus as part of a Department of Agriculture program investigating the effect of placement of superphosphate on lupin production. This work has demonstrated that banding fertiliser at a depth of 5-8cm below the seed at sowing is the most effective and efficient way of applying fertiliser. The value of this potential increase in lupin production is several million dollars.

Laboratory staff, working in conjunction with the Department of Agriculture, have completed a major survey which demonstrated that the molybdenum status of wheat could be assessed at the 6-8 leaf stage. As a consequence of this work, the Department of Agriculture has launched a molybdenum diagnostic service (Youngest Fully Emerged Leaf). Samples are forwarded to the Laboratory for analysis, with results passed on to the Department's extension officers within two weeks of sample receival. The results are discussed with the farmers and appropriate crop treatment recommendations are made.

Analytical support was also provided to the Department of Agriculture to establish the nitrogen requirements and seed nitrogen levels in a new barley variety relative to older varieties at a number of different locations in high rainfall areas. The new barley variety may

have improved yield potential relative to older varieties, yet still maintain its malting qualities.

Lupin and Legume Breeding

The Laboratory continued to support the Department of Agriculture and national lupin breeding programs through the provision of lupin alkaloid screening designed to ensure that lupin seed does not contain unacceptably high levels of alkaloids. This work is supported by the Grains Research Development Corporation. There is also considerable interest in breeding alternative lupin species for areas not suited to L. angustifolius. These include the heavier soils in medium rainfall areas (L. albus), alkaline soils (L. pilosus and L. atlanticus) and acid sands in high rainfall areas (L. lecteus). The Laboratory, in support of efforts to extend the use of lupins as a human food, has undertaken a study to determine the metabolic fate of ingested lupin alkaloids in man. This study is in addition to work which has seen the development of tests to determine the levels of anti-nutritional components in lupins. Recent work has suggested that lupins are essentially free of anti-nutritional components. The alkaloid metabolism studies are being undertaken to address concerns raised by the Committee of Toxicology of the U.K. Ministry of Agriculture, Fisheries and Food which might prevent the registration of lupin seed as a novel food in the United Kingdom and Japan.

Environmental Chemistry Laboratory

Environmental monitoring work for government agencies included several new initiatives aimed at establishing environmental quality databases for the Western Australian environment.

A joint survey with the Environmental Protection Authority into the quality of Perth's metropolitan coastal waters environment revealed a generally clean bill of health. This survey, known as the Southern Metropolitan Coastal Waters Study included examination of 180 sediment sites, and mussels from selected sites, for contamination by organic chemicals including hydrocarbons, polynuclear aromatic hydrocarbons, pesticides, PCBs and tributyl tin biocides. Apart from a few isolated instances around power boat operational areas and industry, Cockburn sound and adjacent waters were found to be relatively free from organic chemical pollution. However, work carried out at CSIRO Centre for Advanced Analytical Chemistry at Lucas Heights NSW as part of the study revealed the presence of widespread trace quantities of tributyl tin (TBT) in Cockburn Sound and as far west as Rottnest Island. The environmental significance of these findings is unclear at this stage, but TBT is no longer permitted in Western Australia on boats less than 25 meters in length. Work is continuing on the TBT issue.

A joint study with the Water Authority and Main Roads Department into the effects of road runoff on a suburban lake has indicated that some heavy metal and nutrient contamination is occurring. Hydrocarbon pollution of natural waterbodies from road runoff was not identified as a major problem in this work.

Crayfish and Kirki Oil Spill

The Laboratory was called on to examine sediments and crayfish from around the site of the Kirki oil spill which were examined for petroleum hydrocarbon contamination. The export crayfish business is a $200 million industry for WA cray fishermen and any contamination from this major oil spill which might have resulted in tainting of the flesh could have disastrous implications for the industry. Thankfully, no contamination was found, probably due in part to the light nature of the Kirki oil cargo and rough weather conditions at the time. Further work is continuing on crayfish larvae to investigate the potential for long-term effects.

Wildflowers for Export

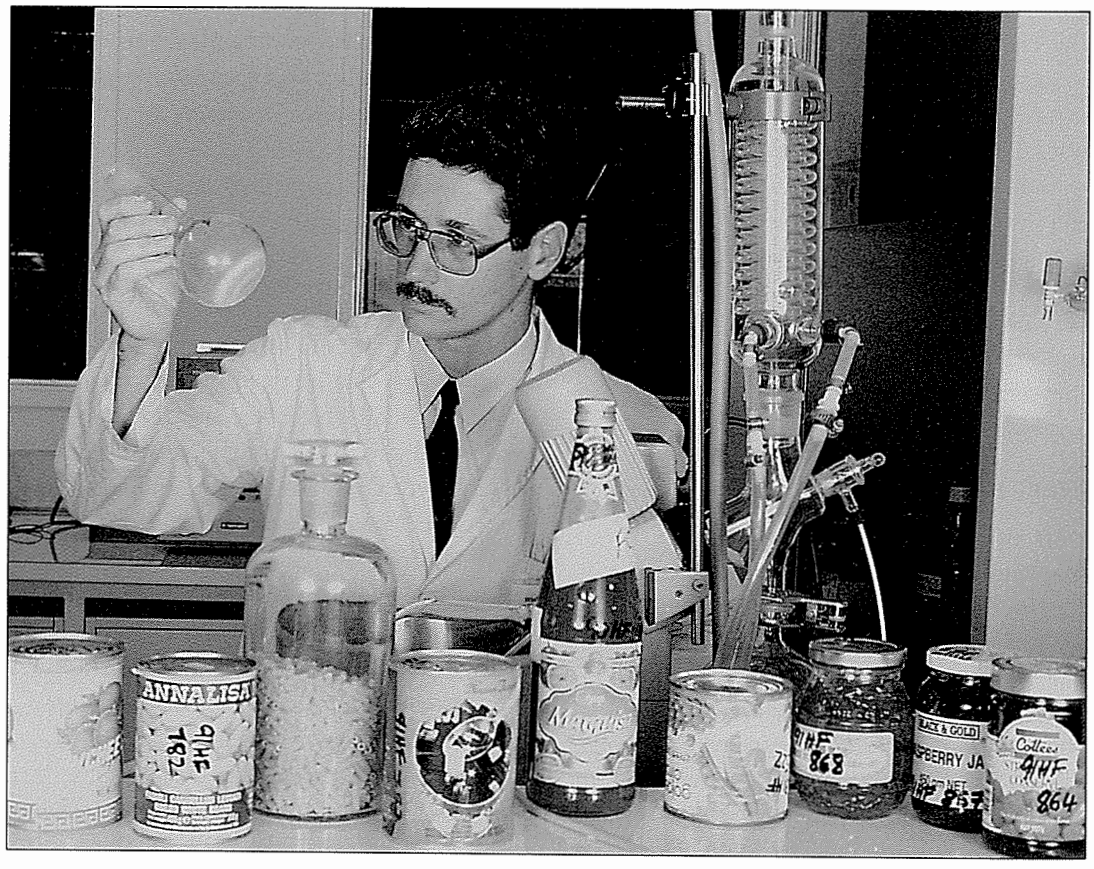
An investigation into pest control on export wildflowers indicated lower than expected levels of pesticides present in the dipping solutions used. The presence of sediments, mainly kaolin, was identified as the other potential major problem due to its adsorption properties. Recommendations were made regarding the likely effects of dip solution strengths, sampling and efficacy for the protection of the export wildflower industry.

Malaysian Consultancy

The first phase of a consultancy on 'Analysis of Food for Pesticide Residue' with the Food Quality Control Unit, Ministry of Health, Malaysia was completed by Principal Chemist Mr Geoffrey Ebell. The consultancy was part of the Ministry of Health's program to improve food quality and was funded through the Asian Development Bank. During the five weeks in Malaysia, Food Quality Control Laboratories were assessed for suitability for pesticide residue analysis, staff were given initial training and recommendations made for upgrading of facilities and purchase of equipment. The second phase of this consultancy is scheduled for 1993. Information on systems of registration, clearance and monitoring of pesticides within Australia was presented to authorities from Ministry of Health and Department of Agriculture, Malaysia, at seminars and talks held during the consultancy.

Forensic Science Laboratory

Case numbers rose by approximately 6% with illicit drug cases, the main contributor, increasing by a further 20%. Despite the increases, the Laboratory was able to meet or



Senior chemist and research officer Stewart Jones examining the chemical composition of additives in food.

better, target response times for most programs for most of the year. In particular, the notable improvement in turnaround times for Coronial toxicology cases, evident in the latter half of the 1990-91 fiscal year, continued and fully justified the method development and instrumental resources which were assigned to the program.

The improved operating efficiency of the Toxicology and Illicit Drug sections was due mainly to the acquisition of a new Hewlett Gas Chromatograph Mass Spectrometer which features facilities for multi-user operation, and the development of a worksheet generation and reporting capability for the illicit drug part of the Laboratory Information Management System. This development enabled illicit drug case management to be standardised and certificates of analysis to be produced directly from the results database.

Internally, the Laboratory's main strategies for the year were to upgrade quality assurance activities, to progress research programs and to consolidate existing strengths. To this end considerable work was put into documentation of methods, the Quality Officer's duties were continued, research projects were consolidated and formally documented, applications for externally funded research grants were successfully pursued and the functionality of the Laboratory Information and Management System was significantly expanded and developed.

Externally, there was a concentration on improving communication with clients to ensure that all were aware of the considerable skills and knowledge base that exists within the Laboratory. This process was assisted considerably by staff participation in a number of joint training exercises, by being available to help clients with expert opinions when and where required and by publication by the Physical Evidence Section of a Quarterly information sheet "Forensic Feedback".

Activities in the various programs are as follows:

Toxicology

The use of deuterated internal standards for quantitation of drugs by mass spectrometry significantly improves the precision of the analyses. The use of standards was extended during the year, with standards now being available for the opiates, all drugs of abuse, and the majority of the tricyclic anti-depressants. The standards were usually acquired from chemical supply companies, however in two cases where the required materials were not available from these sources, the standards were synthesised by Laboratory staff.

A project initiated during the year had its first real application late in December. The case involved the confirmation of thioridazine, an antipsychotic agent, in maggots taken from a badly decomposed body. Analysis of the maggots avoided interference from the post mortem putrifactant products produced in the cadaver, which normally make drug and poison identification extremely difficult in these cases. Confirmation of the presence of the drug provided supportive evidence for identification of the deceased.

A study into post mortem blood drug concentrations of samples taken from various body sites was commenced. The study, which is being undertaken in cooperation with the Forensic Pathology Section of the State Health Laboratories is aimed at establishing the variability in concentration which can be expected from differing sampling sites in drug overdose cases. The drug under consideration in the initial trial was dothiepin an anti-depressant drug, which accounted for 19 deaths in 1990-91. The results indicate that for dothiepin, a wide variation in concentrations exists for different sampling sites on a body.

Research into the use of an ELISA (enzyme linked immunosorbent assay) kit for the analysis of bronchodilator drugs was initiated and completed. A commercial kit released by WTT Inc, Kentucky USA, had been developed

for analysis of these drugs in race horses. The research was aimed at determining the applicability of the technique to the analysis of human blood and serum in toxicology cases. The results proved that the technique could be used for the bronchodilators salbutamol, orciprenaline, terbutaline and isoprenaline. In addition it was found that B-blockers such as propranolol, metoprolol and atenolol also give a measured response. The technique therefore has greater utility given no admixtures of these drugs are present. The bronchodilator drugs are normally most difficult to analysis for due to their poor extraction and chromatographic properties.

Illicit Drugs and Sobriety Programs

The increase in case numbers necessitated the assignment of an additional FTE to the Illicit Drugs program during the year. The continued proliferation of methylamphetamine or "Speed" was the main contributor to the increase, with "homebake" heroin cases also being notable.

The Laboratory continued to provide an analytical and advisory service to the Police Traffic Branch in connection with breath analysis and sobriety programs and to the Department of Corrective Services in connection with drug offences in prisons. In sobriety/drug and prisons programs, case numbers increased by approximately 10 %, with cannabis being the main drug of concern in both programs. A major development during the year was the increase in court cases where staff of the laboratory were required to give expert evidence in police prosecutions. The Laboratory also carried out investigations into the operations of new types of breath analysis equipment at the request of the Police Breath Analysis Section.

Physical Evidence

Progress in the comparison and the identification of fibres was continued with the Wild-Leitz comparison microscope and the development of pyrolysis techniques for determining composition. The microscope has enabled a rapid assessment of coloured fibre evidence from several cases in particular the bombing of a cafe. The discrimination of undyed synthetic and natural fibres from Laboratory collections by pyrolysis - gas chromatography and pyrolysis derivatisation has been studied.

Staff from the Section participated in three Police Department initiated training courses both as instructors and students. The Hazardous Devices Squad - Explosion Investigation course was a major undertaking held over five days, involving range work, lectures and practical work with realistic bomb scenes. The Laboratory staff provided training with evidence collection and explosive residue detection. One staff member attended the entire course as a student.

The Fingerprint Bureau conducted a major training exercise over five days again with one Section member attending as a student. The course was led by Mr Milutin Stoilovic of the Australian Federal Police. The practical laboratory sessions of the course were conducted at the Chemistry Centre, using equipment and facilities of the Physical Evidence Section.

A second Police Forensic Branch initiative during the quarter was the introduction of a thirteen week formal induction and training course for new branch members. The Physical Evidence staff were significantly involved in course preparation and presentation. It is anticipated that two such courses will be run each year.

The formation of the National Institute of Forensic Science (NIFS) has led to the possibility of obtaining realistic financial support to carry out forensic science research. A research proposal for the identification of single synthetic fibres by pyrolysis gas

chromatography-mass spectrometry was successful and funding of $64 000 was obtained. The award recognises the leadership of the Laboratory in the field of analytical pyrolysis gas chromatography in Australia.

Other investigational activities during the year involved characterisation of lipsticks, natural resins and printing inks by pyrolysis techniques and further development of pyrolysis methylation techniques.

Health Chemistry Laboratory

The Health Chemistry Laboratory played a major part in the implementation of major community health and safety projects in conjunction with the Health Department.

Food Monitoring

The Laboratory continued its significant input into the Western Australian Food Monitoring Program during the year. Locally available foods featured in several surveys on additives, contaminants and labelling, including:

- lead in canned foods. Foods in lead soldered seam cans were found to contain many times more lead than foods in welded seam cans. A report recommended that the National Food Authority review the existing maximum permitted concentrations for lead in foods; and
- a study on leachable lead from crystal glassware showed that a person would have to consume the alcoholic beverage from eight 750mL lead crystal decanters before exceeding the current Provisional Tolerable Weekly Intake for lead. Nevertheless, the results show that the consumption of one decanter of port or brandy per week could contribute 25% of an average person's estimated weekly intake of lead, a significant lead intake which consumers could easily avoid.

Industry Assistance

In line with the State Government's support of the formation of a WA Food Industry Institute, Laboratory staff have attended consortium and other meetings to assess industries which could benefit from the Laboratory's expertise in food and agriculture. In particular the assessment of natural toxins in fruit (patulin in apples, cyanide in apricot kernels), vegetables (solanine in potatoes) and seafood (poisonous shellfish toxin) and the correlation of palatability of foods with their chemical profile were highlighted.

A collaborative project with a local dairy looked at the variation with storage time of the vitamin C (ascorbic and dehydroascorbic acids) content of orange juices. The juices may or may not comply with the Food Standards Code depending on the testing procedure used. Clarification of the definition of 'vitamin C' is being sought from the National Food Authority.

Overseas Assignment

Mr Stewart Jones, a Senior Chemist and Research Officer from this Laboratory completed the first phase of a consultancy to the Malaysian Government's Ministry of Health on the analysis of metals in foods. Specialist advice was provided on laboratory requirements for metals analysis and on the efficient structuring of food monitoring programs.

This consultancy has highlighted the developing significance of the Asian region for export of Australian goods and services.

Public Health

A number of paint scrapings from playground equipment were found to contain levels of lead exceeding the Uniform Paint Standards limit of 0.5 percent. An assessment of the risk showed that ingestion of a piece of paint of area one fifth of a one cent piece would cause a child to exceed the Provisional Tolerable Weekly Intake. Analysis of locally-produced powder coatings has shown them to be lead free.

Occupational Hygiene

Glutaraldehyde is used as an antimicrobial agent in many hospitals and health service units for cold disinfection of endoscopes and other instruments. It is still considered to be the most effective and efficient disinfectant for instruments which are sensitive to heat and cannot therefore be autoclaved. However the compound is toxic and may produce adverse health effects upon exposure. This has prompted a joint Health Department/Chemistry Centre investigation to assess hospital staff exposure.

As a result of this work, guidelines on the safe use of glutaraldehyde for disinfection purposes have been developed to protect hospital staff when using this chemical in the future. A joint Health Deptartment/Chemistry Centre seminar on glutaraldehyde use will be convened in late 1992.

Investigation of alleged chemical contamination at Dryandra Primary School

In early August 1991, staff and children from Dryandra Primary School Mirrabooka raised complaints about chemical odours following a graffiti cleaning operation in the school.

In response, Ministry of Education requested the Chemistry Centre to carry out an investigation to:

- determine the chemical nature of the product used in the graffiti cleaning operation;
- determine the atmospheric contaminants from graffiti solvent;
- identify chemical odours; and
- examine brick surfaces for contaminants.

Other schools such as Montrose Primary School were also investigated.

Analysis showed the main offending chemical to be phenol and recommendations were developed for treatment and odour reduction when using graffiti chemicals.

Materials Technology Laboratory

The Laboratory consults to government and industry on corrosion and building problems, consumer products and material failures.

Friction Rock Stabilisers (FRS)

A major investigation into the corrosion of FRS has reached interim report stage. The causes and rates of corrosion in many WA mines have been determined from retrieved samples, mine water and rocks. This information will be used by the Department to formulate guidelines for the longevity of these forms of support which are widely used through WA and the world.

Graffiti Removal

Methodology was developed and several commercial graffiti removers were assessed for safety, toxicity and effectiveness. The removers were supplied by the companies and tested on a variety of typical products used for graffiti and on substrates in common use in Western Australia. The investigation was aimed at screening products to be used by the Building Management Authority to ensure safety of the applicators and nearby personnel as well as assessing the effectiveness of the product.

Industrial Accident

An accident involving failure of a rope and pulley system was investigated. A synthetic fibre rope broke when being used to winch a heavy object above head height and resulted in a fatality and a serious injury to another person. Detailed investigation of the conditions of the pulley system, the tensile strength of the rope and the proximity of the rope to objects likely to cause the failure, formed a significant part of a submission to the Coroner's inquiry.

Building Material Failures

In the past year several new types of brick and also new types of cement products have been developed. It is considered that a

coordinated approach to compatibility of the new cement products, used as renders, plasters and mortars, and the bricks and blocks is required. The increasing number of building failures indicated, at least, a lack of understanding of the mechanism of adhesion of the bricks and blocks to the cement product. It is important to the State's economy that these problems be investigated. As a result all Laboratory staff took the opportunity to visit the Hutton Street Annexe of Leederville TAFE to be shown the practicalities of bricklaying, tiling, plastering and rendering. The visit was part of an effort to develop an understanding of the causes of building failures. Various plaster and render mixes were purposely applied to several substrates demonstrating poor adhesion, poor workability and subsequent material failure. Programs of work are to be set up to solve fundamental material failure problems, incorporating the Laboratory's chemical understanding and the knowledge of the expert trades-person.

State Tender Board

The specifications for the State Tender Board detergent contract were rewritten and an assessment of the suitability and safety of the recommended products was carried out. Approximately 135 tender categories were let, resulting in the necessity to assess over 75 Material Safety Data Sheets and labels. The vast amount of groundwork carried out by State Tender Board officers and the technical input by Materials Technology Laboratory staff have ensured that the manufacturers are able to supply technologically advanced and environmentally friendly products. The Tender Board also was also able to accommodate the needs of the end user while still getting the best value for the Government.

Graffiti has become a significant problem in WA, and the Chemistry Centre has lent a professional hand in efforts to help with the removal of this unwanted artwork.

Plastic Cladding Failures on Seats

A polymer blend material thermoformed for a cladding on stainless steel seat frames in new transport vehicles failed prematurely in service. The cause of the failure was shown to be primarily a manufacturing defect in the polymer blend probably aggravated by environmental factors and in service cleaning procedures. Further studies are expected to eliminate variables and identify the specific causes of failure.

Consumer Problems

Assessment of products for safe use by the consumer is an ongoing program by the Laboratory for the Ministry of Consumer Affairs. Stability of a pantograph type vehicle jack was assessed in accordance with aspects of Australian Standard 2693. The jack was found to pass the requirements of the Standard and its failure was attributed to incorrect use by the consumer. Also a series of children's umbrellas was assessed for safety aspects when in use by small children. The particular type of umbrellas had too much tension on the spring, was easily damaged to expose sharp points and generally represented a danger to small children. Withdrawal from sale was recommended.

Swimming Pool Problems

Several investigations on the quality of two common types of swimming pool paint were carried out. These two types of paint are known to produce a white powdery surface (chalking) after prolonged exposure to ultra-violet light. Recently two manufacturers'paints have degraded to an unacceptable level in less than a year after application. Various options of repainting and re surfacing were given to the client. Investigations of the causes of these recent failures are continuing.

Racing Chemistry Laboratory

The Laboratory provides a drug monitoring advisory and research service for the Western Australian Turf Club, Western Australian Trotting Association and Western Australian Greyhound Racing Association. This service allows the racing codes to maintain their "drug free" stance which requires animals to compete on their own merits. The Laboratory also does drug testing for the Equestrian Federation.

Stipendiary stewards requested that blood and urine be taken from horses and greyhounds on approximately 3 300 occasions in 1991-92 as part of their drug monitoring programs.

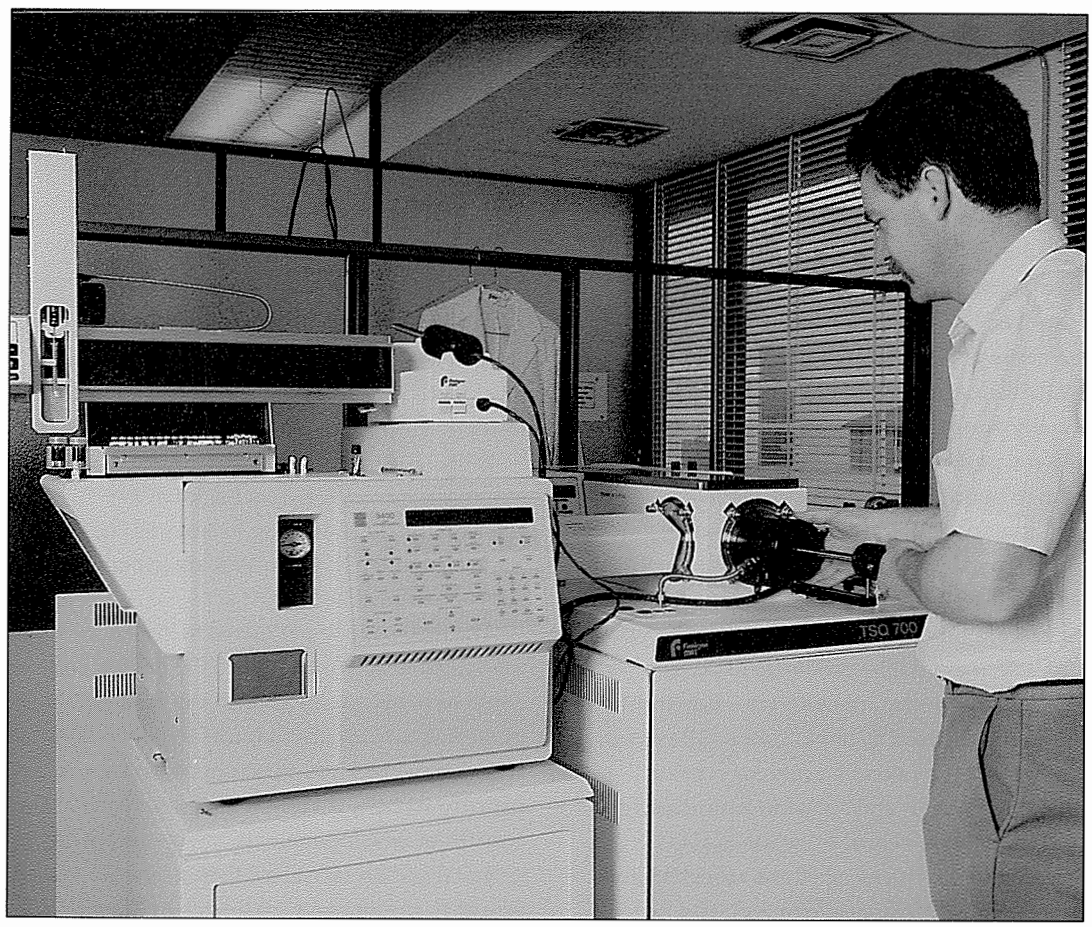
This resulted in the reporting of 22 positive drug detections. As in previous years, the majority of drugs detected were anti-inflammatory drugs (59%), but other notable findings included a narcotic analgesic and two anabolic steroids. For the first time the laboratory was also requested to do retrospective testing of previously cleared samples held in storage. As a consequence there were four detections of the anti-inflammatory drug indomethacin. Testing of jockeys and reinspersons for drugs of abuse continued, with two detections of a metabolite of cannabis.

Following New Zealand's lead in early 1991 to ban the use of "milkshakes" (oral drenches of sodium bicarbonate or other alkalising agents administered pre-race to horses) Australian racing and trotting authorities also banned the practice in late 1991. Administration of sodium bicarbonate or other alkalising agents is detected by the measurement total carbon dioxide (TCO2) levels in pre-race blood.

The levels following the administration of a "milkshake" must be differentiated from naturally occurring TCO2 levels. Extensive research done in New Zealand and by Sydney University, the Australian Jockey Club and the Racing Chemistry Laboratory in WA has provided data on normal levels of TCO2 versus those following the administration of sodium bicarbonate or other alkaline compounds. In support of the racing industry's stance to deter the use of "milkshakes" the WA government

through the racecourse development trust fund provided funding to the Western Australian Turf Club and Western Australian Trotting Association (WATA) for the purchase of the instrument required for measuring TCO2. Pre-race blood testing for TCO2 was initiated by the Western Australian Trotting Association in December and approximately 3 700 samples were tested during the year, with three samples having unacceptably high TCO2 levels. It is the first time the Racing Chemistry Laboratory has been involved in pre-race testing.

In July the Racing Chemistry Laboratory was the first Australian racing laboratory to be accredited by the National Association of Testing Authorities (NATA) (so far only two of the four laboratories have obtained accreditation). This initiative has also been followed internationally, with other racing laboratories looking to become accredited by the equivalent of NATA in their countries. Accreditation by such bodies ensures that the laboratory meets specific criteria for good laboratory practice. It is hoped that eventually such accreditation will lead to increased uniformity in testing between racing laboratories nationally and eventually internationally.



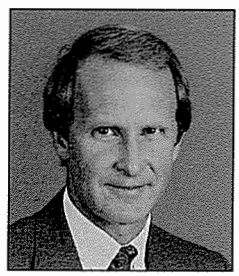
A total of 3 300 urine and blood samples were taken from racehorses and greyhounds in WA last year, all of which were analysed by the Department's Chemistry Centre. Here, Racing Chemistry chemist and research officer Charles Russo, puts one of those swabs to the test using the laboratory's lastest gas chromatographic mass spectrometer.

ROYALTIES AND SUSTAINABLE DEVELOPMENT

" ... royalties were collected on behalf of the community, the aim being to collect a 'fair' return... "

Sustainable development involves ensuring that the current generation provides succeeding generations with an amount and quality of wealth which is at least equal to their inheritance.

A broad view allows the environment to be considered as a source of natural capital which can be transformed by human effort into useful goods, services and infrastructure, subject only to the requirement that future generations should have access to an equivalent total, but not necessarily the same mix of natural and man-made capital.



Mr M (Murray) Meaton, BSc (Agric) Hons, BEc Director, Royalties and Policy Development Division

Mining appears non-sustainable and poses a dilemma as the extraction of apparently exhaustible resources reduces the available stock for future generations. While this seems to be at odds with the concept of sustainable development, the situation is more complex than this. In the first place, most minerals, with the exception of energy commodities, are not destroyed but simply transformed into other materials. These materials are potentially available for recycling although there will usually be some losses. Most minerals also become part of our built environment, being used in buildings, roads, factories, machines and other physical assets. Hence, they remain as capital assets for the next generation. They are a new form of capital which provides benefits to the community and can be potentially recycled after use, should it be profitable to do so.

The concept that minerals are a depletable resource is in itself a simplification. The size of reserves is a function of technology, price, exploration effort and access to land. The total pool of material available for use is also a function of the efficiency of use, recycling and substitution. Increases in demand, and hence price, will usually lead to an increase in exploration and research expenditure and onto a rise in discoveries and reserves. Low grade deposits become profitable to mine and the higher price encourages greater recycling.

The community obtains benefits from mining and petroleum recovery in a range of ways besides the conversion from natural to man made capital. Other benefits include employment, export revenue, infrastructure, taxation, royalty payments and other government revenue.

Royalty payments represent the price charged by the owner of a resource (usually the government) to a developer for the right to extract and sell a resource. If a resource is not priced at all, or is priced too low by the owner, the result will be inefficient investment and production, premature depletion, or excessive use. This creates a bias in favour of the present generation. If, on the other hand, a resource owner sets too high a price, the result will be insufficient investment and production and a lower than optimum rate of depletion.

Divisional Director, Mr Murray Meaton, said royalties were collected on behalf of the community, the aim being to collect a "fair" return. Payment levels in WA are generally similar to other States.

The total royalty payments in WA in 1991-92 amounted to approximately $400 million and could have been used to fund the construction of the entire Northern Suburbs Rail System as well as of eight secondary schools and seven primary schools. If viewed in this way the benefits of development are being used to create physical and social capital to increase the wealth of present and future generations.

ROYALTIES AND POLICY DEVELOPMENT DIVISION

THE YEAR IN REVIEW

INTRODUCTION

Highlights for the year included the collection of a record level of royalties from mining and petroleum companies, the finalisation of a number of royalty audit manuals and substantial progress towards auditing the backlog of outstanding petroleum royalties.

The Communications Branch continues to experience substantial increases in activity with more than 125 media releases issued during the year and a dramatic increase in the number of media enquiries to over 200 per month.

A busy year in Commonwealth/State negotiations meant an increased workload for the Policy Branch while a large number of briefings were also prepared for the Executive and Minister.

A more detailed description of the Division's activities follows, using Program and Sub-program headings from the Department's Corporate Plan.

EXPLORATION AND DEVELOPMENT OF NATURAL RESOURCES

Community Relations

The Communications Branch issued over 120 media releases for the year representing a 50% increase on the previous year. The takeup of these articles by the media was at very high levels and the Department was able to successfully handle over 200 media enquiries per month. These enquiries covered the full range of Department activities.

Media visits were organised to an oil drilling platform off Rottnest and the Kalgoorlie Region to inspect mine rehabilitation activity. The Minister was involved in the launch of: a new Co-operative Research Centre covering geomechanics, environmental excellence awards; photographic competition and the dedication of new Chemistry Centre equipment.

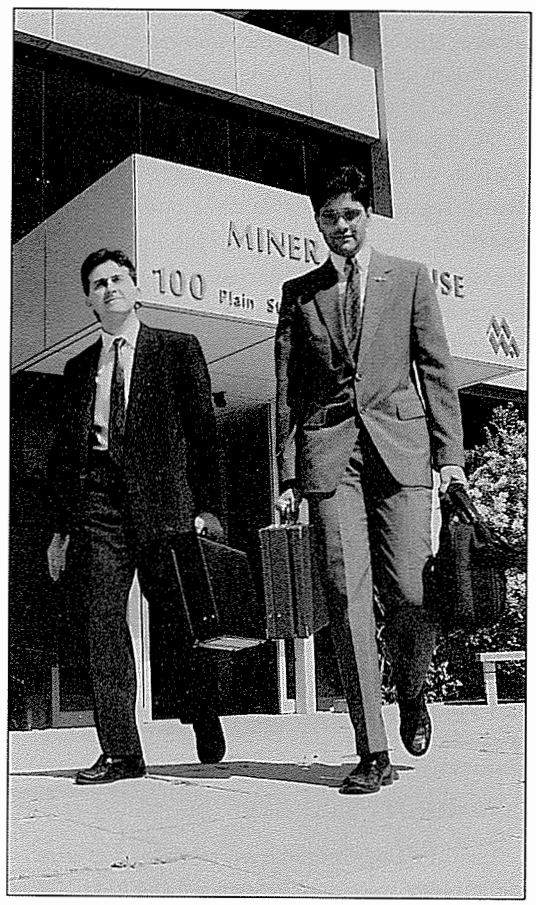
The large amount of very positive media coverage during the year almost certainly improved community understanding about the role and responsibilities of the Department.

The graphic designers and desktop publishing system were used to produce the Department's Annual Report and Annual Review and more than 12 other publications.

A Media Policy Guide was prepared for staff and training programs investigated. Training for those staff involved in media activities will be undertaken during 1992-93.

Planning commenced for the Department's centenary in 1994 and an increase in education activities also occurred. Ten Fact Sheets covering the mineral and petroleum sectors were prepared and distribution commenced to secondary schools.

The photographic competition continues to improve in quality and extent and has now become an annual event. The launch of the Environmental Excellence Awards was a success and planning has already commenced for the 1992-93 awards.



During the year, the Department carried out more than 80 royalty audits at company offices. Here, royalty officers Angelo Duca and Michel Crouche set out from Head Office on one of their routine calls.

ROYALTIES AND POLICY DEVELOPMENT DIVISION

THE YEAR IN REVIEW

A new arrangement was entered into with a private company, Corporate Mining, to publish the Department's Annual Review. For the first time, this Review will be incorporated in a more comprehensive yearbook covering the mining and petroleum sectors. This approach will enable the Review to reach a wider audience and facilitate the Department in communicating its role.

More than 14 speeches were prepared during the year for Government Ministers while over 40 briefing papers were prepared covering a wide range of topics including mineral and petroleum operations, Commonwealth/State financial relations, Commonwealth resource policies, taxation, microeconomic reform, secondary processing and regional development.

The Policy Branch assisted in the preparation of briefings and speeches and was also instrumental in briefing the Director General and Minister on items covered by the Australian and New Zealand Mining and Energy Council (ANZMEC).

During the year a hybrid royalty consisting of a base ad valorem and a second tier net income royalty system was developed. This proposed system was assessed for a number of mining operations and discussions commenced with some companies over its possible application.

Two Statistical Digests were produced during the year along with four Commodity Price Reviews. These documents provide valuable statistical and background information on mineral and petroleum production and are widely circulated to industry and government.

Work commenced on the development of a policy covering the flaring of gas from petroleum projects while the Policy Branch also handled more than 30 Foreign Investment Review Board referrals issued by the Commonwealth Government.

COMMUNITY BENEFITS

Including additional lease rentals from iron ore, mineral royalty payments for the year totalled $282.9 million, an increase of 11% on the previous year. Iron ore payments represent over 62% of total collections returning $177.4 million. Royalty collections from other minerals included:

Diamonds	11%
Alumina	10%
Mineral Sands	4%

All mineral royalties were retained by the State Government.

Collections from 1990-91 were $27.2 million higher than in the previous year, principally due to a substantial increase in iron ore royalties flowing from higher exports, with smaller increases from manganese, diamonds, coal and other minerals. Royalty collections from alumina, mineral sands and copper declined on the previous year, reflecting lower world prices.

The Royalties Branch received more than 850 royalty returns while over 1 200 returns were examined at company offices. Payments were made by 140 companies. Most royalty audits were completed in accordance with the audit plan but some difficulties continued to be encountered in the industrial minerals areas. Audit manuals were completed for alumina operations, Hamersely Iron and some heavy mineral sand projects.

Extensive negotiations were undertaken during the year relating to the payment of provisional royalties, heavy mineral sand refunds and royalty arrangements for diamonds, nickel, iron ore, vanadium pentoxide, coal and gypsum. Negotiations are continuing with respect to the treatment of foreign exchange and hedging gains and losses.

Total royalty payments made by petroleum projects based in Western Australia fell from $126 million to $116.9 million. This reflected reduced oil production from Barrow Island and the Saladin Projects.

Of the total payments made by petroleum projects in Western Australia, $86.5 million flowed to the State Consolidated Revenue Fund. After adjusting for shares from projects under State and Commonwealth jurisdictions,

the State's net share of petroleum royalties was $61.3 million (52%) while the Commonwealth's share was $55.6 million (48%).

Discussions with petroleum companies continued throughout the year and agreements on Airlie Island, Thevenard and Blina oilfields were substantially completed. Considerable negotiations took place during the year over the methodology for calculating royalty payments and the treatment of Commonwealth excise payments. The Premier announced during the year that excise payments would in future be allowed as a deduction in the calculation of State royalty. The departure from the State's traditional position was announced by the Premier as an incentive to further investment in the petroleum sector.

Discussions continued with the Commonwealth Government over appropriate arrangements and royalty calculation methodology for projects under joint jurisdiction. During the year, the Commonwealth unilaterally decided that future payments under the Petroleum Resource Rent Tax (PRRT) would be retained by the Commonwealth. Under the Offshore Constitutional Settlement, agreed between the States and the Commonwealth in 1967, the State had been entitled to a share of PRRT payments. Following negotiations between the States and the Commonwealth, lasting for more than two years, the Commonwealth's decision to retain all payments itself was a great disappointment to the State. Unfortunately, this further reinforces the financial imbalance between the States and the Commonwealth in their revenue raising powers.

CORPORATE SERVICES

The Division operated at virtual full strength for most of the year with the only difficulty being in recruitment of a suitably experienced policy officer. The departure of a number of key staff and Government controls on replacement, meant that at the end of the financial year, a considerable number of people were acting in positions other than their own. This necessitated a substantial increase in training expenditure which again concentrated on computer software and applications. The high level of computerisation now involved in nearly all Divisional activities has meant the need for continuous software training.

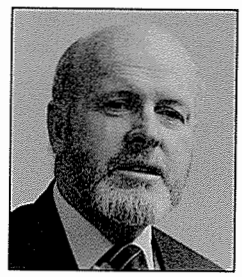
The Department's Communications Branch answered thousands of media enquiries and issued over 100 media statements during the year. Here, the Chief of the Chemistry Centre's Minerals Science Laboratory, Dr John Watling, talks to the media about a newly-installed laser ablation inductively-coupled plasma mass spectrometer which is used for gold "finger printing".

TRADITIONS OF A QUALITY SERVICE

" The overall emphasis in quality management has also required the Department to closely define, examine and monitor its programs as part of the corporate planning process."

During the past 12 months the Department continued to build on its tradition of providing efficient and effective services to the mining and petroleum industry and its workforce.

The Department's Director of Corporate Development, Mr Kerry O'Neil said despite limited resources and increasing demands, there was a continuing demand for better and more cost-effective ways of providing these services.



Mr K O (Kerry) O'Neil, MBA, CPA, Dip Pub Admin Director, Corporate Development Division

Assisting the Department, computing staff within the Corporate Development Division focussed on the development of industry-based information systems such as *Tengraph, Wamex* and *Wapex* to enable the Department to provide improved services.

As such systems are developed, the needs of industry are assessed in liaison with the functional Divisions of the Department to ensure that their requirements are met.

In particular, the *Tengraph* system is being developed to allow clients to use computer workstations in Mining Registrars' offices throughout the State and personally access the *Tengraph* system. To enable this facility, requires state-of-the-art-networking, work station and software technology. This has been assisted by recent technological advances which provide higher levels of network reliability and improved data security. For customers, it means improved public enquiry services involving tenement titles and associated public plan information which will be part of the *Tengraph* system.

As an extension of this direct client servicing, Computer Services staff have carried out some initial testing and evaluation of a system dial-in facility. Such a system would enable individuals or companies to subscribe and have access to specific segments of Departmental data bases such as *Wapex, Wamex* and *Tengraph* from their own premises through Telecom's Auspac network.

"We need to look very carefully at the security and charging aspects of such a service," Mr O'Neil said. "However, we would like to be in a position to be able to provide such a service within the next two years."

The overall emphasis in quality management has also required the Department to closely define, examine and monitor its programs as part of the corporate planning process.

From 1 July 1992 the Department will change its name to the Department of Minerals and Energy and take on additional responsibilities in the energy policy and regulatory field. This means even greater emphasis will need to be placed on ensuring that the Department's services meet the requirements of its various clients.

Depending on the particular program involved, these clients can range from specific segments of the mining industry, workers employed in the industry, other Government agencies or the general public. As part of the Department's strategic planning over the next 12 months the Department's programs will be redefined to ensure that specific client groups are identified for each program. The effectiveness of these programs can therefore be evaluated relative to the Department's success in meeting the requirements of those clients.

The Department's tradition of service will therefore receive even greater emphasis as part of this process.

CORPORATE DEVELOPMENT DIVISION

THE YEAR IN REVIEW

INTRODUCTION

The Corporate Development Division's function provides administrative support services to the Department's Corporate Executive and operating divisions to assist in optimising the resources provided by Government.

The nature of these services is not only affected by the requirements of the operating Divisions, but is influenced by Government policy and the requirements of agencies such as the Department of Premier and Cabinet, Public Service Commission, Treasury, Office of Government Accommodation, State Services and Building Management Authority.

The trend in recent years towards greater Departmental accountability has seen a number of central agency functions devolved to the Department, putting pressure on resources within this program. This has necessitated a continuous review of systems and procedures to make the best use of staff and other resources.

The following summary emphasises the activities of the Corporate Development Division.

Corporate Planning

Over the last few years, the Department's corporate management process has been refined to enable the resources required to support the Department's programs to be clearly identified.

During the year, program steering committees were established with responsibility for developing, monitoring and reporting on the elements that make up each program.

Among key people in the Department's Corporate Development Division are computer operations staff members Chris Fielding (left), Peter Edbrooke and Kate Leese (right).

The steering committees work under a model framework and program cycle which identifies agenda elements under consideration at any time. The framework will also assist the committees to meet program statement and Annual Report requirements in a co-ordinated and orderly manner.

The program committees will also have responsibility for reviewing the effectiveness of programs and the monitoring of outcomes. It is intended that over the next 12 months a schedule of program evaluations will be determined.

Management Services

In addition to co-ordinating the Department's capital and minor works projects, carrying out reviews into Departmental operations and providing a supply service, the Management Services Branch deals with all services of an administrative nature not covered by the other functional branches.

Significant achievements for 1991-92 were:

Capital Works

The Department was allocated $1.614 million for Capital Works in the 1991-92 financial year of which $114 000 was to complete works in progress. The balance of $1.5 million was provided to commence the detailed planning for Stage 1 of the new Chemistry Centre Complex at Bentley. The air conditioning for the Department's central computing facility was also upgraded at a cost of $55 000.

Building Services

Due to problems experienced with the existing security system within the Mineral House complex, a review of the system was undertaken.

Work commenced to increase the effectiveness of air conditioning within the Mineral House complex by integrating the computerised plant in Mineral House North with the manually-operated plant in Mineral House South.

Supply Services

Using the authority devolved to the Department, significant savings were achieved, including $100 000 for purchases of goods and services by locating competitive suppliers through effective sourcing practices; and $30 000 per year by formalising current service arrangements through the Department's contract/tendering system.

The Department actively supports recycling initiatives. During the year, the nomination of a Waste Paper Recycling Officer and promotion of recycling activities resulted in a steady increase in the collection of waste paper for recycling and the purchase, where possible, of recycled products.

Project Services

A computerised asset management system was successfully implemented. This will be used in conjunction with the existing motor vehicle and computer hardware/software assets systems to ensure the Department's assets are correctly managed.

The Department participated in and contributed to the establishment of a computerised Business Licence Centre for Western Australia, and will be seeking to gain in-house access to this centralised legislative and licence data base as an aid to the inspectorial and regional functions of the Department.

Information Systems

Computing

Good progress on the development of a number of key computer-based projects was achieved using innovative systems design and building techniques. The following industry based applications have been undertaken during the year:

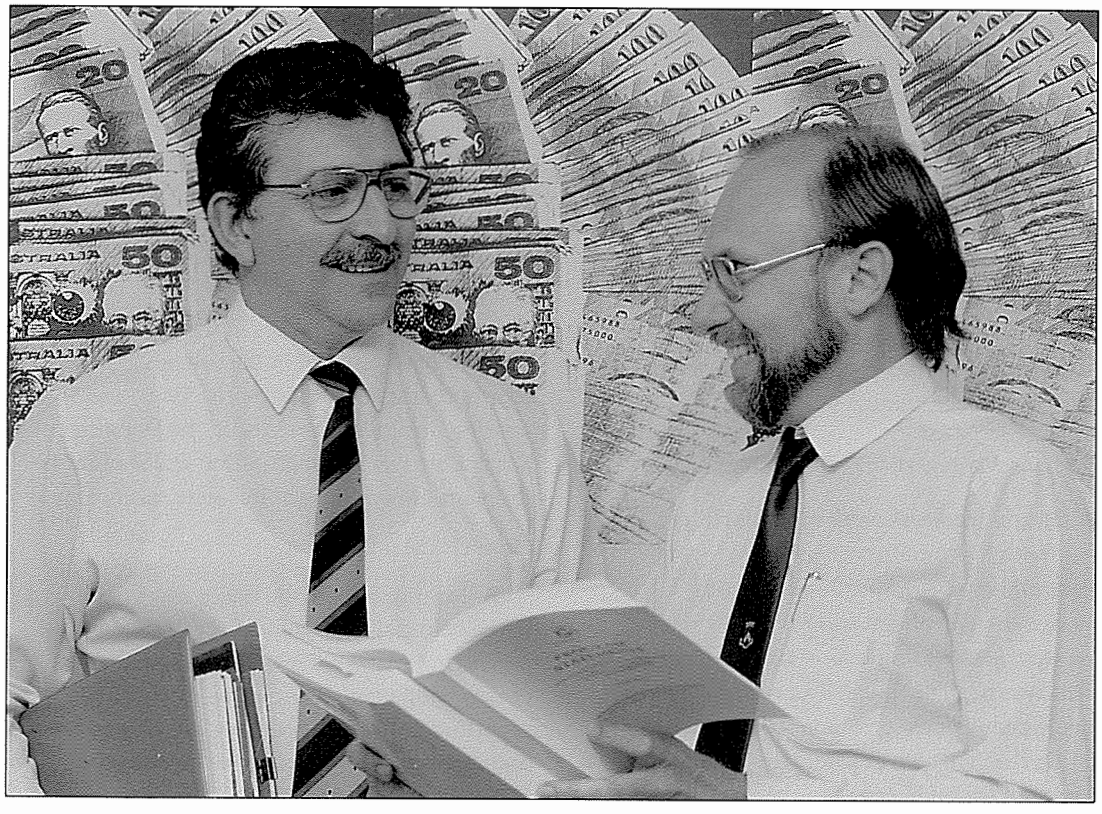
CORPORATE DEVELOPMENT DIVISION

THE YEAR IN REVIEW

- Tenement Graphic System *(Tengraph)*. This system, now under development, will utilise state-of-the-art networking, workstation and software techniques. Recent technological advances have provided higher levels of network reliability and improved data security which will enable the system to provide cross-department and public enquiry/access to tenement title and associated public plan information.
- Mineral Exploration Database - *Wamex 2*. Development effort on industry sub-systems will provide an enhanced database, an improved query facility to industry and the ability to extract and download required sub-sets from the database to micro-computers.
- Western Australia Petroleum Exploration System - *Wapex* - Development and implementation of enhanced *Wapex* database has been undertaken with an improved query facility.
- Contaminants Monitoring System - *Contam 2*. Development and implementation of an enhanced *Contam* database with an improved query facility was completed.
- Mines Index Systems - *Mindex and Mininform*. These systems required the development and implementation of a new comprehensive index and database of all WA mines and associated mineral deposits.

The development of a system to enable industry access to Departmental databases was undertaken, resulting in the completion of testing and evaluation, and the demonstration of a dial-in access facility. When implemented, this system will enable significantly faster and more direct access by industry and the public to Departmental databases.

To assist this development, completion of key extensions to the Departmental Local Area Network (LAN) was undertaken with automatic datalinks to the regional network



Discussing the Department's financial requirements are the Manager of Financial Services, Phil Palmer (right), and Arthur Mistilis, the Assistant Director of Management and Finance.

and other WA Government agencies. There are now over 150 personal computer/intelligent workstations connected to the Departmental LAN.

During the year, additional effort was made to revise standards and improve controls by the introduction of revised personal computer and workstation standards and computer system development standards.

In addition, a Departmental audit of all computing hardware and software against the Department's Assets Register was undertaken. As a result of the audit, tighter control measures have been introduced for the Department's personal computers.

Usage of the Department's centralised computer-based information systems has continued to increase at around 20%, in line with the capacity plan forecast. An upgrade to the central computer is expected early in 1992-93. The Department is also investigating the use of new micro-computer and LAN technologies in accord with industry trends to 'down size' or 'right size' corporate computer applications.

Word Processing

The ageing Wordplex equipment has proved difficult to maintain and within funding restrictions a graduated replacement plan was commenced. The replacement plan using the new Local Area Network (LAN) and microcomputers utilises standardised 'Word for Windows' word processing software and is planned for completion in 1992-93.

Records Management

Steady increases were experienced in the amount of incoming correspondence received, the number of Administrative, Mining Tenement, Petroleum and Mining Project files created, and the volumes of mail despatched. This was partially offset by a reduction in mining tenement correspondence received.

During 1991-92, new initiatives were undertaken to improve Records Management within the Department, including the establishment of protocols for the creation and title structure of 'Petroleum Title' and 'Petroleum Project' files and the establishment of Prime Headings for 'Structured File Titling'. All files created in 1991-92 have been structured according to the new file classification system.

An increase in the microfilm program enabled 43 000 inactive files to be filmed and destroyed (20 000 in 1990-91) to make better use of available physical storage areas.

Information technology continued to play a significant role in providing timely and effective services to the Department and industry. During the year further use of the Computerised Records Management System (RMS) was made to improve information management by recording Energy Policy and Planning Bureau and Exploration Safety and Drilling Branch files on the system.

In addition, an RMS facility to automatically print file covers using laser printers was introduced.

Telecommunication Services

Continued monitoring of telephone usage through the computerised Telephone Information Management System has enabled effective and efficient use of PABX facilities and cost control.

Technological advances in the facsimile industry have resulted in the use of PC-based communication facilities for receiving and sending facsimiles. As a result, the Department has updated its facsimile policy and standards to ensure effective use of this new technology.

Financial Management

Following on from the major redevelopment of the financial management information system in 1990-91, which was undertaken to enable budgeting and financial management reporting to be conducted on both a program and divisional basis, further work has been undertaken in 1991-92 to refine and enhance

the reporting system, including commitment reporting.

Development of a centralised sundry debtors system was initiated and a design concept developed for its implementation in 1992-93. The fundamental aims of the system are to centralise control of sundry debtors and credit approval relating to sales of Departmental products on credit, and to implement a simple charging system to enable credit sales to be made easily and efficiently.

A review of Departmental fees and charges was conducted towards the end of the fiscal period to establish the basis on which fees are determined throughout the Department. The review indicated that the basis for many fees was established a long time ago, and it would be prudent to conduct a major reassessment on the basis of full cost recovery, where appropriate, utilising generally accepted accounting principles. This assessment was commenced in May and is expected to take four months to complete. The outcome will be achieved in time for the determination of fees and charges for 1993-94.

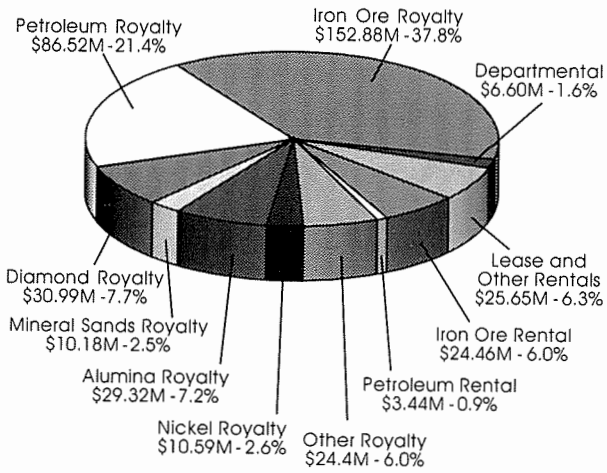
The Financial Services Branch has extended its role in financial and accounting education throughout the Department with the establishment of a comprehensive training program for all staff having financial responsibilities under the Financial Administration and Audit Act. The program covers all divisions located at Head Office and also includes regular visits to outstations.

An immediate cheque facility was established to enable rapid payment of urgent accounts, and payment of invoices throughout the year was generally within 30 days of arrival at the Department.

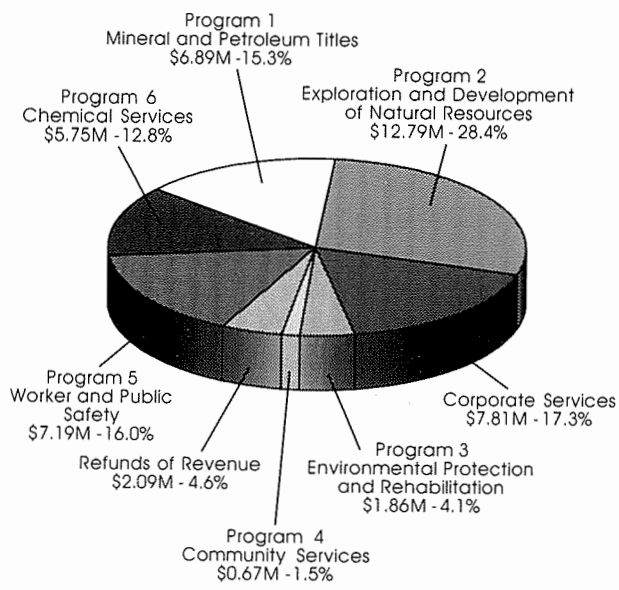
Revenue

During the financial year the Department was responsible for the collection of

Revenue 1991-92
Total $405.03 million



Department expediture 1991-92
Total $45.05 million



$405 million through the Consolidated Revenue Fund (CRF), this being $24.5 million more than 1990-91. Mineral and petroleum royalties collected from companies operating under State legislation comprised 85% of this amount. Part of the revenue was also payments collected by the State on behalf of the Commonwealth for petroleum produced within Commonwealth waters. These receipts subsequently were paid to the Commonwealth by way of special purpose payments after payment into CRF.

In addition to royalties, the Department collected lease and other rental charges and Departmental revenue. The latter, while considerably less as a proportion (1.6%), was still significant ($6.6 million) and represented charges for goods and services provided by the Department. The Departmental revenue largely originated from charges associated with the Registration, Explosives and Chemistry Centre divisions.

Expenditure

Departmental expenditure for 1991-92 totalled $45.05 million. Funds are appropriated by the Parliament through the Consolidated Revenue fund to provide for the operating costs of the Department. This appropriation includes provision for equipment replacement as well as refunds of revenue collected in previous financial years. It also includes expenditure which relates to activities of the mining and petroleum industries which are not operating costs of the Department. For example, costs associated with the Western Australian Coal Industry Council are included. This Council provides a forum at which unions, coal mining companies and Government meet to gain a better understanding of industry needs. The payments, financed through the Consolidated Revenue Fund, are related to the programs of the Department.

Human Resource Management

Once again the Department reduced its staffing levels. This was primarily due to the restrictions on recruitment and to the Government voluntary severance process. It was through the latter process that 18 officers left the Department, although six of these were replaced with school-leaver recruits and a further two replaced by redeployees.

These cutbacks have put pressure on the Department's ability to deliver its programs, necessitating greater emphasis on staff training and management. To assist in this area a performance management system has been installed throughout the Department to provide employees with feedback on their personal development and performance.

Another initiative to maintain an efficient delivery of services is the increasing number of restructures which were commenced, including overall reviews of the Surveys and Mapping and Explosives and Dangerous Goods Divisions. There was also examination of the administrative support services within the Mining Engineering Division and assistance provided to the Chemistry Centre as a result of a reduction in the number of laboratories.

People Planning

In 1991-92 the Department's Approved Average Staffing Level (AASL) was 743 Full Time Equivalents (FTEs). An additional 16 FTEs were utilized in special activities with funding provided by way of a special Government grant and external sources. With the continued use of planning and monitoring strategies the Department was able to operate within this level.

The rate of turnover fell by approximately 22% on the previous year with 111 staff resigning or retiring (14% of staffing level).

Consistent recruitment efforts have enabled the Department to maintain stability and a high level of expertise with a total of 108 new staff being recruited.

CORPORATE DEVELOPMENT DIVISION

THE YEAR IN REVIEW

Training and Development

Intensive training initiatives continued this year with 1 052 staff attendances at a variety of management, development and technical seminars, workshops and courses. This represents a 29% increase in staff attendances since 1990-91.

Enterprise Bargaining

In October 1991 the Australian Industrial Relations Commission formally introduced a system of enterprise bargaining. This system was also adopted by the Western Australian Industrial Relations Commission in January 1992. As a result of these decisions the Industrial Relations framework will shift from a system based on award based initiatives to one based on the implementation of enterprise based initiatives.

This framework was adopted by the Western Australian Government and as such the Department will be placed under the Primary Industry Enterprise Bargaining Unit. The enterprise bargaining process will entail negotiations by employers, unions, and employees on wages and other benefits in return for actual implementation of enterprise specific measures designed to improve enterprise efficiency and productivity.

It is anticipated that negotiations in the effective introduction of the bargaining unit, and the Department's participation in it, will be negotiated during the 1992-93 year.

Equal Employment Opportunities

The Department has again shown its commitment to Equal Employment Opportunities in the workplace through strict adherence to its Equal Employment Opportunity policies and practises. In addition, the Equal Employment Opportunity yearly report was submitted to the Directorate for Equal Employment Opportunities in Public Employment in August 1991 and received a favourable response.

Occupational Health

Continuing emphasis with respect to occupational health and safety has resulted in a 19.9% reduction in the number of worker's compensation claims received by the Department.

During the year there were 26 workers' compensation claims of which 24 were accepted, one rejected and one remained under consideration.

A total of 920.50 person days were lost as a result of worker's compensation injuries, with 564.00 (61.2%) of these days lost being a result of long-term ongoing worker's compensation injuries.

Through the engagement of a part-time occupational therapist and external counsellors the Department was able to provide the following services:

- rehabilitation programs for all staff following work related injuries;
- workplace assessments to ensure safe working conditions and environments;
- health education programs designed to prevent accident or injuries;
- a confidential counselling service for work and personal issues that may impinge on staff productivity; and
- claims management for all workers' compensation claims.

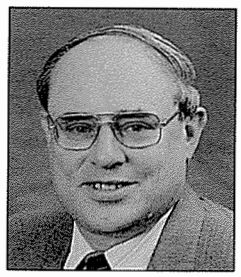
Internal Audit

During the year, nine system-based audits were carried out in accordance with the strategic audit plan. These included an internal audit of the Energy Policy and Planning Bureau which became a sub-department of the Department of Mines as from 1 January 1992. Audits were also conducted at eight of the Department's regional offices including the Kalgoorlie Metallurgical Laboratory. This coverage together with the programmed transaction-based audit work represented a significant cross-section of the strategic audit plan for the year.

REWARDS FOR ENVIRONMENT EXCELLENCE

" The aim of the awards for environmental excellence is to promote, encourage and give due recognition to advances in environmental management..."

Two firsts this year have highlighted the Department's increasing involvement in the protection and rehabilitation of the natural environment as it may be affected by mineral and petroleum exploration and development.



Mr J M (Jim) Torlach, BE(Min), MAustIMM
Director, Mining Engineering Division

In mid 1991, awards for environmental excellence were developed by the Minister for Mines to both acknowledge the commitment of the State's mining and petroleum industries towards responsible environmental management practices and make the public aware of the industry's achievements in these very important areas.

Awards will be made annually to give recognition to those operators in the mining and petroleum industries who have shown that they are actively working to achieve excellence in the environmental management of their operations.

The awards are open to all mining operations and companies or individuals may nominate themselves or be nominated by other individuals or organizations. Each nomination is assessed on the environmental performance up to the end of the previous calendar year, with submissions closing at the end of March each year. After an the initial review of all nominations is carried out by a Technical Panel, made up of Government officers and a representative of the Conservation Council of WA, the selection committee decides on the award winners. The winners are announced by the Minister for Mines in July of each year.

Up to six separate awards may be given each year from the following sectors; mineral exploration, operating minesites, and the petroleum industry. Each sector is divided into two categories, one being overall environmental management and the second being the application of innovative techniques.

The aim of the awards for environmental excellence is to promote, encourage and give due recognition to advances in environmental management and rehabilitation in all aspects of the mining and petroleum industries of Western Australian. In order to maintain the high standard, awards will only be given where the selection committee considers the nominations are fully worthy of an award.

This year the selection committee made awards in five of the six categories. The recipients were: Normandy Poseidon Limited (Jubilee Minesite), CRA Exploration Pty Ltd (Rudall River Project), Alcoa of Australia (Wellard Wetlands), Hadson Energy Ltd (Tanami 1 Well, Varanus Island) and West Australian Petroleum (Barrow Island Operations). In addition, the selection committee awarded five Certificates of Merit to Forsayth Mining NL, Robe River Iron Associates, BHP Iron Ore, Pancontinental Mining and West Australian Petroleum.

While some companies qualified for environmental excellence awards, others weren't so responsible. During the year, the Department had to call on its first unconditional performance bond to enable rehabilitation to be undertaken on a small-scale open pit mining operation at Paynes Find when the company became bankrupt.

MINING ENGINEERING DIVISION

THE YEAR IN REVIEW

INTRODUCTION

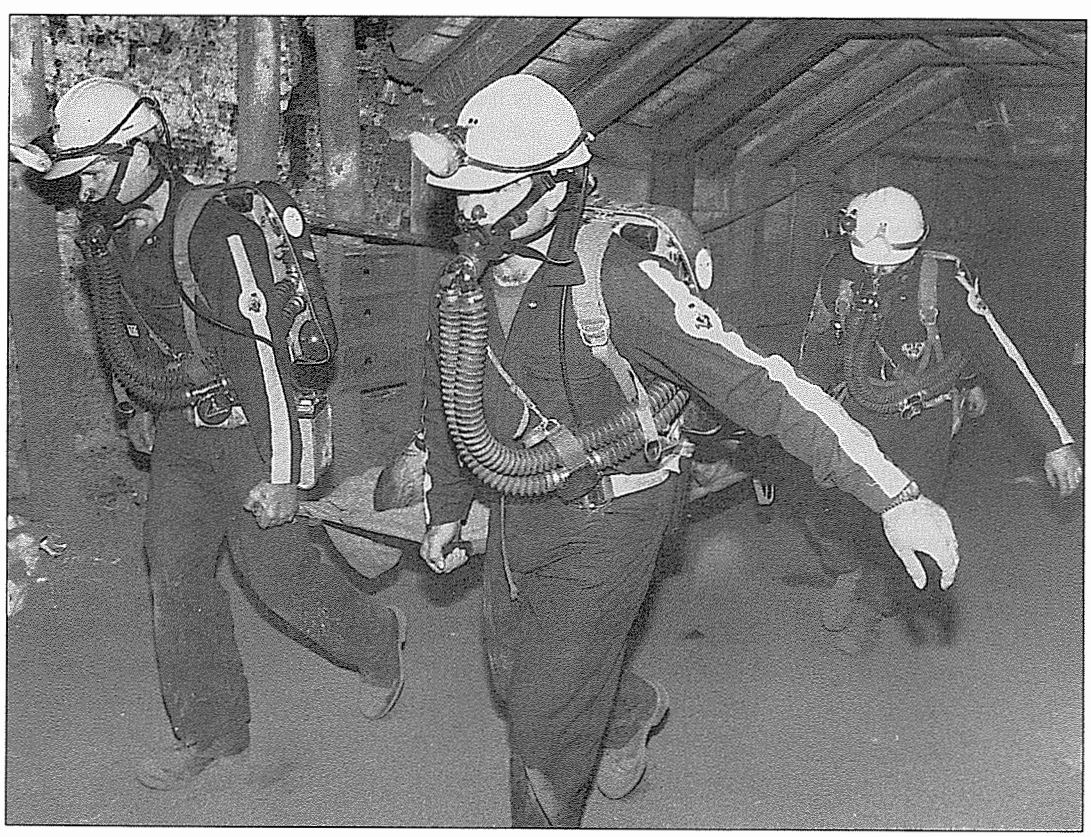
A substantial improvement in safety performance in the industry was achieved during the year. The underground metalliferous and coal sectors recorded a 35% decrease in lost-time injuries. There were five fatalities during the year, three of which occurred in the underground nickel/gold sector. Despite the fatality-incidence rate being the lowest for five years, the sad loss of lives is still of deep concern to the Inspectorate.

A study commissioned by the Minister for Mines into fatal accidents in the mining industry between 1980-1991 was completed, and the results published. The study examined the underlying causes of the 104 fatalities reviewed.

The initiatives introduced by industry after the Inquiry into Safety in Underground Gold Mines were followed up by the Inspectorate at all the underground mines, and included an audit of emergency preparedness as well as an induction review for supervisors and management. Improved emergency warning systems at mines and fixed fire suppression devices on the large underground diesel vehicles have had a positive effect on safety management.

The Mines Regulation Amendment Act, which was assented to in December 1990, has not yet been proclaimed. However, the consultative provisions of the Amendment Act have been implemented at most minesites, and joint training courses for health and safety representatives continue to be well attended.

Staff of the Mining Engineering Division devoted considerable time and resources to assist the Kelly Enquiry into Occupational Health and Safety in the Mining Industry in Western Australia. The Enquiry report has been distributed to relevant bodies.



The year saw a big improvement in safety in WA mines. A contributing factor involved developing a greater preparedness among mine workers — such as this safety training exercise at Western Collieries underground mine near Collie.

MINING ENGINEERING DIVISION

THE YEAR IN REVIEW

A review of the administrative support of the Division was initiated by the Director General in May 1992, as this was an area that the Enquiry felt required additional resources.

A brief review of the Mining Engineering Division's activities is presented below using the Department's Corporate Plan program and sub program headings.

EXPLORATION AND DEVELOPMENT OF NATURAL RESOURCES

Geological Data Collection

During the year a contract was awarded for Scott Coastal Plain groundwater investigation which involved 13 sites. The contract was awarded in February 1992 and completed by May 1992.

Community Relations

Western Australian Coal Industry Council

The Department provides a secretariat and funding for the operation of the WA Coal Industry Council. During the year, the Council concentrated on promoting SECWA's recommendation for the coal-fired power station at Collie. To this end, a report was prepared by the Council's standing committee, stating the advantages of the coal option, and supporting the Government and SECWA in their decision. The report was widely distributed and well received.

Members of the Council's Occupational Health, Safety and Welfare committee inspected Hamersley Iron's health and safety program at their Dampier and Paraburdoo operations. A report on the mission was made available to the coal industry.

Members of the Council and secretariat have maintained a keen interest in environmental issues that affect the coal industry. Council has heard from a guest speaker on environmental issues, and continues to disseminate information on coal's place in the environmental debate.

The council sought closer ties with the Australian Coal Industry Council, and implemented an information exchange between the two bodies.

ENVIRONMENTAL PROTECTION AND REHABILITATION

A total of 213 Notices of Intent to mine were submitted during the year, and 13 Environmental Management Programmes. Eleven notice of intent proposals were formally assessed by the Environmental Protection Authority.

Proposals were reviewed for 88 new mining activities ranging from major production developments, such as vanadium, to small alluvial operations, while 125 proposals to expand or modify existing operations were reviewed. A further 13 environmental management programs for operating mines were received.

Of the 213 proposals received, 166 were for gold ventures, four for mineral sands and three for nickel. There was a marked increase in sand/gravel projects proposals which indicated that sand/gravel operators are more aware of their obligations under the Mining Act 1978.

Projects	New	Expansion	Total
Gold	52	114	166
Mineral Sands	3	1	4
Nickel	2	1	3
Sand/Gravel/Clay	23	2	25
Manganese	-	2	2
Salt	-	1	1
Limestone	2	-	2
Iron Ore	-	2	2
Coal	1	-	1
Gypsum	1	-	1
Vanadium	1	-	1
Chrysoprose	1	-	1
Diatomite	1	-	1
Tantalite	-	1	1
Rare Earths	1	-	1
Zinc	-	1	1
	88	**125**	**213**

MINING ENGINEERING DIVISION

THE YEAR IN REVIEW

Over the last three years improved liaison between local councils and industry has been achieved by the activities of the Mining Development Planning Committees in the Yilgarn, Leonora and Laverton. The need for continuation of these committees will be assessed in the ensuing year.

Representation was maintained on Land Conservation District Committees, and approaches were made for committees to become involved in rehabilitation of abandoned minesites. Funds for this work is to be obtained from performance bonds imposed on mining tenements.

1991-92 saw completion of the second MERIWA research project on rehabilitation of mine waste dumps. Sites were located at Laverton, Leonora, Leinster and Mt Magnet. The report on this project will be published in the first half on 1992-93 with results being incorporated in guidelines early in 1993. It is hoped that other MERIWA projects on the success of rehabilitation and acid treatment of native seeds to improve germination may commence in 1992-93.

Bonds to ensure compliance with environmental conditions imposed on mining tenements are now compulsory for all new mining operations. Amendments to the Mining Act 1978 gazetted in June 1991 enable bonds to be placed on licences as well as leases. Exploration programs involving significant ground disturbance now may have bonds imposed as part of the District Mining Engineer's approval. At 30 June 1992 the Minister for Mines held 684 bonds, totalling $18.259 million.

The Commissioner of Soil and Land Conservation has delegated to the State Mining Engineer authority to assess 'Notifications of Intention to Clear Land' required under the Soil and Land Conservation Act. During this year,

Spreading the message about safe work practices in the mining industry is a senior research and publications officer for the Mining Engineering Division, Cathy Stedman, who visited many mine sites during the year.

75 notifications for mining projects were received.

Divisional Environmental Officers continue to be involved with the Goldfields Land Rehabilitation Group. A very successful rehabilitation workshop was organised by this Group in May 1992 with assistance from Divisional staff. The Karratha Environmental Officers, also in May, organised an inaugural meeting of industry environmental officers and other interested practitioners at Marble Bar.

The meeting formed the Pilbara Land Rehabilitation Group. It is hoped that a similar group will form in the Murchison during 1992-93.

A small number of industry members continue to flagrantly commence mining operations prior to receiving State Mining Engineers' approval to proceed as required by mining lease conditions. The Minister has been imposing penalties of up to $5 000 on these leaseholders under Section 97(1) of the Mining Act 1978.

Prosecutions for mining without authority (Section 155(1) of the Mining Act 1978) continue with fines of up to $500 being imposed by the courts for first offences.

A memorandum of understanding has been exchanged between the EPA and the Department for referral of Notices of Intent to the EPA under Part IV of the Environmental Protection Act. The memorandum enables the Department to review mining proposals in-house and refer only those projects planned for environmentally significant sites (e.g. near townsites, the coast, conservation reserves).

A new initiative by the Division is an exchange of environmental specialists between Mining Engineering Division and the Federal U.S. Bureau of Land Management. Mr Mark Cannon, Environmental Officer, Kalgoorlie, has exchanged locations with Mr Ahmed Mohsen, Reclamation Specialist, Battle Mountain, Nevada. The exchange began on 19 March 1992 and finishes on 15 November 1992.

Concerns surfaced late in 1991 over approval processes for "prospectors" operating metal detecting or dryblowing operations as tributors on land held by other tenement holders. A meeting attended by 80 prospectors was held in Kalgoorlie. The meeting resulted in interim guidelines for approval for prospectors being developed and published by the Division. These will be reviewed early in 1992-93.

The Wonnerup clean-up operation to remove old Mineral Sands tailings with high radiation levels from rural/residential land continued. The operation is being carried out by Cable Sands (WA) Pty Ltd under an agreement between Cable Sands, The Minister for Mines and land owners.

WORKER AND PUBLIC SAFETY

Workers' Safety and Health

Mine Safety Legislation

The Mines Regulation Amendment Act, 1990, remains unproclaimed and no other mine safety legislation was promulgated during the year. A number of items, however, are pending the outcome of current tripartite discussions and deliberations, and include:

- Mines Regulation Amendment Bill (Continuous Production) which addresses restrictions and requirements currently imposed by the Mines Regulation Act in respect to employment on minesites;
- the Mines Regulation Amendment Bill (Exploration activities) which seeks to incorporate mineral exploration activities relating to occupational health safety and welfare, under the jurisdiction of the Mines Regulation Act;
- the Coal Mines Bill 1990 which seeks to modernise the Coal Mines Regulation Act;

SUMMARY OF MINE CLOSURES AND EQUIPMENT SHUTDOWNS 1991-92

		Surface		Underground	
	Inspectorate	Safety Reasons	Following Accident	Safety Reasons	Following Accident
Number of items of equipment stood down:	Perth	78	1	15	-
	Kalgoorlie	63	15	16	-
	Karratha	61	7	1	-
	Collie	3	1	3	-
	Total:	**205**	**24**	**35**	**-**
Number of occasions portion of mine closed:	Perth	22	1	28	2
	Kalgoorlie	19	8	42	4
	Karratha	22	3	17	-
	Collie	11	10	2	-
	Total:	74	**22**	**89**	**6**

Accidents are a constant worry to the Department. Here, an expensive ore truck is wrecked by fire after making contact with an overhead power line at a mine site near Kalgoorlie.

- the Mines Regulation Amendment Regulations (OHSWA) which seek to review those Mines Regulation Act Regulations dealing with the general provisions of duty of care and requirements for health and safety representatives and committees on minesites; and
- the Mines Regulation Amendment Regulations (Radiation) which seek to provide for the sale and disposal of products containing an amount of radiation, the provision of personal radiation exposure dose information to employees and the safe storage of monazite and xenotime on minesites.

Inspections

Inspections in the fields of occupational health, classified and general machinery, ventilation, noise, chemical, electrical and radiation by the three classifications of inspectors were maintained at a high level during the year.

A number of repetitive incidents in the industry necessitated increased emphasis by the inspectorate on issues that included the adequacy and use of seat belts in both surface and underground vehicles, and the hazard of overhead power lines.

The continued emphasis on emergency awareness and response included a preliminary audit of underground mines. Attention was given to established procedures, condition of escape ways, fresh air bases and refuge stations, as well as the need for communications, alarms and trained emergency and mine rescue personnel. Several mines were required to update their preparedness, while others introduced facilities such as stench warning alarm systems and state of the art underground communication devices.

The recent requirement by Senior Inspectors to have all underground heavy haulage vehicles equipped with AFFF (aqueous film forming foam) fire extinguishing devices installed by 30 June 1992 was successfully achieved.

Several underground fires reported during the year were quickly and successfully dealt with by fixed AFFF systems.

Continued support and assistance was provided to all inspectorates by specialists from the Research and Technical Services Branch of the Mining Engineering Division including:

- long distance commuting;
- evaluation of methods and devices for reducing diesel emissions;
- policy and advice on mine ventilation; and
- safety evaluation on the use of underground electric trucks.

The information and assistance provided was sourced from Australian and international agencies and research organisations.

The most immediate and effective remedial action for non-compliance with relevant regulations continued to be the standing down of defective equipment or plant and the closing of sections of the mine. The following table provides a breakdown of these events reported by each inspectorate. Details of prosecutions are given in the statistical section of this Annual Review.

Mechanical - Structural

New mining ventures and the expansion of existing ones, notably the Hismelt Project, Forrestania Nickel Project, Kalgoorlie Nickel Smelter Oxygen Plant, Yandi Iron Ore Project, Alcoa Wagerup II and the Junction Shaft and Bounty Shaft sinking projects have resulted in an increase in the number of design submissions related to classified machinery. During this year a total of 310 design submissions were reviewed and approved.

An additional 13 persons were "approved" to carry out statutory inspections of classified machinery on mines bringing the total of "approved persons" to 57.

An increase in underground mining activities necessitated the assessing and approving eight transportable haulage systems

and five fixed haulage systems. Several hoists and shaft conveyances were also approved. One applicant for a Winding Engine Driver's certificate was approved.

Railways

A total of 52 Locomotive Engine Driver's Certificates of Competency were issued during the year.

Electrical

During the year a total of 877 inspections were carried out in 490 mining locations by Special Inspectors of Mines (Electricity). These inspections included both routine inspections and additional inspections carried out in conjunction with major alterations and additions of new plant and equipment. Following inspection, 453 notifications detailing electrical defects were submitted to registered managers.

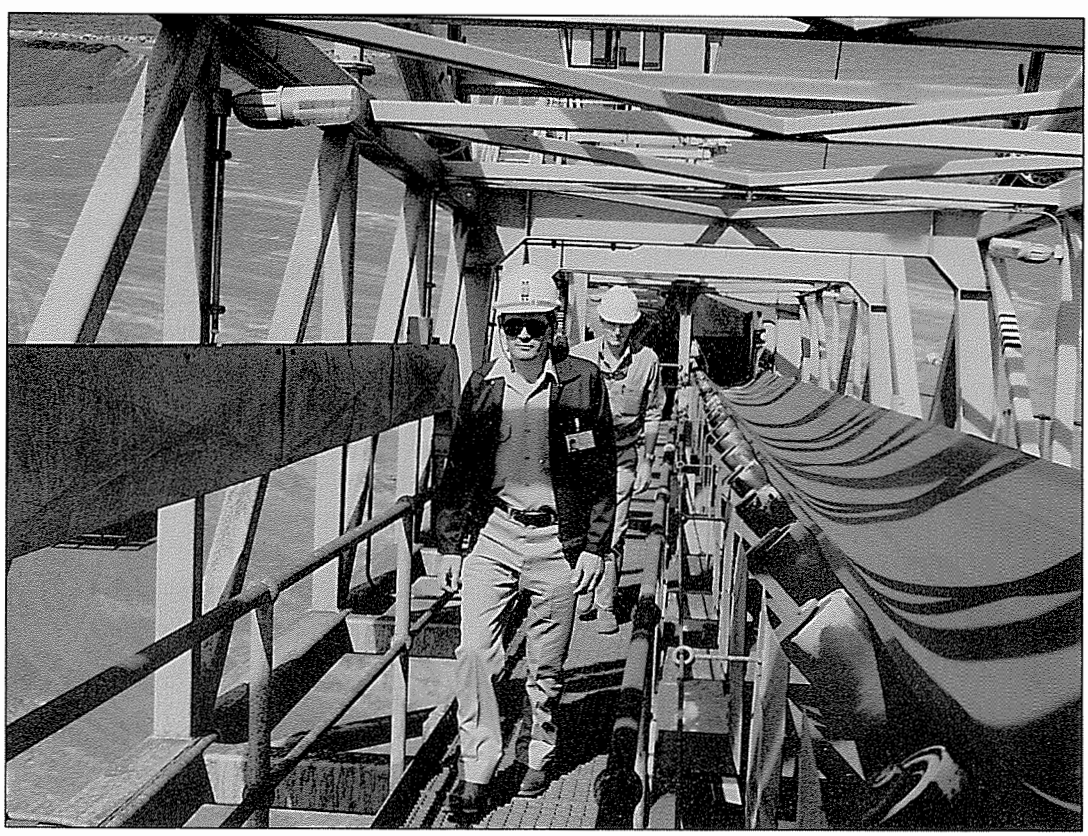
The number of electrical accidents on mines reduced by 25% to 85. One fire on a mining lease was investigated and determined as non-electrical in origin.

A total of 168 submissions relating to approvals, exemptions and appointments were processed, and 13 warnings were issued for the carrying out of unlicensed or unauthorised electrical work.

Occupational Hygiene

During the year attention was focussed on a small number of specific agents which attracted workforce concern these included:

- the presence of small quantities of contaminant asbestos in gold and nickel mines sited within the greenstone belts;
- the presence of mercury in gold rooms of plants retreating old tailings, dumps; and
- the airborne levels of carbon disulphide resulting from the use of xanthate flotation chemicals.



Departmental inspectors make more than 2 000 visits to mining sites throughout WA every year. Here, Karratha-based District Inspector of Mines, Simon Ridge, inspects a new loader-stacker at Robe River Iron Associates' Cape Lambert operations.

MINING ENGINEERING DIVISION

THE YEAR IN REVIEW

In an effort to ensure that asbestos management strategies were developed based on informed knowledge, a publication entitled "Asbestos Management in Mining" was prepared. This publication will supplement existing Department guidelines on asbestos management.

A revised version of the cyanide management guideline was produced during the year. The release of this guideline will be accompanied by a further series of seminars throughout the State.

A discussion paper entitled "A Proposal for a Revised Medical Surveillance System for Mines Workers" was prepared in order to facilitate discussion on the need to revise Part 9 of the Mines Regulation Act Regulations, as the present Mine Workers Health Certificate System is outdated and in urgent need of revision.

Advice to industry about the likely impact of the amended Dangerous Goods Regulations was initiated. The requirements relating to storage of dangerous goods has implications for the mining industry, particularly in terms of bunding, segregation and placarding.

Noise and Vibration

A schedule of noise inspections on mines were completed by the inspectorate and 61 notifications of noise survey reports from industry were submitted during the year. Most mining companies were well advanced in assessing workers exposure to occupational noise and implementation of engineering noise control work.

The Division continued to work on developing guidelines for noise control in mines. Numerous proposals for new mining operations and expansions to major existing operations were reviewed for their noise impact on surrounding areas.

New blast monitoring equipment was purchased and used throughout the State to assist the industry in controlling noise and vibration from blasts.

Chemicals Handling and Management

The program of minesite and mineral processing plant chemical inspections continued, with extended surveys undertaken in the Perth, Kalgoorlie and Karratha Inspectorates. The reports on each inspection detailed existing and potential hazards and recommended means of improving storage, handling, work practices and operating conditions. Chemistry Centre officers assisted with inspections early in the year.

To assist with the development of chemical safety systems within mines, a checklist of the principal areas to be inspected was distributed during the visits. The list outlined aspects of ordering, storage requirements and handling procedures including protective and safety equipment to support in house audits of chemical management.

The series of chemical guidelines previously developed were extended to include respiratory protection and safety showers.

Radiation Safety

An investigation into the radiation exposures of workers in underground mines was completed during the year. The investigation, covering 27 underground mines and encompassing some 80% of the underground workforce, concluded that radiation doses in Western Australian underground mines are uniformly low in comparison with the permissible exposure limits. The investigation was funded by MERIWA and a report is available from that agency.

A computer program that will enable mineral sands companies to maintain radiation records and calculate worker radiation doses was further refined. Through this program the Department will be able to maintain a register of radiation measurements and a history of radiation exposures of mine workers in this State.

MINING ENGINEERING DIVISION

THE YEAR IN REVIEW

The Division continues to be active in reviewing methods of auditing the radiation measurements taken by industry. Quality assurance programs include a comparative counting program for both routine dust samples as well as those samples that are taken to characterise the particle size of the dust. Equipment calibration methods have also come under review.

In an effort to gain a further insight to the dose assessment procedures following the inhalation of thorium and uranium bearing dust, a sensitivity analysis and a bioassay project have been undertaken. A scientific paper on the results of this bioassay work was well received at an international conference of world experts.

The Radiation Section continued its involvement in regulatory tasks. The secretariat function continued to be provided to the tripartite Mines Radiation Safety Board. Six meetings of this board were held with site visits to the RGC operation at Eneabba and Cable Sands operations at Waroona and Bunbury.

Ventilation

A total of 267 new permits for underground use of diesel engines were issued during the year. Seventeen were issued in Karratha Inspectorate; 177 in Kalgoorlie and 73 in Perth.

Inspectorate scrutiny and industry awareness of diesel emissions in the underground environment, especially the particulates, resulted in increased retro-fitting of emission devices to underground vehicles. The tendency is to catalytic converters and soot filters, with all new large equipment being fitted with these desired options. Some of the larger underground mines conducted research into reducing particulate emissions by trialling low emission fuels, decarbonisation of engines, and reviewing maintenance needs to keep smoke and particulate emissions at minimum levels. Some companies have elected to purchase enclosed, air conditioned cabins on new vehicles.

The purchase by the inspectorates during the year of accurate gas measuring instruments for quantifying diesel engine gas emissions has provided the senior inspectors with a tool to more accurately administer the legislation requirements for diesel emissions.

The Surface and Underground Ventilation Officers courses held by the Department both meet the requirements of the training guarantee legislation and have been allocated approval numbers. The continuing excellent support by industry of these courses is resulting in an increased awareness and monitoring of atmospheric contaminants and of the requirements of Parts 8 and 14 of the Regulations.

Four meetings of the tripartite Ventilation Board were held during the year. The board did not visit any mine sites this year because of funding restrictions.

The Mines Medical Officer reported the following data from the Perth Chest Clinic:

- 5 602 new applicants for mine workers health certificates (up 5% on previous year);
- 3 998 re-examinations (up 54% on previous year); and
- six new cases of silicosis identified at re-examination.

Contaminant Recording

The CONTAM database, which holds the results of analysis of atmospheric contaminants, was upgraded during the year. The upgrade was commissioned in December. Historical data was maintained on the pre-upgrade database, and following the merging and conversion of this data, expected by October 1992, full flexibility and trend reporting will be available.

Accident Recording

The computer-based AXTAT system and database on which vital information relating to lost time injuries in the State's mining industry

is kept, was used extensively to provide information for both the retrospective study into Fatal Accidents in the Western Australian Mining Industry (1980-1991) and for the Enquiry into Occupational Health and Safety in the Mining Industry in Western Australia.

Reports eight and nine in the series "Fatal and Lost Time Injuries in Western Australian Mines" were compiled and published. They provide statistical data for the 12 months ending 30 June 1991 and 31 December 1991 respectively. A summary of the relevant data for the 1991-92 fiscal year is presented in the statistical summary of this Annual Review.

Geotechnical Investigations

Eighty two technical reports were prepared following site visits or reviews of reports submitted to the Division on geotechnical aspects of mining operations.

Geotechnical advice was provided on aspects of open pit and underground mine stability, as well as the design and operation of tailings dams.

Education and Training Initiatives

This year the Inspectorate took a more active role in the Chamber of Mines and Energy Annual Underground Mine Rescue Competition held at Mt Charlotte. At this event 16 teams participated, with six teams entering for the first time, including a team from Stawell in Victoria. The winners were Kalgoorlie No. 2 team, with the New Celebration team being the best of the newcomers. Paul McCreed was judged best captain.

At the WA Coalfields surface mines rescue competition held in Collie, the Griffin Coal team won for the fourth consecutive year, with Michael King taking out the inaugural champion captain's trophy.

A program of site-based educational presentations for supervisors, health and safety representatives and the general workforce began during the year. Both Inspectorate and Research & Technical Services staff are involved in the program which focuses on accident prevention.

A series of educational pamphlets on work practices were produced and well received by industry.

New CONTAM guidelines were published, and several other guidelines were under review. These include a cyanide manual, and interim noise regulation guidelines.

The Division continued to play an active role in promoting education programs related to substance abuse on minesites. Seminars papers and lectures formed the basis of this initiative together with representation on committees working to provide resources to minesites.

Fatal Accidents

There were five fatalities in the mining industry for the year, all in metalliferous mines, with three occurring in the underground nickel/gold sector. Details of the fatalities are included in the statistical summary.

Prosecutions

There were 13 prosecutions initiated for offences against the Mines Regulation Act during the year. Those that have been finalised are detailed in the statistical summary.

Board of Examiners - Coal

The Board of Examiners (Coal) met four times during 1991-92 and issued one Third Class Deputies Certificate of Competency.

Board of Examiners - Metalliferous

The Board of Examiners met eight times during the year (all meetings in Perth).

A total of 476 candidates sat for examinations during 1991-92, but not all had been assessed at the end of June.

For the year the Board issued the following Certificates of Competency:

First Class	34
Underground Supervisors	64
Quarry Managers	39
Restricted Quarry Managers	50

MINING ENGINEERING DIVISION

THE YEAR IN REVIEW

Mines Survey Board

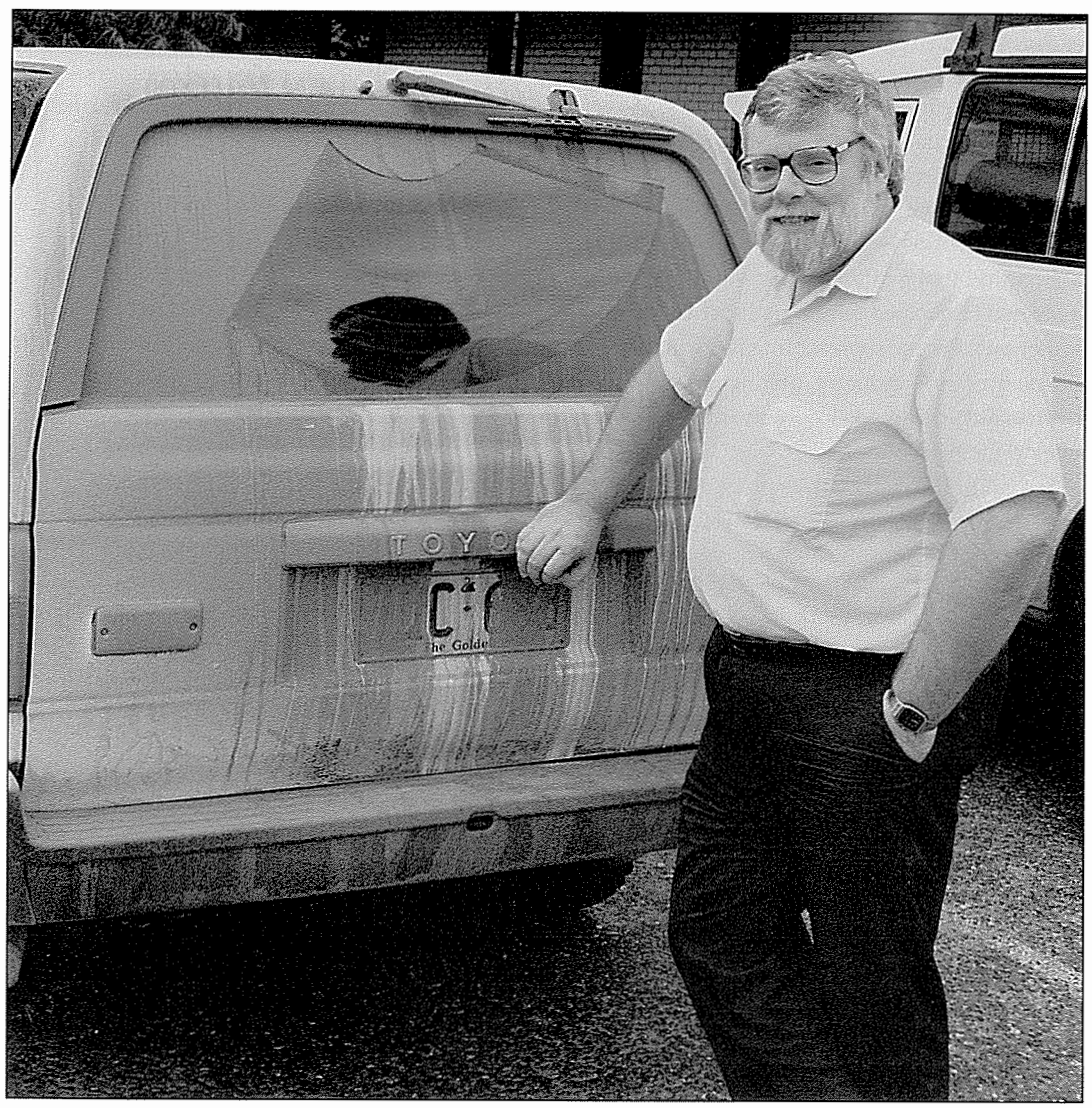
The Board met three times during 1991-92 and ten Authorised Mine Surveyor's Certificates were awarded.

CORPORATE SERVICES

Personnel changes within the Mining Engineering Division during the year included nine new appointments and nine resignations. Six of the resignations, four wages and two salaried officers were from the Drilling Branch and were not replaced.

The effort expended to fill staff positions was rewarded with four new district mining engineers, a mechanical engineer, an environmental officer and a technical officer being appointed to the inspectorate ranks.

Following the report from the Enquiry into Occupational Health and Safety in the Mining Industry in Western Australia, a Departmental review of the support services for the inspectorate was initiated. The review was still in progress at year end.



Pictured outside his Karratha office is Martin Knee, one of the Department's Regional Mining Engineers.

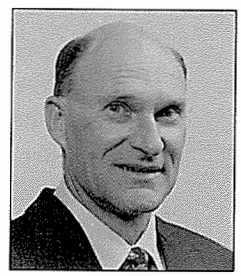
CONSULTING THE COMMUNITY

" ... the process of consultation which had worked so well in the past was continuing in other areas of the dangerous goods industry."

The Explosives and Dangerous Goods Division has a long history of community consultation about which it is proud.

It began with the development of the Dangerous Goods (Road Transport) Regulations back in the early 1980s and peaked with the introduction of driver licensing and training provisions in 1985.

Divisional Director, Mr Ken Price, believes that the regulations were well received by all parties involved, mainly because of the high level of consultation that went into their preparation.



Mr K R (Ken) Price BSc (Hons), Grad Dip Admin, ARACI Director, Explosives and Dangerous Goods Division

So when it was time to draft the new Dangerous Goods Regulations in 1988 it was only natural that a public safety sub-committee be formed to oversee development of the regulations. People representing three main interest groups -- industry, unions and government -- worked closely and very hard to develop the regulations.

As part of the consultative process, the committee invited comments from industry and the public. This attracted responses from 80 different groups, covering about 700 specific points. All of the comments received were assessed and acted upon.

"Resulting from this, we now have a shared ownership of the regulations," said Mr Price.

"Having established general agreement on all the major issues raised by the major stakeholders involved, the task of implementing the regulations will be a lot easier."

The regulations are due to become effective from 1 October 1992.

Another key date looming is 31 March 1993 when licensing provisions for the storage of dangerous goods become effective.

Mr Price said the process of consultation which had worked so well in the past was continuing in other areas of the dangerous goods industry.

"We are now at the stage where we are about to approach our Minister to establish a community consultative committee to provide ongoing advice about legislation and the implementation of the Dangerous Goods Act," he said.

The four major stakeholders — industry, unions, government and the public — will be strongly represented.

Not only is the Explosives and Dangerous Goods Division working in close liaison with interested parties in Western Australia, it is also working with its counterparts in other parts of Australia.

Mr Price chairs the Drafting Sub-Committee of the National Advisory Committee for the transport of dangerous goods by road and rail, and is active on the Senior Officer Group which is overseeing the development of uniform regulations for the handling of storage of dangerous goods in Australia.

Mr Price said that realistic goals had been set for the future. "Any vision of zero accidents and zero risk was impossible to achieve," he said. "The aim is to deliver a tolerably low-level of risk to the public."

The Explosives and Dangerous Goods Division believes that it is succeeding with its endeavours to spread a broader mantle of safety in the community.

This is borne out by the fact that accidents involving the transport of dangerous goods have not increased during the last decade. This is despite the fact the number of vehicles carrying dangerous goods has roughly doubled since 1983.

EXPLOSIVES AND DANGEROUS GOODS DIVISION

THE YEAR IN REVIEW

INTRODUCTION

Throughout the year, the Division has assiduously applied itself to the development and introduction of the Dangerous Goods Regulations 1992.

New initiatives in the regulatory control of the storage and transport of dangerous goods will be effected in the latter part of 1992.

A brief review of the Explosives and Dangerous Goods Division's activities is presented below using the the Department's Corporate Plan program and sub program headings.

ENVIRONMENTAL PROTECTION AND REHABILITATION

Inter-agency Liaison

Liaison with the Environmental Protection Authority and the Western Australian Water Authority (WAWA) continued effectively during the year. The Division referred proposals for the storage of dangerous goods to these authorities when adequate environmental protection measures had not been suitably addressed and acted as an agent for the other authorities for other proposals.

Departmental Officer, Colin Campbell, checks a vehicle leaving the Kalgoorlie Explosives Reserve. The reserve is one of the biggest explosives manufacturing sites in Australia.

Development by WAWA of new, more stringent by-laws to protect the State's water resources continued during the year with extensive consultation between the Division and WAWA. The consultative process will ensure that where they relate to dangerous goods, the WAWA by-laws are consistent with and will complement the Dangerous Goods Regulations. The Division will develop a liaison protocol to encompass the new requirements, and will integrate them with the requirements of the Dangerous Goods Regulations when preparing guidance notes for industry.

Vehicle Routing

The Working Party set up under the Western Australian Advisory Committee on Dangerous Goods presented its report, "The Feasibility of Setting Routes for the Road Transport of Dangerous Goods" to the Advisory Committee in October 1991.

The report deals with the protection of the State's important water resources, mainly in the Greater Perth Metropolitan area, from the activities associated with the transport of liquid hydrocarbons and sodium cyanide.

Recommendations in the report seek to enhance the protection of water assets by considering the effects of spills during transport. Emergency response considerations at the scene of an accident should take into account both the effects of any spilt substance and the effects of any response and cleanup operations on the environment.

Prime contractors and consignors must take account of the routing of vehicles in the proximity of the Gnangara water mound and avoid the dispatch of vehicles on routes across the mound.

Inspector Lawry Lim conducts an inspection of an autogas LPG installation at a metropolitan service station.

EXPLOSIVES AND DANGEROUS GOODS DIVISION

THE YEAR IN REVIEW

WORKER AND PUBLIC SAFETY

Management of Dangerous Goods

Accidents

There were 40 accidents reported during the year; 21 relating to storage of dangerous goods, 17 involving transport of dangerous goods and two associated with explosives.

The two most significant incidents were in the storage and transport areas. 130,000 litres of diesel fuel spilt from a major storage site when inappropriate operation of the valve system permitted escape of the product into the tank bund area. A head-on collision between two road trains, one loaded with 54 tonnes of ammonium nitrate, resulted in a fire, the destruction of the vehicles and load and the closure of the State's main northbound road for more than 18 hours.

Improved Turn-around Time

To assist proponents in scheduling their projects, a policy of setting a maximum turnaround time for assessments was developed. Proponents submitting standard applications for licences can expect a reply to their proposal within 15 days.

This system will be severely tested when the new regulations come into effect.

Accreditation of Third Party Auditors

The Division has been working towards accrediting third party auditors who will assist in the implementation of the Dangerous Goods Regulations.

During the year, the Division worked closely with AVCA (Agricultural and Veterinary Chemicals Association) on their accreditation program for premises storing agricultural chemicals. The AVCA program requires self assessment prior to audit and accreditation. Provided that this program is established and implemented suitably, the Division will be able to assume an auditing role in conjunction with its targetted inspection program.

Rail Transport

Following the review of Westrail's dangerous goods transport operations in 1991, dialogue was initiated with Westrail management to ensure that the provisions of the Australian Dangerous Goods Code were being implemented. It is intended to institute a memorandum of understanding between Westrail and the Chief Inspector to ensure that this continues.

Westrail are seeking to amend the Railways Act to enable the adoption of the Australian Dangerous Goods Code by reference. This should enhance the legal enforcement of the Code in rail operations.

National Uniformity - Road Transport Law

The National Road Transport Commission is currently undertaking studies to incorporate dangerous goods regulations into the National Road Transport Law in line with moves to have a single Act and regulations covering all aspects of road transport throughout Australia. The Explosives and Dangerous Goods Division is participating in this process to ensure that the provisions of the ADG Code are referenced in the legislation and that consistent and uniform administration and enforcement provisions are included. It is proposed that the States will adopt the legislation by reference.

Third Party Accreditation

During the year, ten organisations held accreditation status to undertake testing and rectification of bulk containers for the transport of dangerous goods. This has resulted in a marked decrease in the time spent by inspectors carrying out pressure tests on tankers and allowed industry to arrange tests in accordance with normal maintenance schedules. Random auditing of accredited organisations will ensure that the standards applied to the testing continue to be of a high quality.

EXPLOSIVES AND DANGEROUS GOODS DIVISION

THE YEAR IN REVIEW

Australian Explosives Code

Ministerial approval has been given for the adoption of the Australian Explosives Code as a step towards achieving national uniformity in the transport of explosives. The code which deals with the packaging, labelling and transport of explosives, was prepared by a special working party reporting to the Advisory Committee on the Transport of Dangerous Goods by Road and Rail.

The code was implemented in this State on 1 January 1992. All new explosives vehicles must fully comply with the requirements of the new code, whereas existing vehicles have two years before they are required to comply.

One of the requirements of the code is that where explosives and detonators are to be transported together on a vehicle, a barrier which has been demonstrated to prevent sympathetic detonation, be used to segregate the two types of explosives. The explosives companies have conducted full scale tests to demonstrate that the barriers they have developed will comply with this requirement.

Import of Ammonium Nitrate

During the early part of 1992, the Division reviewed and approved the Esperance Port Authority Emergency Response Plan for the importation of ammonium nitrate through the port, thereby finalising the approvals process to allow the import of eight 2 000 tonne shipments per annum.

The effectiveness of the plan was demonstrated during a planned emergency exercise (Exercise AN'92) attended and evaluated by the Division.

Explosives Reserves

As a result of the Division's restructure there have been a number of changes at the Baldivis and Kalgoorlie Explosives Reserves which will lead to a more flexible access to the reserves by the users of these facilities.

During the year, the Department approved an emergency response plan relating to the importation of ammonium nitrate through the Port of Esperance. Here, local volunteer firemen apply water to an ammonium nitrate "fire" during a training exercise.

Some of the staff are being retrained to become regional inspectors of explosives, other staff are performing new duties and a small number are being redeployed. To maintain the same level of security, the electronic security systems were upgraded.

Provision is being made for users to have 24 hour access to the reserves without compromising the level of security or public safety. The overall security for the reserves is currently under review.

Nufarm Coogee Kemerton

Nufarm have prepared a Hazards Control Plan for their Kemerton chlor-alkali pant. The plan has been audited by a third party auditor and the audit recommendations are being reviewed by the Division. Once the recommendations have been agreed to by the Division and Nufarm, the plan will be implemented to optimise the maintenance of public safety.

A similar plan which is currently in use at Nufarm Coogee's Kwinana plant will be modified to align more closely with the Kemerton Plan.

SCM Pigment Plant

The company's compliance with the Hazards Control Plan accepted by the Chief Inspector last year has been audited by a third party auditor. The findings of the auditor are currently being reviewed by the Division and SCM and, where necessary, improvements in the safety management system will be made by the company.

Import of Anhydrous Ammonia

Two shipments of anhydrous ammonia were received at the bulk cargo jetty Kwinana. As required by the EPA, the Public Access Risk Plan for the Wells Park area was enacted during each shipment. Following each shipment the Public Access Risk Plan was revised in response to the experience gained.

Elmina Aluminium Fluoride Plant

A quantified risk assessment was prepared to enable the Division to evaluate the relative safety of the two proposed Kwinana sites for the plant.

Tiwest Kwinana Pigment Plant

Following a number of incidents at the plant, an audit of the plant's safety management systems was conducted by Australian and American auditors. The recommendations of the resultant reports were reviewed by the Division, and Tiwest prepared a program to comply with these recommendations. The implementation of the now completed program was monitored by the Division. This audit and the on-going requirements of the Tiwest Hazards Control Plan should ensure the plant continues to operate at an acceptable level of safety performance.

Kemerton Industrial Area

The Acting Safety Coordinator participated in the deliberations of the Kemerton Emergency Management Working Party which was established to prepare an integrated emergency management system for the Kemerton industrial area. The group has prepared a preliminary report and is continuing to design the detailed plan for the area.

Expert Working Group on the Control of Major Hazards

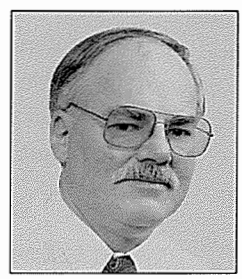
The Safety Coordinator participated in the first three meetings of this Expert Working Group which was serviced by Worksafe Australia. The group is preparing nationally uniform regulations for the control of major hazards facilities.

MINING TITLES IN A SUSTAINABLE ENVIRONMENT

" ...the future direction of the mining industry lays in ensuring that developments pay due regard for the environment."

The 1980s could be described as the "green decade" in terms of landmark government decisions concerning the balance between development and the environment, with mining occupying centre stage in this very public debate.

During the '80s environmental issues played a greater role in the formulation of legislation, as Federal and State Governments signalled their intention to react to public opinion and place more emphasis on ecologically sustainable development.



Mr W (Bill) Phillips, Dip Pub Admin Director, Mining Registration Division

This period saw the introduction of the Mining Act 1978, with new reserved land provisions that introduced a formal consultation process between the Minister for Mines and Minsters responsible for the reserves and any vested authorities. It also saw the introduction of the Conservation and Land Management Act 1984 and the Environmental Protection Act 1986. Further, the Mining Act was amended to allow the Minister for Mines to impose additional conditions on mining operations for the protection of the environment.

While the pendulum may now have swung back to a more pro-development position, public environmental awareness continues to be high and the community continues to demand responsible development to ensure short-term gains are not eroded by long-term environmental liabilities.

To this end, the Mining Registration Division has a very important role in ensuring mining titles are issued with conditions relevant to the principle of sustainable development and that developments are guided in such a way as to achieve broad community expectations.

During 1991-92, standard conditions concerning operations within environmentally-sensitive areas were agreed with the Department of Conservation and Land Management and the Environmental Protection Authority. This allowed responsible exploration to proceed in these areas under strict supervision.

There was close consultation with industry on these issues through the Mining Industry Liaison Committee and prospectors in the Goldfields were also given the chance to participate.

In August 1991 a seminar on land access and prospectors rights was held in Kalgoorlie. Attended by over 80 prospectors, it provided an opportunity for an exchange of views with Departmental officers on how to improve the effectiveness of current legislation and procedures including those relating to rehabilitation and environmental protection.

An excursion to inspect a number of previously mined areas in Kalgoorlie was also conducted and involved some 10 prospectors and Government officers including registration officers and the local CALM manager.

These events resulting in some administrative changes suggested by prospectors being implemented and it being agreed that some amendments should be made to the Mining Act.

The Director of Mining Registration, Mr Bill Phillips, believes the future direction of the mining industry lays in ensuring that developments pay due regard for the environment. He added that conditions applied on mining tenements should reflect this responsibility.

MINING REGISTRATION DIVISION

THE YEAR IN REVIEW

INTRODUCTION

The year began with the introduction of the Graticular Exploration licence system and the "user pays" survey system which resulted in survey fees no longer being paid on applications for leases.

Both these changes have been well received by industry and proved over the year to be easier to administer than the systems they replaced.

The trend of significantly increased tenement activity evident toward the end of the previous year did not eventuate during 1991-92, with the number of applications received being slightly higher than the previous year.

A brief review of the Mining Registration Division's activities is presented below using the Department's Corporate Plan program and sub program headings.

MINERAL TITLES

Title Systems

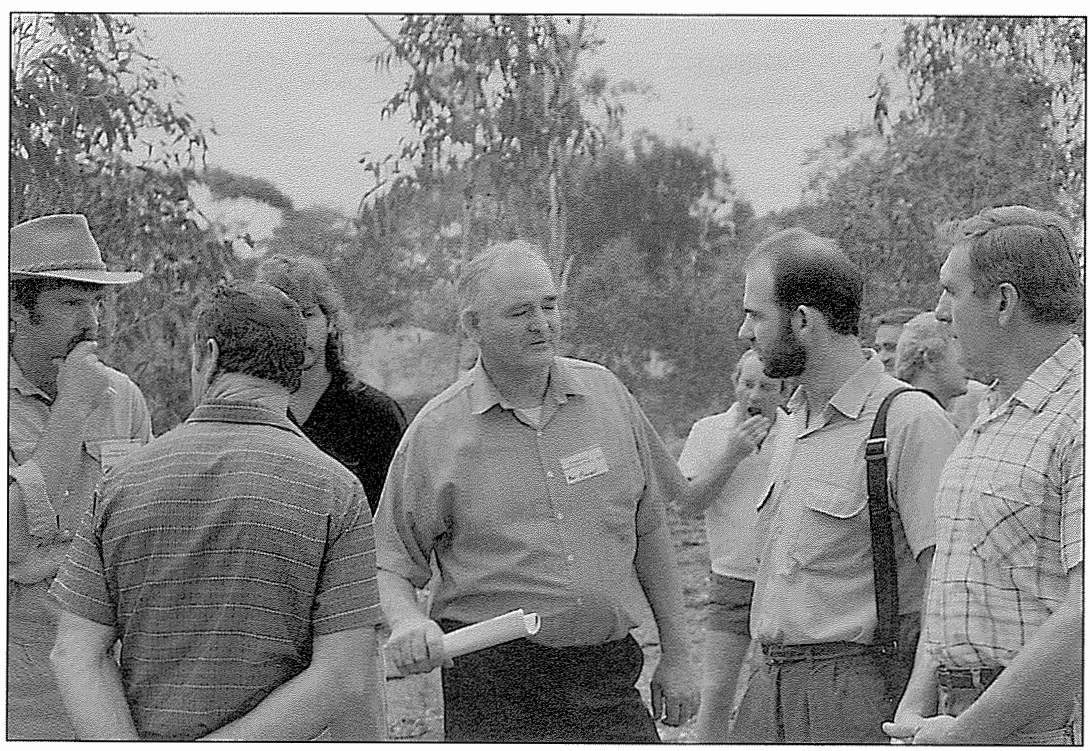
Tenement Applications

During the year a total of 5 613 applications for mining titles were received.

A comparison of applications received in recent years is shown below:

	1988-89	1989-90	1990-91	1991-92
Prospecting Licence	3 367	2 426	2 720	3 284
Exploration Licence	1 420	1 451	1 285	1 445
Mining Lease	1 243	998	695	689
Other	367	201	289	195
Total	**6 397**	**5 076**	**4 989**	**5 613**

There were 15 318 mining titles in force at 30 June 1992. The total area of the State held under mining titles was 23 219 571 hectares which is the third largest area on record.



Gold prospector Bill Powell (centre) and Departmnetal Environmental Officer John Robinson (beard) chat about revegetation techniques during an inspection of a rehabilitated mine site, near Kalgoorlie.

MINING REGISTRATION DIVISION

THE YEAR IN REVIEW

Fluctuation in the number of mining titles in force has largely been linked to prospecting licences, with numbers increasing 8% from 5 517 on 30 June 1991 to 5 989 on 30 June 1992. The total of all other existing titles fell 4% from 9 330 to 8 902 in the same period.

Tenements on Reserved Land

During 1991-92 the Department continued to process long outstanding tenement applications in respect to National Parks and Conservation reserves under the Government's "Resolution of Conflict - A Clear Policy for National Parks".

Standard environmental conditions agreed to with the Department of Conservation and Land Management (CALM) and the Environmental Protection Authority (EPA) were introduced early in the year. This agreement has been fundamental in enabling the grant of 72 applications situated over areas affected by the Resolution of Conflict (ROC) Policy during the last six months of the 1991-92 year. This represents almost an 800% increase in the grant of similarly affected applications during the first six months of the year.

Prospecting Licence Extensions

A total of 887 extension applications were received during the year. This represents a decrease of 15% on applications lodged during 1990-91.

Dealings

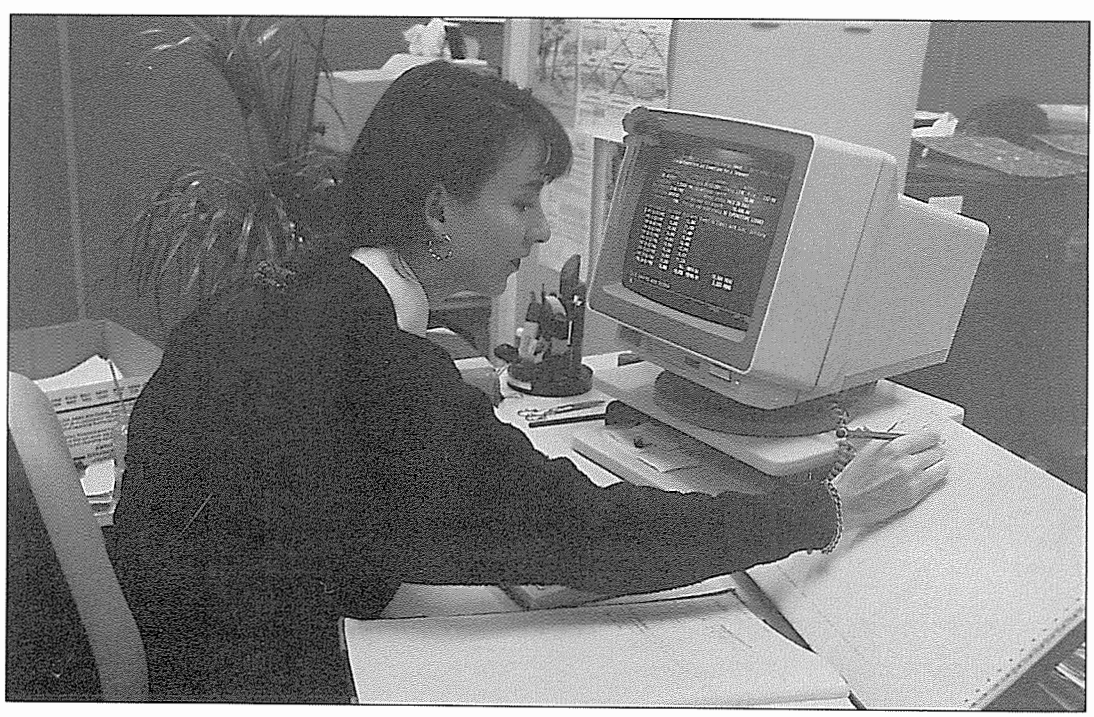
There were 11 283 dealings received during the year.

Tenement Surveillance

The number of applications for exemption dropped to 2 338 after the all-time high of over 3 300 in 1989-90 and the previous year's total of 2 744.

There were 8 238 Form-5 reports lodged during this period.

A total of 468 mining tenements were forfeited for non-payment of rental or breach of condition.



As part of the tenement surveillance process, Mining Registration clerk Lee Holubecki transfers mining tenement files to a computer database.

MINING REGISTRATION DIVISION

THE YEAR IN REVIEW

Departmental officers were involved in the investigation of four cases of illegal or unauthorised mining. Proceedings were commenced in respect of three of these.

Customer Service

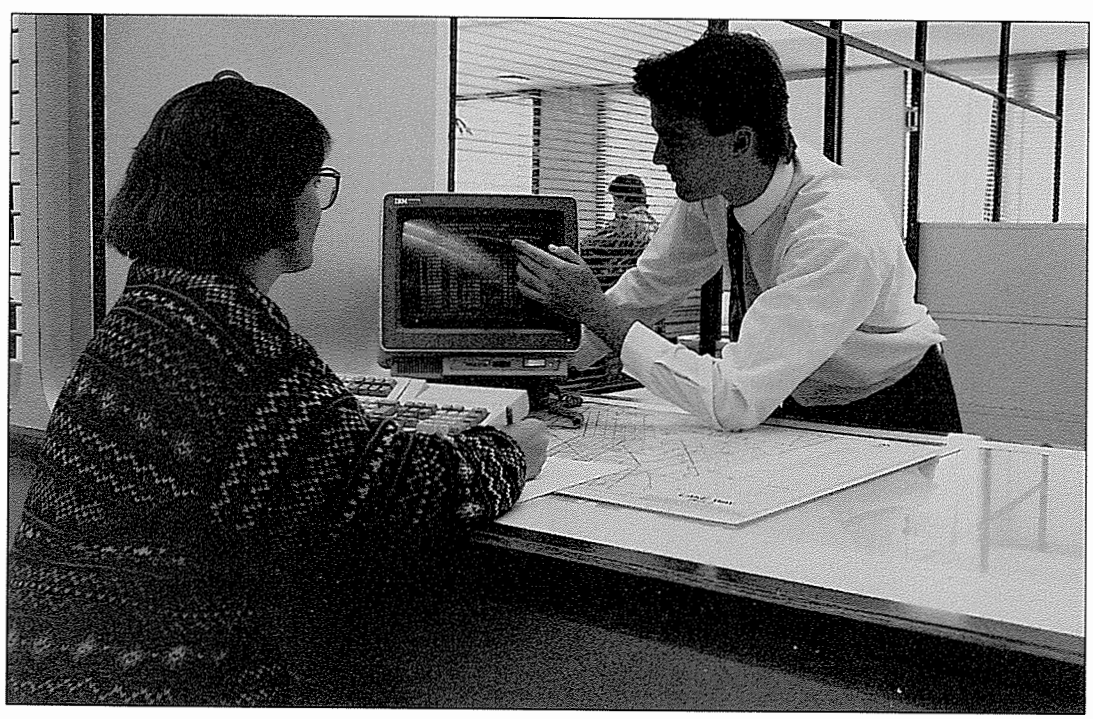
Work levels at the Mining Information Centre at Head Office remained high. An average of 75 customers were served and 15 plan orders received on a daily basis throughout the year. A total of 14 702 tenement register searches were provided.

The separate telephone centre facility set up several years ago to deal with general tenement enquiries and receive plan and publication orders continued to provide a high level of customer service averaging 84 calls per day.

Mining Industry Liaison Committee

Throughout the year regular meetings continued of the Mining Industry Liaison Committee (*MILC*). Topics covered in *MILC* included:

- changes to the requirements for advertising applications for mining tenements;
- amendment to the private land provisions of the Mining Act 1978 to remove the need for landowner consent and establish a compensation tribunal;
- a change to the Mining Act to overcome the practice of holders surrendering plainted tenements to avoid the Act's forfeiture provisions;
- a number of submissions from the Amalgamated Prospectors and Leaseholders Association relating to access to land held by companies;
- a proposal to have a Mining Court Judge; and
- the refund of survey fee deposits held by the Department following introduction of the user pays system.



Head office counter clerk Paul Power assists a customer in accessing information from the Department's Tendex computer system.

MINING REGISTRATION DIVISION

THE YEAR IN REVIEW

Dispute Management

A low level of administrative appeals to the Minister against conditions imposed at the time of grant or the refusal of title applications was maintained.

Arising from the submissions from prospectors and the Amalgamated Prospectors and Leaseholders Association amendments to the Mining Act are proposed to:

- overcome the practice of title holders surrendering plainted titles to avoid the Act's forfeiture provisions which give the plaintiff a prior right to the ground if forfeiture results; and
- provide access to land held under lease by others by providing for a Special Prospecting Licence to be granted over an existing mining lease where the lessee consents.

Several disputes between mining companies over the area of land available in competing applications of exploration licences were resolved by liaison between Departmental officers and the parties, thus avoiding legal proceedings and the potential for additional costs to be incurred by all parties.

During this period 493 objections were lodged against 366 applications and 103 plaints for forfeiture were lodged.

Review of Fees and Charges

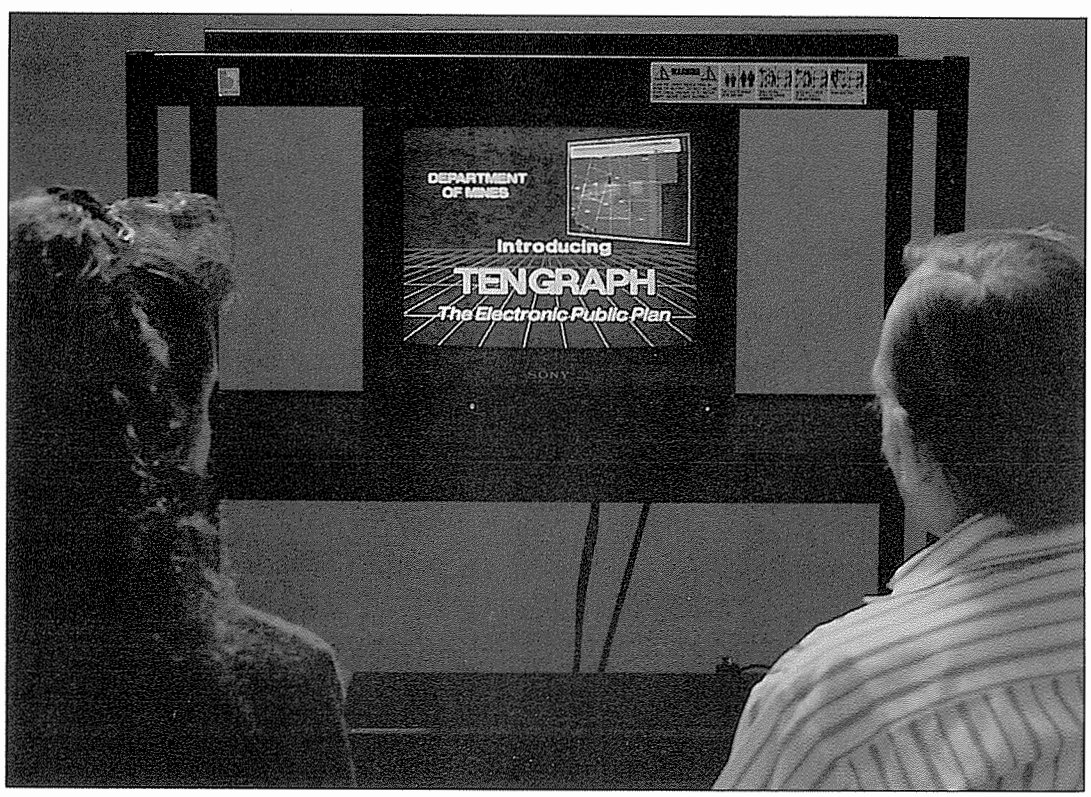
Application fees and various dealings charges were reviewed. An increase of 7% in all these charges was implemented on 1 July 1991. Tenement rentals were previously increased in July 1990.

CORPORATE SERVICES

During the year, a total of 90 staff were employed in the Division, 60 in Head Office and 30 at country centres.

Computerisation

The Division took another step toward its goal of replacing its present manual register



The development of the electronic public plan "Tengraph" is expected to be a boon both to the minerals industry and the Department.

MINING REGISTRATION DIVISION

THE YEAR IN REVIEW

system with an "Electronic Register" with the introduction of the Tenement Rental and Expenditure (*Trax*) System in the Kalgoorlie Mining Registrar's Office. Rental and expenditure details relating to mining tenements previously held in the manual registers are now held electronically.

A project to introduce *Trax* into the Division's other Mining Registrars' offices was commenced under the control of the Manager Tenement Surveillance in the latter half of the year and it is planned to bring these offices on line during 1992-93.

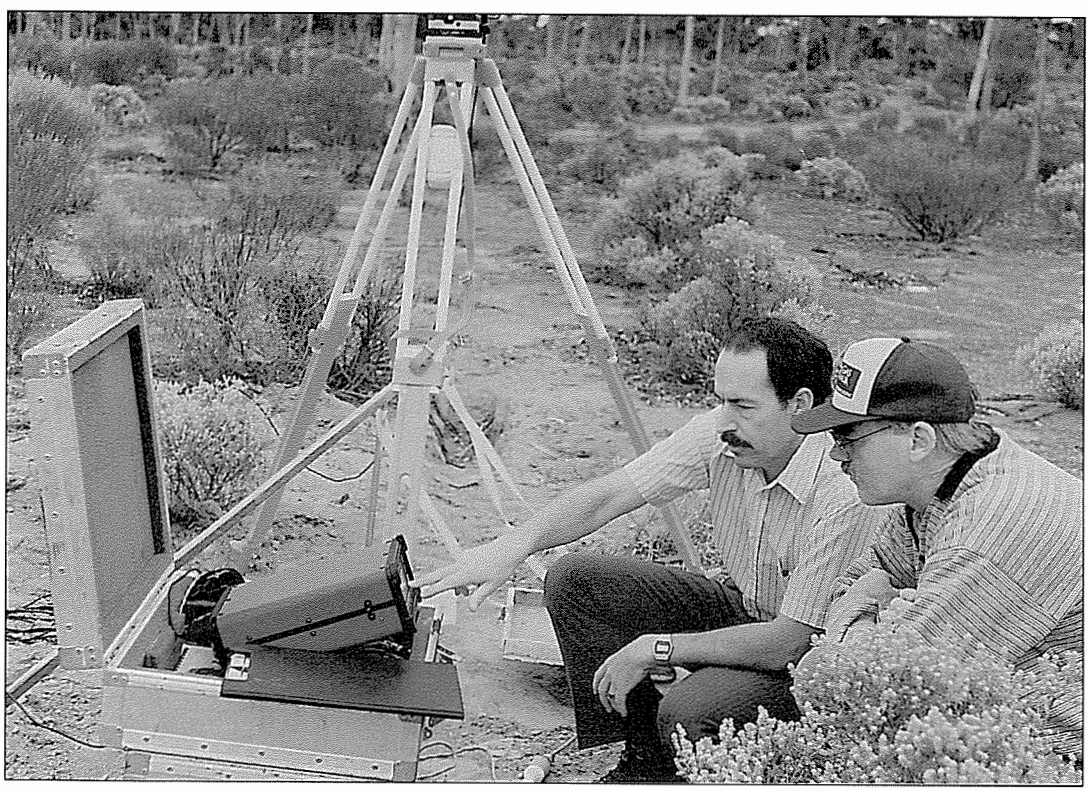
The Division, together with the Surveys and Mapping Division and the Computer Services Branch, has been involved in developing the *Tengraph* system which when introduced will replace the Department's Public Plans with an "electronic plan". It is planned to introduce this system in the Kalgoorlie Mining Registrar's office early in 1993 with the rest of the State being phased in over a period of five years.

As part of the *Tengraph* development the Division is training staff in use of the *Tengraph* prototype to ensure that when the system is introduced they will be familiar with it and able to assist and support customers in its use.

The *Tendex* system continued to be well used by the mining industry with sales of *Tendex* remaining on a par with last financial year. The Division is currently engaged in enhancing the system to support new initiatives being developed to support *Tengraph*.

The Division has also developed a number of small PC-based systems to assist in achieving its objectives. These systems include a computerised "Bond Register" which hold details of all "performance bonds" lodged by tenement holders and a system to monitor the referral process for tenements affected by nature and conservation reserves.

Due to the increased workload in this area additional resources have been allocated to assist in the various developments.



Mining Registration Director, Bill Phillips (right), gets a first-hand introduction to the latest GPS (global positioning system) technology which accurately establishes a position on the Earth's surface.

INFORMATION FOR LAND USE PLANNING

" ... some digital products were now available in data sets for interested parties wishing to 'value add' their own information systems."

There is a strong expectation from governments, the resources industry and the general public of the need to address the various issues associated with the new-found term "economically sustainable development."

One of those issues is the impact of resource developments on the environment.

Mr L (Les) Annison, LS
Director, Surveys and Mapping Division

In recent times there has been a strong demand – from various interest groups – for the release of more detailed information relating to environmental matters.

The Surveys and Mapping Division remains committed to providing such information to interested parties.

This is achieved through the current public plan system which details all mining tenements in relation to most of the State's environmentally-sensitive areas. Such areas include:

- conservation and marine park reserves;
- wetlands of international importance;
- EPA Red Book areas;
- CALM management plans;
- declared and gazetted rare flora; and
- Aboriginal Heritage Act reserves.

Once a tenement is plotted, the impact of potential mining activity on the environment and other land tenure is appraised and any encroachment of tenements on environmentally-sensitive areas is detailed. This appraisal process was developed to minimise delays in tenement approvals as well as to assist with the data entry of information.

A manual system which has been used to gather such information since 1984 is now complemented by the computerised textual databases - *Planmon* and *Tendex*. These systems assist in the prompt and accurate retrieval of information.

Client expectation for prompt, easy-to-read and selective information has also resulted in the development of a graphics database. This comes via a new electronic public plan system called *Tengraph*.

The Director of the Surveys and Mapping Division, Mr Les Annison, said the advantage of having this information in a graphical database was that it could be extracted as a complete entity, or included with selected information and then produced in a map form.

For example, he said, any ground available for pegging could be overlaid with conservation reserves to indicate special conditions which may need to be applied before the tenement was approved.

Mr Annison said some digital products were now available in data sets for interested parties wishing to "value add" their own information systems.

This service, he said, was just one example of how the Surveys and Mapping Division was assisting the Government in addressing society's concerns for sustainable development of the State's natural resources.

SURVEYS AND MAPPING DIVISION

THE YEAR IN REVIEW

INTRODUCTION

The introduction of new technology and systems such as *Tengraph* (electronic public plan), Survey Data Input (*SDI*), computer-aided map production (*Camp*), computer-aided drafting (*CAD*) and global positioning systems (*GPS*), has resulted in a more streamlined mapping system and new challenges for the staff of the Division.

Training programs continue as part of the professional development program and are providing staff with skills and expertise to meet the needs of the changing environment. Topics again were diverse with subjects ranging from management and information technology, negotiation skills, presentation skills and quality management.

During the year the capacity of the time management/job costing system was strengthened by upgrades to both hardware and software. Data input and various reports have continued on a regular fortnightly basis.

A review of the Surveys and Mapping Division's activities is presented below using the Department's Corporate Plan program and sub-program headings.

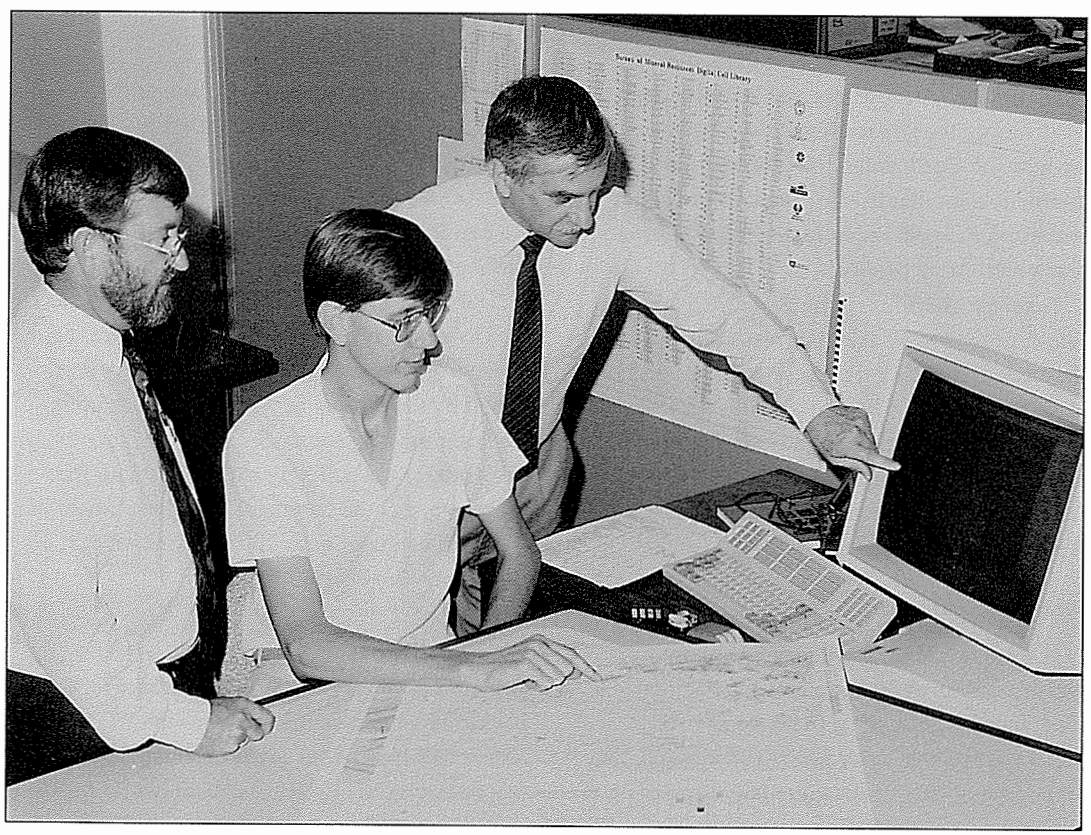
MINERAL AND PETROLEUM TITLE

Titles Systems

Cadastral Mapping

To support *Tengraph* significant advances were made in the transition from analog base mapping to the digital equivalent. Mapping methodologies and procedures have been totally redeveloped to accommodate and facilitate computer digital mapping.

The validation and compilation of base digital data for *Tengraph* in the Kalgoorlie Mining Registrar's administrative area is almost complete. With the imminent



Checking the Department's first computer-assisted geological map (of Cheriton's Find in the Yilgarn) are Surveys and Mapping staff members Geoff Loan, Michael Prause and Ross Duberal.

completion of programming, final data enhancement will be achieved.

Mapping

A total of 3 708 public plans and working transparencies (held in Head Office and the Mining Registrars) were maintained by Tenement Graphic Services Branch to chart all mineral tenements throughout the State.

A total of 5 610 mining tenement applications were recorded, plotted and appraised for land tenure status while 5 144 mining tenements were cancelled from public plans.

All petroleum tenement maps and plans were fully maintained and quarterly editions of the State petroleum maps and booklets were produced.

Tengraph

The *Tengraph* prototype was successfully demonstrated to the Minister for Mines, the Mining Industry Liaison Committee, the Amalgamated Prospectors and Leaseholders Association, the Association of Mining and Exploration Companies, the Chamber of Mines, tenement consultants, surveyors and relevant Government agencies. Industry response was overwhelmingly positive.

Tengraph continues to be developed and the data capture program is progressing as planned, The Division is optimistic that with additional funding *Tengraph* will be formally released in Kalgoorlie in the 1993-94 financial year. At that stage only the Kalgoorlie Mining Registrar's administrative region will have data available within *Tengraph.*

Surveys of Tenements

A total of 126 mining tenements were surveyed at an average area of 116 hectares. Of the 126 surveys carried out, there were 60 conducted on the "user pays" system while the remaining 66 were departmentally funded on a reduced survey budget.

The number of tenements awaiting survey is 2 988, inviting a further consideration of survey techniques and costing represented by limited marking, global positioning systems and user pays.

There was considerable interest from industry in the definition and delineation of Exploration Licence boundaries requiring Survey Services Branch to precisely calculate true relationships of adjoining tenements in order to resolve disputes.

In consultation with the Geodetic Branch, Department of Land Administration, field observations were carried out to fix and co-ordinate topographic features and previously surveyed mining tenement corners in the central mineral fields. This task was aimed at improving the integrity of mapping data during compilation and maintenance operations on digitally prepared original public plans.

Landcap/Landraw

Landcap is a data entry, capture and analysis program which validates the mathematical dimensions of field survey observations. Landraw, which is dependent on the Landcap file, enables the Branch to produce hard copy survey plans.

The Mining Act has been amended to reflect the Division's commitment to the preparation of all survey documents either by instruction issued by the Survey Services Branch or under the "user pays" system.

Landraw is also likely to be utilised in the preparation of the tenement title (Instrument of Lease) in conjunction with the proposed "Electronic Register".

Survey Data Input

Survey Data Input (*SDI*) is a software package that allows the accurate co-ordination and positioning of survey data in support of the State Geographic Reference Framework. Input is from existing survey documents with digital

data transferred direct to the State Cadastral Database.

SDI is being used to capture all surveyed mining tenements in the eastern mineral fields region in support of the *Tengraph* graphical database. This will be expanded to eventually cover all mineral fields within the State.

Global Positioning System (GPS)

The Global Positioning System (*GPS*) is a space-based positioning system using radio signals from orbiting satellites. GPS applications have been used in environmentally-sensitive areas to reduce vegetation clearings at lease corner marks and along lease boundaries. The benefit of its application is the high accuracy level that can be achieved at lower costs.

Standards and specifications were developed following pilot studies of the application of GPS surveys to mining tenements. From this a commitment has been made to introduce GPS for mining tenement boundary delineation and miscellaneous mapping control.

Investigations have continued into hardware availability and techniques. It is envisaged hand-held receivers will be used where less accuracy is required, while the high order survey type will be used for mining tenement marking and feature control.

A limited marking, GPS survey of 15 mining tenements and associated land parcel locations was undertaken at the Marandoo site in the Hamersley Ranges.

Microfilm Program

The Mapping Information Service records, maintains and stores microfiche obtained from the microfilming of original manuscripts. The microfilming program for 1991-92 included:

Surveys and Mapping Director Les Annison (left), Assistant Director General of Mines Lee Ranford (second from left), Mining Registration Director Bill Phillips (standing centre), and Assistant Director Mining Registration Geoff Spencer provide Mines Minister Gordon Hill with a demonstration of the Department's Tengraph computer program at Parliament House.

- the completion of all survey diagrams in black and white;
- the virtual completion of field books is almost complete; and
- the continuation of jacketing and labelling of public plan and diagram microfilming.

Graticular Sections

A review of the early months of Graticular Section Exploration Licences by 11 Mining Registrars and this Division has established positive client acceptance of the system. The major benefits are greatly increased security of title and ease of making application for a licence.

In response to concerns from environmental groups trying to locate the position of Graticular Section Exploration Licence applications from newspaper advertisements, 1:1 000 000 index maps were produced covering the South West of the State. These maps show the graticular section numbers with an index to the public plans overlayed in a contrasting colour, providing a quick guide to the application's location. Full State coverage of these indexes is planned next year.

EXPLORATION AND DEVELOPMENT OF NATURAL RESOURCES

Geological Data Collection

Computer-Generated Maps

During the year a total of 50 computer plots from the Petroleum Mapping System (WAPMAP) were generated to meet a variety of specialised requirements.

Geoscientific Data Dissemination

Cartography

Consolidation of new technology was the main thrust of the year with additions to the computer resources. In the mapping area, the acquisition of two workstations plus a powerful file server running Map Publisher software was a major step forward.

Within the Publications and Design Area, a third CAD Microstation has made an impression on the workload. Expansion of the desk top publishing facility, to a second unit, had reduced the reliance on outside support for type and some processes.

Nine colour maps and 68 seismic (monochrome) maps were printed. Additionally, three other maps on petroleum, oil and gas installations and mineral production were printed as part of a thematic series.

The Cheritons Find 1:100 000 map was completed using computer assisted map production techniques while Davyhurst 1:100 000, Broome and Derby hydrogeological maps were prepared by conventional methods.

Special projects completed during the year included a map showing bauxite areas of the State, maps depicting the Warriedar Fold Belt, the Perth Basin Pollution Inventory (2) and structure details of the Savory Basin.

Release of preliminary data for Kurnalpi and Kanowna 1:100 000 map sheets for field excursions were well received by the exploration industry.

Publications

During the year 1 470 figures, diagrams, slides and overhead films were produced for all divisions with a diminishing number of figures being prepared by traditional methods.

Computer-Assisted Drafting (CAD)

Extension of resources to a third workstation, a quantum leap in quality provided by a software package CADscript and a second unit expanding desk top publishing facilities, were the main developments in the CAD Section.

All graphic needs of the departmental programs are being achieved and the developments have had a significant influence on the preparation of publication material with the gradual phasing out of traditional techniques.

SURVEYS AND MAPPING DIVISION

THE YEAR IN REVIEW

Reprographics

An increase in demand for all graphic forms of information affected the Reprographic and Photographic area. A re-organised layout plus streamlined procedures expanded the capabilities of the section resulting in increased products and output and effectively reducing a five day turnaround to two days for 80% of work.

A total of 62 000 documents were handled over the year. The plan printing plain paper copier, replacing the hazardous ammonia unit, has proved most successful.

Computer-Assisted Map Production (CAMP)

The successful completion of Cheritons Find 1:100 000 pilot study has allowed further developments in the area of computer-assisted map production. Favourable response to the first fully computer-generated geological series in Australia, has attracted funds for Stage 2 of the five-year program.

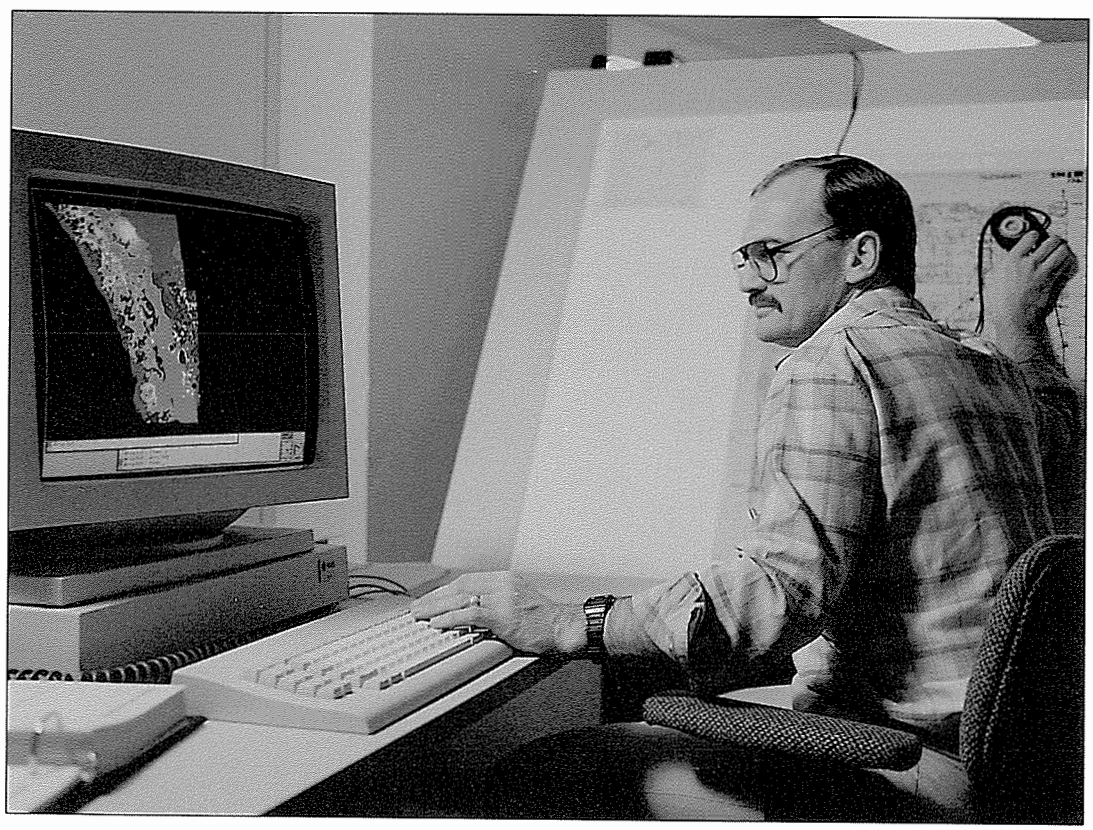
The expanded resources have enabled the *CAMP* section to move into production using this technology. A further three map sheets are in the advanced stages of preparation.

Other maps being tested in this map publishing production include the four colour thematic series of maps, of which one is to be printed in the near future.

Land Information

The Surveys and Mapping Division is represented on the Integrated Information Program *(ILIP)*, which also involves the Department of Land Administration and other government agencies with an interest in land information. The Department of Mines has accepted custodianship of several types of land information and maintains a current listing of available digital data through the ILIP Land Information Directory (LID).

The use of the Department of Land Administration's Land Information Access



Manager of the Department's Cartographic Computing Section, Steve Bandy, is pictured using the computer-based Geographical Information System.

(LIA) database provides information on the location and tenure of land. Use of this online facility enables more efficient information retrieval for the client.

Geographic Information System (GIS)

Two GIS projects were undertaken in the past year. The Hamersley Range GIS was completed in June 1992. Its aim was to provide the basis of a resource strategy for the rational long term development of the Pilbara iron-ore industry and its possible impact on National Parks and other land use strategies. A total of 14 different maps were produced and distributed to the Geological Survey Division and the Department of State Development. In addition, copies of the maps as well as digital data have been sold to industry.

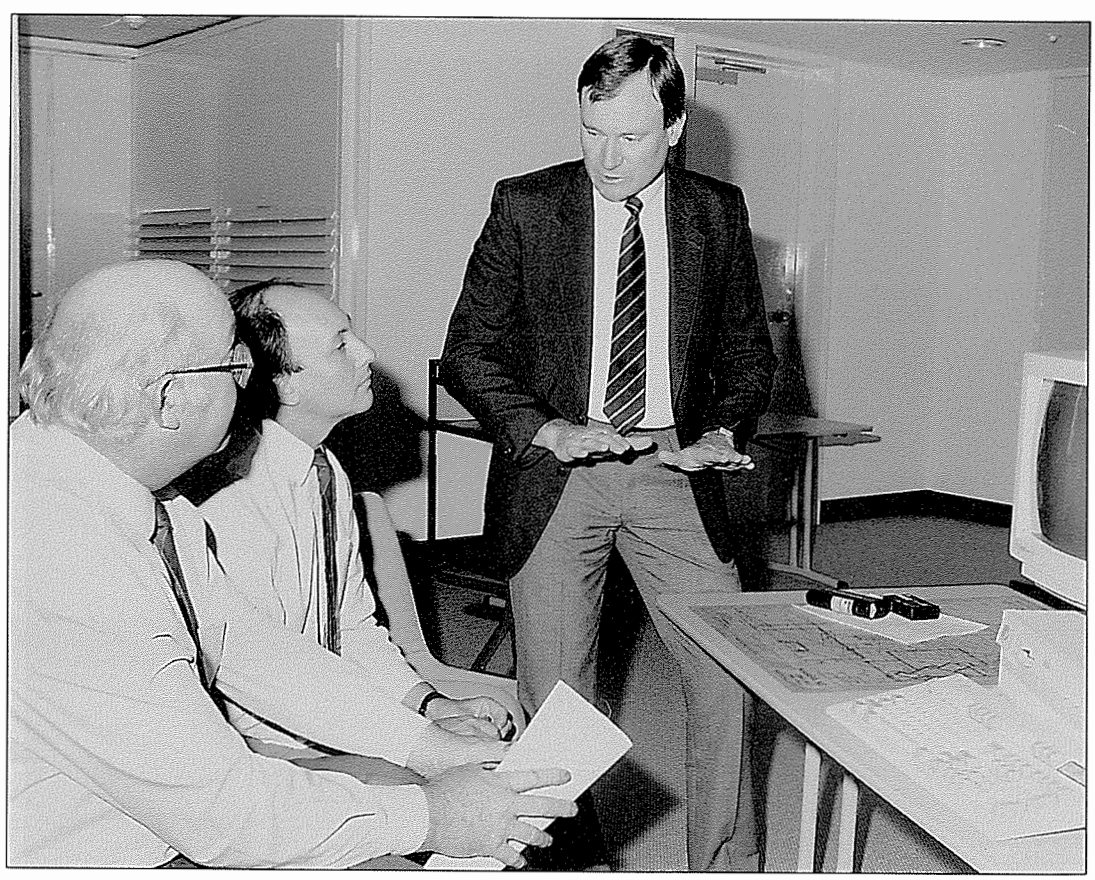
Secondly, the *PERTECH* pilot project, which commenced in May 1992, will conclude early in the 1992-93 financial year. The study aims to establish a database of geotechnical data for the Perth Central Business District. The results of the project will provide valuable feedback for a proposed larger scale database to commence in the future.

A second IBM RS/6000 workstation with ARC/INFO software has been installed. ARC/INFO has been upgraded and the more advanced features will greatly enhance the capabilities of GIS.

Industry Liaison

A key strategy adopted by the Surveys and Mapping Division is to increase contact with the mining industry. This included:

- a divisional exposition held for the general mining industry and relevant Government agencies;



As part of the Department's industry liaison policy, the Department's Assistant Director of the Surveys and Mapping Division, Geoff Spencer, demonstrates the virtues of the new Tengraph computer system to members of AMEC (a body representing Australian Mining and Exploration Companies).

- organisation of *Tengraph* seminars in both Kalgoorlie and the metropolitan area;
- demonstrations of Computer Assisted Map Publishing (*Camp*), *Tengraph*, and the Geographic Information System at the offices of CRA Exploration; and
- the inaugural meeting of the Surveys and Mapping Industry Liaison Committee.

ENVIRONMENTAL PROTECTION AND REHABILITATION

Mapping Support for Environmental Management

The regional conservation reserve map was maintained and continues to be in strong demand in the assessment of environmentally sensitive or restricted lands.

In addition, the following mapping activities were undertaken as part of Program 3:

- the encroachment of mining tenements onto Aboriginal Lands and Reserves were entered into and maintained on the *Planon* system;
- work was completed on the entering of approximately 2 200 Conservation Reserves into the *Planon* system; and
- work continued on developing a digital system to enable Declared Rare Flora to be identified at the mining tenement application stage.

The Conservation Estate

As part of the "Resolution of Conflict" policy, Environmental Protection Authority areas within Systems 1 to 12 were added to the public plans.

A dedicated set of 33 maps was produced covering CALM proposals for conservation areas in the "South West Forest" and "South Coast" regions. Work is continuing in the "Goldfields" region. A dedicated set of maps for the South Coast - 65 maps and 156 proposals were highlighted.

COMMUNITY BENEFITS

Development of *Minedex*, the Department's Mine Index System, continued with priority being shifted to the Kalgoorlie region in preparation for the release of *Tengraph*.

A detailed list of data enhancements and additions was produced for the *Mineloc/Minform* work program with the ultimate objective of achieving simplicity of use for both data maintenance and use by the client.

Over 1 500 minesites have been plotted onto the Graticular Map Sheets.

WORKER AND PUBLIC SAFETY

Registration of Mine Plans

The Surveys and Mapping Division records and stores all plans of mines and minesites so that this information is readily available to the mining inspectors and the mining industry.

A computer generated three dimensional model of the William Ford Decline at Coolgardie has been developed. This has enabled a plan of the mine in isometric and plan view to be used for prosecution action. It is expected to provide the magistrate with a better understanding of the underground layout described by the mining engineer.

CORPORATE SERVICES

All staff participated in one-day strategic planning sessions, followed by progress reviews.

The sessions concentrated on identification of roles and objectives to support the Corporate Plan and the development of priorities for the next 12 months.

Staff also attended several conferences during the year at which papers were presented.

STATISTICS

TABLE OF CONTENTS

MINING

PETROLEUM

STATISTICS

MINING TENEMENTS IN FORCE AT 30 JUNE 1992

	1978 MINING ACT			1904 MINING ACT
MINERAL FIELD DISTRICT	PROSPECTING LICENCES	EXPLORATION LICENCES	MINING LEASES AND OTHERS	MINERAL CLAIMS
01 Greenbushes			14	
04 West Kimberley	11	96	193	229
08 Ashburton	34	109	50	
09 Gascoyne	47	52	37	
12 Collie			95	
15 Coolgardie	459	80	798	
16 Kunanalling	259	10	149	
20 Cue	171	28	175	
21 Day Dawn	94	9	49	
24 Broad Arrow	453	11	296	
25 Bulong	195	27	64	
26 East Coolgardie	332	10	341	
27 Kanowna	182	23	89	
28 Kurnalpi	82	52	46	
29 Menzies	111	26	109	
30 Ularring	29	17	79	
31 Yerilla	40	40	69	
36 Lawlers	247	47	224	25
37 Mt Malcolm	593	61	227	
38 Mt Margaret	218	68	190	
39 Mt Morgans	389	48	127	
40 Niagara	59	11	60	
45 Pilbara	136	248	302	
46 Nullagine	108	43	72	
47 West Pilbara	86	122	235	
51 Meekatharra	334	61	245	
52 Peak Hill	222	190	217	
53 Wiluna	78	116	193	
57 Black Range	110	44	128	160
58 Mt Magnet	84	11	157	
59 Yalgoo	146	115	172	
63 Dundas	83	48	181	
66 Northhampton		7	1	
69 Warburton	1	57	1	
70 South West	122	176	534	4
74 Phillips River	13	18	43	1
77 Yilgarn	401	111	404	
80 Kimberley	63	184	165	
TOTAL	**5 992**	**2 376**	**6 531**	**419**

Total Area of Mining Tenements in Force

As at	Area (hectares)	As at	Area (hectares)
Dec 83	10 505 270	June 88	26 998 964
Dec 84	17 308 525	June 89	26 278 115
June 85	18 414 443	June 90	22 107 826
June 86	17 496 124	June 91	20 472 186
June 87	22 232 171	June 92	23 219 572

STATISTICS

MINING AND PETROLEUM INDUSTRY EMPLOYEES

MINERAL/Company	**LOCATION**	**1990-91**	**1991-92**
BASE METALS			
BHP Minerals Ltd	Cadjebut	162	140
Murchison Zinc Co. Pty Ltd	Golden Grove	277	345
TOTAL BASE METALS		439	485
BAUXITE - ALUMINA			
Alcoa of Australia Ltd	Del Park-Huntley/Pinjarra	2 220	1 885
	Jarrahdale/Kwinana	1 748	1 632
	Wagerup/Willow Dale	911	585
Australian Fused Materials Pty Ltd	East Rockingham	-	25
Worsley Alumina Pty Ltd	Boddington/Worsley	1 198	1 057
TOTAL BAUXITE - ALUMINA		6 077	5 184
COAL			
Griffin Coal Mining Co. Ltd	Collie	551	479
Western Collieries Ltd	Collie	734	673
TOTAL COAL		1 285	1 152
DIAMOND			
Argyle Diamond Mines Pty Ltd	Lake Argyle	694	887
Poseidon Ltd	Bow River	102	106
TOTAL DIAMOND		796	993
GOLD			
Arimco NL	Gidgee	140	132
	Mt McLure	-	108
Asarco Australia Ltd	Wiluna	151	194
Ashton Gold	Cork Tree Well	149	115
Australian Mine Management Pty Ltd	Mt Pleasant	106	107
	Racetrack/Royal Standard	36	-
Aztec Mining Co Ltd	Bounty	143	191
Big Bell Mines Pty Ltd	Big Bell	208	194
Broken Hill Metals NL	Hopes Hill	95	104
Central Norseman Gold Corp. NL	Central Norseman	197	207
Coolgardie Gold NL	Greenfield	123	120
Dominion Mining Ltd	Bannockburn	-	112
	Labourchere/Nathans	80	89
	Meekatharra	260	243
	Mt Morgans	174	190
	Tower Hill	89	-
Eastmet Ltd	Youanmi	113	84
Goldfan Ltd	Three Mile Hill	86	187
Hampton Australia Ltd	Jubilee	89	103
Harbour Lights Mining	Leonora	67	108
	Mertondale	51	-
	Nambi	-	33

STATISTICS

MINING AND PETROLEUM INDUSTRY EMPLOYEES

MINERAL/Company	**LOCATION**	**1990-91**	**1991-92**
GOLD (cont)			
Hedges Gold Pty Ltd	Hedges	124	122
Hill 50 Gold Mine NL	Mt Magnet	318	298
Kalgoorlie Consolidated Gold Mines Pty Ltd	Kalgoorlie	1 446	1 389
Metana Minerals	Reedy	118	177
Mt Gibson Management Pty Ltd	Lawlers	87	107
	Mt Gibson	134	110
Newcrest Mining Ltd	Gimlet South	151	170
	New Celebration	382	479
	Telfer	740	643
	Tuckabianna	111	135
Pancontinental Pty Ltd	Kundana	80	70
	Paddington	176	229
Placer Pacific Pty Ltd	Granny Smith	193	213
Plutonic Operations Ltd	Plutonic	126	130
Poseidon Ltd	Kaltails	136	99
	Karonie	61	40
Resolute Resources Ltd	Marymia	-	113
Reynolds Yilgarn Gold Operations Ltd	Yilgarn	204	195
Sons of Gwalia NL	Sons of Gwalia	121	117
Spargos Mining Pty Ltd	Bellevue	227	198
St. Barbara Mines Ltd	Meekatharra	157	185
Sundowner Minerals NL	Darlot	107	122
Western Mining Corporation Ltd	Emu	122	120
	Kambalda	232	253
	Lancefield	137	130
Worsley Alumina Pty Ltd	Boddington	405	392
All Other Operators		2 034(r)	2 023
TOTAL GOLD		10 486	10 173
HEAVY MINERAL SANDS			
Cable Sands Pty Ltd	Capel	185	208
ISK Minerals Pty Ltd	Picton	66	59
RGC Mineral Sands Pty Ltd	Capel	178	211
	Eneabba	107	280
	Narngulu	450	264
TiWest Pty Ltd	Cataby/Chandala	303	242
Westralian Sands Ltd	Capel	434	365
All Other Operators		35(r)	38
TOTAL HEAVY MINERAL SANDS		1 758(r)	1 667
IRON ORE			
BHP Iron Ore (Goldsworthy) Ltd	Pilbara/Port Hedland	1 001	739
BHP Iron Ore Ltd	Newman/Port Hedland	3 521	3 487
	Yandicoogina	230	81

STATISTICS

MINING AND PETROLEUM INDUSTRY EMPLOYEES

MINERAL/Company	**LOCATION**	**1990-91**	**1991-92**
IRON ORE (cont)			
BHP Minerals Ltd	Yampi	341	269
Hamersley Iron Pty Ltd	Tom Price - Paraburdoo/Dampier/Channar	3 206	3 295
Portman Mining Ltd	Ferro Gully	47	52
Robe River Mining Co. Pty Ltd	Pannawonica/Cape Lambert	897	769
TOTAL IRON ORE		9 243	8 692
NICKEL			
Agip Australia Pty Ltd	Radio Hill	153	-
Outokumpu Australia Ltd	Forrestania	-	71
Western Mining Corporation Ltd	Kalgoorlie	381	387
	Blair/Kambalda	1 617	1 363
	Kwinana Refinery	299	343
	Leinster	538	751
	Mt Windarra	249	139
All Other Operators		13	10
TOTAL NICKEL		3 250	2 922
PETROLEUM PRODUCTS			
Hadson Energy Pty Ltd	Harriet/Rosette	130	130
West Australian Petroleum Pty Ltd	Dongara	8	9
	North West Area	229	223
Western Mining Corporation Ltd	North Herald/South Pepper/Chervil	108	110
Woodside Offshore Petroleum Pty Ltd	North Rankin A/Burrup Peninsula	1 550	1661
All Other Operators		23	21
TOTAL PETROLEUM PRODUCTS		2 048	2 154
SALT			
Dampier Salt Ltd	Dampier	183	167
	Lake MacLeod	120	115
Leslie Salt Co.	Port Hedland	121	129
Shark Bay Salt JV	Useless Loop	79	71
Other		5	6
TOTAL SALT		503	488
ALL OTHER MATERIALS (including Rock Quarries)		**945**	**930**
TOTAL		**36 830**	**34 840**

(SOURCE: AXTAT REPORTING SYSTEM, MINING ENGINEERING DIVISION)

STATISTICS

QUANTITY AND VALUE OF MINERALS

		1990-91		1991-92	
MINERAL	UNIT	QUANTITY	VALUE($)	**QUANTITY**	**VALUE($)**
BASE METALS					
Copper	t	11 995	20 349 205	**12 018**	**17 440 805**
Lead	t	12 481 (r)	5 990 776 (r)	**21 678**	**7 297 295**
Zinc	t	57 331 (r)	76 385 678 (r)	**142 919**	**125 578 837**
TOTAL BASE METALS			102 725 659 (r)		**150 316 937**
BAUXITE-ALUMINA					
Alumina	t	6 800 451	2 099 125 726	**7 129 199**	**1 758 150 370**
CLAYS					
Attapulgite	t	15 403	3 914 836	**19 329**	**5 860 557**
Cement Clay	t	22 994	137 964	**16 741**	**170 243**
Fire Clay	t	620	744	**0**	**0**
Kaolin	t	0	0	**3 120**	**218 131**
White Clay	t	153 611 (r)	1 689 718 (r)	**22 575**	**225 745**
TOTAL CLAYS			5 743 262		**6 474 676**
COAL	t	5 218 176	232 915 908	**5 491 310**	**243 540 117**
CONSTRUCTION MATERIALS					
Aggregate	t	102 945	435 358	**121 343**	**737 177**
Gravel	t	30 952	152 200	**120 716**	**620 463**
Rock	t	43 135	454 534	**144 617**	**538 908**
Sand	t	548 673	2 327 258	**1 031 609**	**5 752 069**
TOTAL CONSTRUCTION MATERIALS			3 369 350		**7 648 617**
DIAMOND	ct	29 964 155	435 725 448	**47 485 294**	**564 768 721**
DIATOMITE	t	22	160	**169**	**1 300**
DIMENSION STONE					
Black Granite	t	249	76 706	**5 687**	**1 932 444**
Quartz Rock	t	430	19 302	**295**	**13 258**
Spongolite	t	115	9 430	**376**	**26 836**
TOTAL DIMENSION STONE			105 438		**1 972 538**
GEM SEMI-PRECIOUS & ORNAMENTAL STONE					
Amethyst	kg	24 617	131 426	**17 659**	**127 910**
Chrysoprase	kg	0	0	**18 555**	**342 249**
Jasper	kg	0	0	**8 844**	**7 499**
TOTAL GEM, SEMI-PRECIOUS & ORNAMENTAL STONE			131 426		**477 658**

STATISTICS

QUANTITY AND VALUE OF MINERALS

MINERAL	UNIT	1990-91 QUANTITY	1990-91 VALUE($)	1991-92 QUANTITY	1991-92 VALUE($)
GOLD	kg	181 175 (r)	2 762 816 830 (r)	**182 043**	**(e)2 689 922 065 (e)**
GYPSUM	t	82 520	612 778	**101 822**	**1 041 012**
HEAVY MINERAL SANDS					
Garnet	t	22 141	2 071 178	**35 993**	**3 385 985**
Ilmenite	t	965 930	85 482 878	**974 801**	**83 153 556**
Upgraded Ilmenite (a)	t	263 408	131 710 093	**305 118**	**153 117 864**
Leucoxene	t	23 836	13 259 826	**11 782**	**6 517 864**
Monazite	t	6 869	5 113 867	**7 372**	**2 131 269**
Rutile	t	65 446	49 598 010	**47 466**	**26 878 559**
Zircon	t	208 424	100 801 777	**226 930**	**61 114 152**
TOTAL HEAVY MINERAL SANDS			388 037 629		**336 299 249**
INDUSTRIAL PEGMATITE MINERALS					
Felspar	t	34 315	1 346 129	**22 793**	**1 057 900**
Mica	t	2 280	113 597	**164**	**6 483**
TOTAL INDUSTRIAL PEGMATITE MINERALS			1 459 726		**1 064 383**
IRON ORE					
Domestic	t	4 368 036	113 955 037	**5 797 570**	**157 663 947**
Exported	t	103 304 766	2 534 731 534	**105 267 816**	**2 783 845 640**
TOTAL IRON ORE		107 672 802	2 648 686 571	**111 065 386**	**2 941 509 587**
LIMESAND-LIMESTONE-DOLOMITE					
Dolomite	t	0	0	**280**	**1 120**
Limesand-Limestone	t	1 738 427	9 853 611	**2 053 239**	**12 143 544**
TOTAL LIMESAND-LIMESTONE-DOLOMITE			9 853 611		**12 144 664**
MANGANESE ORE	t	160 322 (r)	25 585 813 (r)	**395 303**	**71 855 982**
NICKEL INDUSTRY	t				
Cobalt by-product	t	222	3 697 617	**634**	**28 808 544**
Nickel Concentrate	t	510 320	591 302 981	**475 528**	**486 563 425**
Nickel Matte	t	0	0	**221**	**464 942**
Nickel Ore	t	8 666	4 575 271	**5 210**	**3 135 393**
Palladium by-product	kg	350	1 229 183	**555**	**1 386 855**
Platinum by-product	kg	89	1 268 587	**126**	**1 646 045**
TOTAL NICKEL INDUSTRY			602 073 639		**522 005 204**
PEAT	t	376	28 000	**762**	**56 685**

STATISTICS

QUANTITY AND VALUE OF MINERALS

MINERAL	UNIT	1990-91 QUANTITY	1990-91 VALUE($)	1991-92 QUANTITY	1991-92 VALUE($)
PETROLEUM					
Condensate	kl	1 867 892	370 948 987	**1 996 708**	**338 981 745**
Crude Oil	kl	5 136 529	1 054 061 459 (r)	**5 432 496**	**941 222 640**
LNG	MMBtu	184 930 679	836 400 762	**219 701 000**	**846 338 551**
Natural Gas	'000m3	3 613 720	379 228 944	**3 768 848**	**349 257 426**
TOTAL PETROLEUM			2 640 640 152		**2 475 800 362**
PIGMENTS					
Red Iron Oxide	t	5 757	110 531	**0**	**0**
RARE EARTHS					
Gallium	kg	8 481	267 377	**0**	**0**
SALT	t	6 413 163	136 973 045	**6 927 198**	**153 141 494**
SILICA-SILICA SAND					
Silica	t	80 147	822 975	**74 171**	**749 846**
Silica Sand	t	781 503	6 774 328	**580 467**	**5 489 268**
TOTAL SILICA-SILICA SAND			7 597 303		**6 239 114**
SILVER	kg	36 919 (r)	5 491 093 (r)	**42 697**	**6 540 741**
TALC	t	161 560	11 691 732	**168 891**	**11 822 370**
TIN-TANTULUM-LITHIUM					
Spodumene	t	40 376	7 079 333	**42 516**	**8 893 387**
Tantalite	t	702	22 767 073	**873**	**25 005 667**
Tin	t	262	1 229 162	**273**	**1 286 279**
TOTAL TIN-TANTULUM-LITHIUM			31 075 568		**35 185 333**
VERMICULITE	t	507	90 227	**225**	**39 943**
TOTAL VALUE			12 152 934 002 (r)		**11 998 019 122 (e)**

Note: Quantities used in this table only apply to Minerals and Petroleum covered by the Mining Act 1978, the Petroleum Act 1967, the Petroleum (Submerged Lands) Act 1982 and relevant State Agreement Acts.

(a) Also known as synthetic rutile

(e) Estimate

(r) Revised from previous edition

STATISTICS

ROYALTY RECEIPTS

MINERAL	1990-91 $A	1991-92 $A	Value $A Variance	%up (%down)
BARYTES	50 330.15	**0.00**	(50 330.15)	(100)
BASE METALS				
Copper	1 490 425.64	**697 081.32**	(793 344.32)	(53)
Lead	334 491.55	**255 500.19**	(78 991.36)	(24)
Zinc	3 307 359.63	**5 020 467.96**	1 713 108.33	52
TOTAL BASE METALS	5 132 276.82	**5 973 049.47**	840 772.65	16
BAUXITE-ALUMINA				
Alumina	33 777 840.23	**29 315 958.26**	(4 461 881.97)	(13)
CLAYS	380 489.93	**269 193.35**	(111 296.58)	(29)
COAL	5 236 321.85	**8 560 139.80**	3 323 817.95	63
CONSTRUCTION MATERIALS				
Aggregate	23 274.30	**11 238.80**	(12 035.50)	(52)
Gravel	9 741.60	**34 080.42**	24 338.82	250
Rock	19 251.12	**40 737.09**	21 485.97	112
Sand	156 610.73	**329 922.91**	173 312.18	111
Sandstone	0.00	**58.00**	58.00	n.ap.
TOTAL CONSTRUCTION MATERIALS	208 877.75	**416 037.22**	207 159.47	99
DIAMOND	27 289 552.17	**30 985 305.96**	3 695 753.79	14
DIMENSION STONE	1 381.15	**21 949.43**	20 568.28	1 489
GEM SEMI-PRECIOUS & ORNAMENTAL STONE	1 103.73	**21 360.03**	20 256.30	1 835
GOLD	291 690.92	**204 375.08**	(87 315.84)	(30)
GYPSUM	26 911.03	**30 657.62**	3 746.59	14
HEAVY MINERAL SANDS				
Garnet	102 079.57	**157 601.51**	55 521.94	54
Ilmenite	4 370 511.40	**4 736 252:73**	365 741.33	8
Leucoxene	555 141.31	**226 390.50**	(328 750.81)	(59)
Monazite	302 211.02	**138 056.77**	(164 154.25)	(54)
Rutile	3 140 086.21	**1 295 023.91**	(1 845 062.30)	(59)
Zircon	5 366 172.39	**3 788 578.53**	(1 577 593.86)	(29)
TOTAL HEAVY MINERAL SANDS	13 836 201.90	**10 341 903.95**	(3 494 297.95)	(25)
INDUSTRIAL PEGMATITE MINERALS				
Felspar	67 753.29	**20 826.50**	(46 926.79)	(69)
Mica	6 318.09	**324.00**	(5 994.09)	(95)
TOTAL INDUSTRIAL PEGMATITE MINERALS	74 071.38	**21 150.50**	(52 920.88)	(71)

STATISTICS

ROYALTY RECEIPTS

Mineral	1990-91 $A	1991-92 $A	Value $A Variance	%up (%down)
IRON ORE	130 935 140.94	**152 880 227.56**	21 945 086.62	17
LIMESAND-LIMESTONE-DOLOMITE				
Dolomite	0.00	**84.00**	84.00	n.ap.
Limesand-Limestone	102 706.75	**144 700.81**	41 994.06	41
TOTAL LIMESAND-LIMESTONE-DOLOMITE	102 706.75	**144 784.81**	42 078.06	41
MANGANESE	939 488.38	**5 089 927.45**	4 150 439.07	442
NICKEL				
Cobalt by-product	79 982.92	**480 605.24**	400 622.32	501
Nickel	10 597 322.76	**10 589 461.24**	(7 861.52)	0
Palladium by-product	23 422.80	**26 113.95**	2 691.15	11
Platinum by-product	23 302.38	**35 560.33**	12 257.95	53
TOTAL NICKEL INDUSTRY	10 724 030.86	**11 131 740.76**	407 709.90	4
PEAT	958.62	**1 623.78**	665.16	69
PETROLEUM				
Condensate	2 970 781.49	**2 879 224.65**	(91 556.84)	(3)
LNG	6 511 739.42	**7 144 851.72**	633 112.30	10
Natural gas	5 635 165.38	**4 944 107.97**	(691 057.41)	(12)
Oil	77 309 419.92	**71 552 596.06**	(5 756 823.86)	(7)
TOTAL PETROLEUM	92 427 106.21	**86 520 780.40**	(5 906 325.81)	(6)
PIGMENTS				
Red Iron Oxide	5 526.55	**0.00**	(5 526.55)	(100)
RARE EARTHS				
Gallium	116 950.60	**0.00**	(116 950.60)	(100)
SALT	1 301 673.64	**1 410 094.74**	108 421.10	8
SILICA SAND	389 453.08	**358 707.05**	(30 746.03)	(8)
SILVER	115 630.15	**154 896.97**	39 266.82	34
TALC	87 917.00	**84 649.50**	(3 267.50)	(4)
TIN-TANTALUM-LITHIUM				
Spodumene	356 225.05	**416 760.90**	60 535.85	17
Tantalite	569 877.68	**491 352.52**	(78 525.16)	(14)
Tin	30 711.54	**31 771.14**	1 059.60	3
TOTAL TIN-TANTALUM-LITHIUM	956 814.27	**939 884.56**	(16 929.71)	(2)
VERMICULITE	1 246.69	**2 206.38**	959.69	77
TOTAL ROYALTIES	324 411 692.75	**344 880 604.63**	20 468 911.88	6

STATISTICS

MINING ACCIDENTS

LOST TIME INJURIES IN MINES DURING 1991-92

Type of Mining	No. of Employees	No. of LTI's	Incidence	Frequency	Duration	Injury Index	Days Lost
Metalliferous Surface	29 753	1 215	41	19	12.2	235	14 790
Metalliferous U/Ground	2 605	202	78	41	17.6	716	3561
Metalliferous Total	32 358	1 417	44	21	13.0	270	18 351
Coal Surface	911	118	130	85	9.0	763	1 063
Coal U/Ground	243	76	313	220	11.0	2 414	833
Coal Total	1 154	194	168	112	9.8	1 090	1 896
Total Mining	**33 512**	**1 611**	**48**	**23**	**12.6**	**291**	**20 247**

Duration in this table does not take into consideration time lost after 30 June 1992, time lost by persons with carry-over injuries from before June 1991, or time lost from recurrent injuries.

Definitions:

Lost Time Injury (LTI)

A work injury which results in inability to work for at least one full day or shift any time after the day or shift on which the injury occurred.

Incidence

The number of lost time injuries per thousand employees for a 12 month period.

Duration

The average number of work days lost per injury.

Frequency

The number of lost time injuries per million hours worked.

Injury Index

The number of work days lost per million hours worked.

STATISTICS

MINING ACCIDENTS

MINING ACCIDENTS FOR 1991-92

Mineral	Number of Persons Employed	Accidents		
		Fatal	Serious	Minor
Gold and Nickel	13 321	5	237	475
Iron	9 150		77	271
Bauxite, Alumina	5 164		22	62
Mineral Sands	1 677		21	35
Coal	1 154		49	145
Diamond	1 041		31	21
Salt	513		8	23
Construction Materials	246		10	10
Base Metals	499		29	49
Other Minerals	747		16	49
Totals	**33 512**	**5**	**500**	**1 111**

STATISTICS

FATAL ACCIDENTS

FATAL ACCIDENTS

There were five people killed in the mining industry during 1991-92. All worked in metalliferous mines:

- An underground truck driver and another miner were scaling the backs of a decline approximately eight metres from the face. They were standing in the bucket of a front end loader. After scaling down a slab, it was followed by another large slab which fell onto both men, killing the truck driver.
- An underground miner was killed when he was buried by a fall of rock from the back of a stope.
- A boilermaker welding on a leach tank was killed when he fell 13 metres to the ground.
- A driller was killed when he became trapped between the tower and platform of a drill rig, as he was raising the tower into position.
- An underground shrink stope miner was killed as a result of being buried with ore when a hang up in the stope he was working collapsed. This caused him to be drawn down into the moving ore.

PROSECUTIONS

- A site supervisor was fined $700 with costs of $200 after pleading guilty to offences relating to unlicensed manufacture of a blasting agent.
- An underground miner was charged with failing to use ventilating equipment and fined $300 with $41.20 costs.
- A crane operator pleaded guilty and was fined $1000 with costs of $200 for operating machinery for which he did not have the appropriate certificate.
- A defendant charged with negligence under Section 54 of the Act was found not guilty, and costs of $530 awarded against the complainant.
- A supervisor pleaded guilty and was fined $400 with $41 costs, relating to his failure to ensure that a workman wore a safety helmet in a designated area.
- Two miners pleaded guilty and were each fined $750 with $35.20 costs following mid shift blasting incidents.
- Two miners were charged with failing to wear safety helmets in a quarry excavation and were each fined $300 with $40.80 costs.
- A miner was charged under Section 54 and 55 of the Mines Regulations Act of endangering the safety of another through negligence. He was fined $500 and $41.20 costs.

STATISTICS

CERTIFICATES

METALLIFEROUS MINING CERTIFICATES OF COMPETENCY ISSUED 1991-92

FIRST CLASS MINE MANAGERS

SPICER, Nigel Arthur 342
BEILBY, Peter Alexander 343
BRADFORD, Robert Bathurst 344
CAHILL, Barry John 345
COONEY, Thomas Gregory 346
EXTRACT, Andrew Wallace 347
GREGORY, Bruce Stevens 348
HUITSON, Ian David 349
HUMPHRAY, Stephen John 350
HUNNAM, Stephen Anthony 351
MacARTHUR, Nicol Allan 352
McDONALD, Errol Christopher 353
OBSCHONKA, Charles 354
RAINSFORD, Christopher John 356
SHEPPARD, Maxwell Carl 357
SOLDINI, Juan Raul 358
WOODALL, David Graham 359
GILLAM, Thomas Andrew 360
GLASTONBURY, Andrew John 361
SYME, Douglas Leonard 362
JAMES, Anthony Paul 363
McCREED, Paul Shane 364
MILNE, Peter Ronald George 365
CHAPLYN, Andrew Brian 366
ELMER, Timothy John 367
LLOYD, Peter George 368
MOORMANN, Josef Carel 369
SMITH, Paul Chapman 370
FOOTE, Wayne Edward 371
BEAZLEY, Richard John 372
NEDIN, Paul Robert 373
NICOL, Stephen John 374
VALENT, Cornelis 375

UNDERGROUND SUPERVISORS

CAHILL, Barry John A747
BORGATO, Gabriele Luigi A748
URQUHART, Stuart Clinton A749
BARDSLEY, John A750
BLAASCH, Konrad Mark A751
BRADFORD, Gavin Ross A752
CAMILLER, Kelvin John A753
CARR, Vincent Micheal A754
CURRY, Martin James A755
DAVIDSON, Geoffrey Edward A756
DONALDSON, Scott David A747
EVANS, Craig John A758
FOX, Andrew John A759
GLOVER, Adrian Gregory A760
HEAD, John William A761
HOCKLEY, Robert Anthony A762
LEWIS, Lindsay John A763
MAHER, Paul Francis A764
MARISSEN, Christopher Karl A765
MORGAN, David Beaumont Gwyn A766
PETERS, Lewis Roger A767
ROBINSON, Noel John Thomas A768
SKRZYPA, Joseph Stanislaw A769
WILSON, Kim A770
CRAIG, Mark Raymond A771
GRYLLS, Kenneth Francis A772
McGOWAN, Robert William A773
MARTIN, Leslie John A774
MATTHEWS, Ricky Thomas A775
SKRZYPA, Joseph Stanislaw A776
SCHOCH, Charles Grant A777
ROBB, David Ian A778
BELL, David John A779
BRINCKLEY, Matthew Ernest A780
DOWN, Paul Kelvin A781
HARRING, Paul Ashley A782
HEALEY, Robert Thomas A783
HUMPHRYSON, Robert James A784
KELLY, Lionel John A785
LEE, Barry Linden A786
McEWAN, David A787
MORGAN, David Luke A788
PHILLIPS, Jeffrey Bruce A789
POPHAM, Rex Harold A790
SHERATT, Alfred Henry A791
SUTHERLAND, Duncan Keith A792
COENEN, Jozephus, Henricus A793
DOHERTY, Daniel Anthony A794
GORZKOS, Richard Paul A795
GARBIN, Glenn Thomas A796
MORRIS, Florian Christopher A797
CURLEY, Brett Francis A798
HAMEL, Perry Mark A799
MOIR, Edward Charles A800
SCHLOSSER, Franz Charles A801
BENNETT, John Miskin A802
LANDON, Andrew John A803
MULRONEY, Peter Clive A804
MASON, Neil William A805
OLIVER, Robert William A806
MARAKI, Michael Paddy A807
THOMPSON, Hugh David A808
ROBERTSON, John Charles A809
SEYBAL, Stephan A810

QUARRY MANAGERS

ABRAHAMS, Timothy Christopher 252

STATISTICS

CERTIFICATES

COX, Dallas Michael 253
DALTON Richard John 254
DUNCAN, Blair Lawson 255
GELL, Mark Stewart 256
HOLLIS, Andrew John 257
MATTHEWS, Richard Alexander 258
MITCHELL, Zane Quentin 259
ODELEYE, Olusegun Olatunde 260
RIGBY, David Alan 261
ROSENTHAL, Scott David 262
SCHACHT, Philip John 263
TUCKWELL, Christopher Mark 264
YOUNGE, Graham John 265
GARDINER, Joanne Shirley 266
WOJTOWICZ, Tadeusz Roman 267
WYLLIE, David Ronald 268
BELL, Stephen Craig 269
JOHNSON, Daryl Keith 270
LAVERY, Francis Alexander John 271
SOE MYA, Zaffer 272
SCHALIT, Steven 273
BENNETT, Shane Michael 274
CAMERON, Andrew Ronald 275
DE PRINSE, Justin Jacòb 276
MORROW, Robert John 277
ANDERSON, Gregory Joseph 278
BULOW, Bradley Mark 279
COGHILL, Peter William 280
JONES, Stephen Thornton 281
KELLY, Peter Kenneth 282
MILES, Paul Frederick 283
VAN ROOYEN, Fransiscus Johannes 284
CAMPBELL, Anthony Evans 285
ROGERS, Graham John 286
EGAN, John 287
BRIERLEY, Robert James Shaw 288
WILLIAMSON, Glen Louis 289
BOHM, Michael Andrew 290

RESTRICTED QUARRY MANAGERS

HALL, Lindsay Garry 386
HUNT, David Harry 387
McINTYRE, Michael John 388
MORRIS, Phillip Edwin 389
NOTLEY, Andrew Damon 390
SUTTON, Kimberley Paul 391
BALD, Colin Neil Ross 392
BEBBINGTON, Paul Leslie Vaughan 393
BUTTERLY, Robert Wayne 394
ELLIS, David James Munro 395
FINN, Nola Louise 396
JOHNSTONE, Phillip Brian 397
ROBINSON, John Leslie 398
THORPE, Rodney Arthur 399
TURNER, Alan William 400
WALDING, Barry Glen 401
NELSON, Ed Wynn 402
ARCHER, Robert William 403
FOX, Douglas James 404
JONES, James Stephen 405
BROOKER, Ivor William Thomas 406
MacPHERSON, Robert John 407
CARRUTHERS, Kenneth Laurie 408
FEILDING, Howard Rodd 409
HILL, Anthony Mark 410
ESBARY, Peter Gordon 411
DEERING, Gary 412
HANSON, Stuart 413
KRAMER, Michael Waldamar 414
BATT, Kim Harvey 415
BIES, David John 416
BRUHNS, Murray Wayne 417
HAMES, Glenn Jeffrey 418
JUDKINS, Derek Christopher 419
KEOUGH, Henry William 420
KOZYRSKI, Edward Anthony 421
LEEKE, Bradley John 422
SAINSBURY, Brian Charles 423
SERMON, Phillip Geoffrey 424
STOKES, Peter Anthony Viktor 425
WARBURTON, Kelvin Ray 426
WOODS, Paul Stephen 427
MILLER, Paul Alexander 428
JACKSON, James Kenneth 429
FOOKES, Peter John 430
GLOCKNER, Oliver 431
JONES, David Leigh 432
PATRONI, Rodney Maxwell 433
NEALE, Larry Thomas 434

AUTHORISED MINE SURVEYORS

GIBLETT, Neil Laurence 149
GRAY, David 150
LARKIN, Alan Percy 151
WILSON, Andrew Noel 152
BRADY, Allan Patrick 153
CAMPBELL, Gregory Kevin 154
HOLMES, Peter Andrew 155
ASSHETON, Ralph Ian 156
FERNS, David Gordon 157
RIPPON, John Gunnar 158

COAL MINING CERTIFICATES OF COMPETENCY ISSUED 1991-92

THIRD CLASS (DEPUTIES)

REYNOLDS, Henry Walter C-1-92

STATISTICS

PETROLEUM PRODUCTION 1991-92

Field	Crude Oil (kL)	Condensate (kL)	Gas (Kcm)
Barrow Island	824 387	0	94 658
Beharra Springs	0	1 023	49 066
Blina	12 829	0	0
Boundary	2 556	0	0
Chervil	70 242	0	10 007
Cowle	171 670	0	14 095
Dongara	5 337	223	67 708
Harriet	879 535	0	108 549
Lloyd	1 032	0	0
Mondarra	0	0	128
Mt Horner	27 164	0	0
North Herald	22 191	0	3 694
North Rankin	0	1 987 694	13 443 149
Saladin	2 209 940	0	172 082
South Pepper	531 614	0	113 485
Sundown	2 142	0	0
Talisman	353 432	0	3 987
Tanami	13 642	0	452
Tubridgi	0	0	155 235
West Terrace	850	0	0
Woodada	0	597	67 211
Yammaderry	274 199	0	22 999
TOTAL	**5 452 190**	**1 989 537**	**14 326 505**

North Rankin gas production figure includes 5 673 263 thousand cubic metres of LNG and 3 212 189 thousand and cubic metres of reinjected gas.

STATISTICS

PETROLEUM EXPLORATION PERMIT DEALINGS

	1990-91		1991-92	
	No.	AREA (km)	No.	AREA (km)
AREA ADVERTISED				
Onshore	4	95	All Vacant	-
Offshore	27	225 501	14	120 903
TOTAL	**31**	**225 596**	**14**	**120 903**
PERMITS GRANTED				
Onshore	8	37 531	12	16 783
Offshore	8	25 779	13	96 733
TOTAL	**16**	**63 310**	**25**	**113 516**
PERMIT APPLICATIONS				
(pending at year's end)				
Onshore	2		1	
Offshore	10		5	
TOTAL	**12**		**6**	
EXPLORATION PERMITS HELD				
(at year's end)				
Onshore	50	163 770	56	161 468
Offshore	47	127 936	58	235 319
TOTAL	**97**	**291 706**	**114**	**396 787**
PERMITS SURRENDERED				
Onshore	10	89 791	2	9 922
Offshore			1	6 000
TOTAL	**10**	**89 791**	**3**	**15 922**
PERMIT RENEWALS				
Onshore	5	29 355	9	8 546
Offshore	1	2 096	5	12 413
TOTAL	**6**	**31 451**	**14**	**20 959**
PERMITS CANCELLED				
Onshore	4	26 217	1	1 185
Offshore			-	-
TOTAL	**4**	**26 217**	**1**	**1 185**
PERMITS EXPIRED				
Onshore			2	10 325
Offshore	1	5	1	370
TOTAL	**1**	**5**	**3**	**10 695**
LICENCES HELD				
(including pipelines)				
Onshore	22	3 110	26	
Offshore	21	3 462	25	
TOTAL	**43**	**6 572**	**51**	

STATISTICS

PETROLEUM WELLS DRILLED

Class	Name	Operator	Tenement	Latitude	Longitude	Grnd Elev.	RT-KB	Depth @ 31.6.92	Spud Date	Rig Release Date	Status @ 31.6.92
					Bonaparte Basin						
NFWO	Halcyon 1	LASMO	WA-199-P	11 56 16	125 28 18	-98	18	2090	6-Jul-91	6-Aug-91	P&A
	Harbinger 1	KUFPEC	WA-217-P	12 13 12	126 44 41	-98	22	2765	28-Sep-91	9-Nov-91	P&A
	Jacana 1	LASMO	WA-199-P	11 58 24	125 42 54	-83	18	1718	7-Aug-91	29-Aug-91	P&A
	Oberon 1	KUFPEC	WA-217-P	12 13 32	126 42 02	-68	27	378	27-Jun-92		DRILLING
	Shalimar 1	KUFPEC	WA-217-P	12 02 14	126 39 04	-98	22	2750	28-Dec-91	30-Jan-92	P&A
					Browse Basin						
NFWO	Arquebus 1	AMOCO	WA-206-P	15 18 52	121 29 29	-192	18	3256	22-Sep-91	2-Dec-91	P&A
					Canning Basin						
NFW	Sunshine 1	BRIDGE	EP142	18 27 00	122 54 00	178	182	738	10-Nov-91	14-Nov-91	P&A
	Whistler 1	BRIDGE	EP142	18 22 25	122 53 39	169	173	884	1-Nov-91	6-Nov-91	P&A
					Carnarvon Basin						
NFW	Abdul's Dam1	PANPAC	EP110	21 57 22	114 49 52	5	10	790	18-Aug-91	4-Sep-91	P&A
	East Somelin 1	LENNARD	EP137	21 18 52	115 49 21	7	9	143	18-Oct-91	31-Oct-91	SUSP
	Tanami 1	HADSON	EP307	20 39 17	115 34 47	12	15	2465	8-Jun-91	23-Jul-91	O SUSP
	Trealla 1A	AMPOL	EP359	22 17 30	114 03 24	26	5	1495	4-Dec-91	2-Jan-92	P&A
	Wingette 1	AMPOL	EP41	22 23 21	113 50 38	112	5	1439	5-Jan-92	23-Jan-92	P&A
NFWO	Black Ledge 1	WAPET	TP/3	21 37 03	115 02 41	-11	32	2680	13-Dec-91	13-Jan-92	P&A
	Cassidy 1	MOBIL	EP325	22 01 16	114 10 04	-16	32	2642	26-Jan-92	28-Feb-92	P&A
	Cody 1	MOBIL	EP325	21 58 05	114 17 44	-18	29	3165	9-Dec-91	24-Jan-92	P&A
	Coojong 1	AMPOL	WA-202-P	20 00 23	116 32 58	-60	28	2528	2-May-92	31-May-92	P&A
	Forrest 1A	PHILLIPS	WA-192-P	20 13 32	115 32 15	-60	25	2166	21-May-92		DRILLING
	Gregory 1	PHILLIPS	TP/8	20 49 40	115 31 56	-14	27	2800	30-Sep-91	28-Oct-91	P&A
	Leatherback 1	LASMO	EP342	21 41 08	114 21 55	-13	32	2258	31-May-91	6-Jul-91	O SUSP
	Skate 1	WAPET	TP/3	21 35 54	114 58 44	-9	28	1332	30-Oct-91	13-Nov-91	P&A
	Skate 1 "ST1"*	WAPET	TP/3	21 35 54	114 58 44	-9	28	1090	13-Nov-91	25-Nov-91	O G SUSP
	Taunton 1	WMC	TL/2	21 19 46	115 05 36	-17	27	1877	27-Jun-91	21-Jul-91	P&A
	Wandoo 2	AMPOL	WA-202-P	20 07 17	116 25 31	-50	38	1546	1-Jun-92		DRILLING

STATISTICS

PETROLEUM WELLS DRILLED

Class	Name	Operator	Tenement	Latitude	Longitude	Grnd Elev.	RT-KB	Depth @ 31.6.92	Spud Date	Rig Release Date	Status @ 31.6.92
EXT	Mardie 1B	LENNARD	EP137	21 21 16	115 41 46	6	9	166	4-Nov-91	18-Nov-91	SUSP
	Rough Range 11	AMPOL	EP41	22 25 05	114 05 00	63	5	1168	11-Nov-91	26-Nov-91	P&A
EXTO	Campbell 3	HADSON	TL/5	20 24 56	115 43 44	-39	40	1477	25-Apr-92	14-May-92	SUSP
	Campbell 4	HADSON	TL/5	20 24 56	115 43 44	-39	40	1887	14-May-92	8-Jun-92	SUSP
	Cossack 2	WOODSIDE	WA-9-L	19 33 21	116 29 45	-82	18	3659	10-Dec-91	11-Feb-92	O SUSP
	Cossack 3	WOODSIDE	WA-9-L	19 34 07	116 29 49	-82	18	3382	11-Feb-92	7-Apr-92	O SUSP
	Roller 3	WAPET	TP/3	21 38 47	114 54 14	-10	30	1010	26-Nov-91	5-Dec-91	P&A
	Roller3 "ST1"	WAPET	TP/3	21 38 47	114 54 14	-10	30	1204	5-Dec-91	12-Dec-91	P & SUSP
	Sinbad 2	HADSON	TL/5	20 29 05	115 42 40	-38	42	2223	18-Jun-92		DRILLING
	Tanami 2	HADSON	TL/1	20 40 58	115 35 57	-7	25	2444	29-Sep-91	22-Oct-91	P&A
	Wanaea 4	WOODSIDE	WA-28-P	19 37 52	116 23 44	-78	18	3150	8-Apr-92	14-Jun-92	O SUSP
	Wanaea 5	WOODSIDE	WA-28-P	19 35 18	116 24 37	-85	18	2773	16-Jun-92		DRILLING
DEV	Barrow F21A	WAPET	PL1H	20 50 08	115 22 13	47	52	767	4-Jul-91	9-Jul-91	O SUSP
	Barrow F71A	WAPET	PL1H	20 51 08	115 2215	20	25	710	10-Jul-91	15-Jul-91	O SUSP
	Barrow F82	WAPET	PL1H	20 51 23	115 22 41	6	11	794	17-Jul-91	23-Jul-91	O SUSP
	Barrow G28A	WAPET	PL1H	20 50 08	115 21 59	35	40	728	28-Jun-91	3-Jul-91	O
DEVO	NRA 23	WOODSIDE	WA-1-L	19 35 08	116 08 12	-125	46	6027	13-May-91	16-Aug-91	G & C SUSP
	South Pepper 16	WMC	TL/2	21 07 34	115 17 14	-13	27	2053	31-Jul-91	6-Sep-91	O SUSP
	South Pepper 17	WMC	TL/2	21 07 34	115 17 14	-13	27	1920	29-Jul-91	22-Aug-91	O SUSP
					Perth Basin						
NFW	Chapman Hill 1	DISCOVERY	EP340	33 46 12	115 18 48	38	41	1350	2-Apr-92	12-Apr-92	P&A
	Mullering 1	ARROW	EP323	30 41 27	115 19 30	57	61	1666	11-Mar-92	29-Mar-92	P&A
	Warramia 1	AMPOL	EP351	30 11 08	115 43 41	303	5	1498	6-Apr-92	20-Apr-92	P&A
NFWO	Tuart 1	AMPOL	WA-220-P	31 57 05	115 21 27	-86	21	1600	11-Jul-91	20-Aug-91	P&A
DEV	Woodada 12	CONS. GAS	L5	29 50 27	115 07 43	34	38	2300	30-May-91	12-Jul-91	G SUSP

KEY

NFW(O)	New Field Wildcat (Offshore)	P&A	Plugged and abandoned	O	Oil
EXT(O)	Extension Test (Offshore)	SUSP	Suspended	G	Gas
DEV(O)	Development (Offshore)	ST	Sidetrack	C	Condensate

STATISTICS

PETROLEUM SEISMIC SURVEYS COMMENCED DURING 1991-92

Survey Name	Title	Operator	Commenced	Completed	Total km
		Bonaparte Basin			
BP 1991 Bonaparte Gulf MSS	WA-219-P	BP	18-Nov-91	30-Nov-91	552
HCB91A MSS	WA-218-P	BHP	26-Aug-91	14-Sep-91	2 311
Malita MSS	WA-74-P	Petroz	24-Nov-91	17-Dec-91	2 578
Myrmidon MSS	WA-224-P	Lasmo	18-Dec-91	23-Jan-92	4 028
PW91 MSS	WA-223-P	Phillips	6-Oct-91	24-Nov-91	6 174
		Browse Basin			
BS91 MSS	WA-35-P	Shell	10-Nov-91	16-Nov-91	613
Clarion MSS	WA-207-P	Bridge Oil	18-Jan-92	30-Jan-92	976
Elizabeth MSS	WA-206-P	Ampol	8-May-92	12-May-92	366
MI MSS	WA-212-P	Ampol	7-Jan-92	17-Jan-92	626
Sascha MSS	WA-238-P	Ampol	29-Apr-92	7-May-92	1 132
		Canning Basin			
C92A MSS	WA-236-P	Esso	20-Jun-92	20-Jul-92	2 739
S91C SS	EP 353	Shell	15-Aug-91	29-Oct-91	819
		Carnarvon Basin			
1992 Cuvier MSS	WA-229-P	Mobil	22-May-92	12-Jun-92	1 241
SPA 4SL/91-92 (Cuvier MSS)	Vacant	Mobil	22-May-92	12-Jun-92	450
Barrow 15 (475) MSS	WA-7-L	Wapet	14-Oct-91	14-Oct-91	12
Carapace High Resolution MSS	EP 342	Lasmo	8-Jun-92	10-Jun-92	79
East Dampier 3D MSS	WA-28-P	Woodside	13-Mar-92		60 039
Echo/Dixon 3D MSS	WA-28-P	Woodside	20-May-91	27-Oct-91	33 699
Glennie (474) MSS	TP/3	Wapet	8-Oct-91	9-Oct-91	65
Gorgon 3D (471) MSS	WA-25-P	Wapet	14-Sep-91	13-Mar-92	61 138
Gorgon 4 (472) MSS	WA-205-P	Wapet	26-Aug-91	8-Sep-91	1 018
HH91A 3D MSS	WA-210-P	BHP	30-Oct-91	17-Dec-91	6 567
HH91B 3D MSS	WA-155-P	BHP	30-Oct-91	17-Dec-91	1 961
Jennifer MSS	TP/7	WMC	22-May-92	24-May-92	60
Kennedy MSS	EP 325	Mobil	21-Oct-91	30-Oct-91	533
Kirsten MSS	WA-149-P	WMC	29-Nov-91	15-Dec-91	1 619
Leatherback MSS	EP 342	Lasmo	1-Nov-91	23-Nov-91	603
Legendre 3D MSS	WA-1-P	Woodside	26-Feb-92	22-Apr-92	22 666
Lightfoot Reef MSS	EP 341	Command	21-May-92	7-Jun-92	519
Loggerhead MSS	EP 342	Lasmo	10-Jul-92	12-Jul-92	226
Mahakam MSS	WA-225-P	Kufpec	3-Feb-92	16-Jun-92	2 197
N91A MSS	WA-216-P	Norcen	24-Dec-91	3-Jan-92	425
North Saladin 3D (470) MSS	TP/3	Wapet	7-Sep-91	17-Oct-91	2 067
PD91 MSS	WA-208-P	Phillips	22-Dec-91	30-Dec-91	553
Rose MSS	TP/7,TL/2	WMC	29-Nov-91	15-Dec-91	210
Simone MSS	TP/7,TL/2	WMC	29-Nov-91	15-Dec-91	139
Snark (473) MSS	EP 355	Wapet	11-Oct-91	18-Oct-91	233
SPA 2SL/91-2 MSS	Vacant	Halliburton	20-Dec-91	8-Jan-92	2 578
SPA 3SL/91-2 MSS	Vacant	Aus. Seis. Br.	17-Mar-92	21-Mar-92	341
Taylor MSS	WA-192-P	Phillips	17-Jun-92	5-Jul-92	1 264
		Perth Basin			
Kerrie MSS	WA-220-P	Ampol	19-Sep-91	22-Sep-91	411
PV-91 MSS	WA-221-P	Petrofina	7-Aug-91	18-Sep-91	2 427
SI 1/91-2 (New Norcia SS)	Vacant	Ampolex	1-Jul-92		
West Abrolhos MSS	WA-232-P	Conoco	8-Mar-92	12-May-92	2 797
Yandanooka SS	EP 320	Sagasco	16-Jan-92	19-Feb-92	263

STATISTICS

IDENTIFIED RECOVERABLE PETROLEUM RESERVES AT 30 JUNE 1992

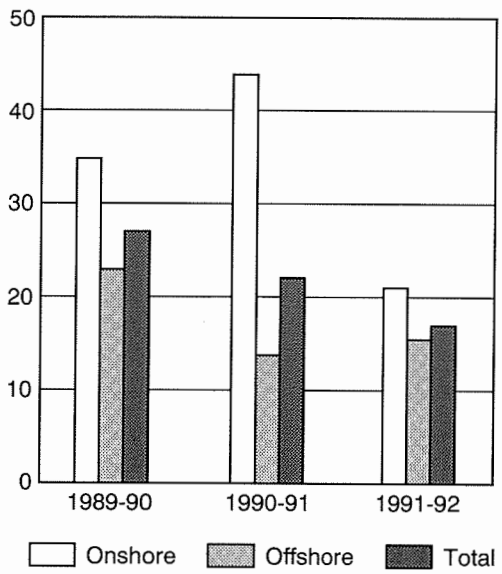
	Oil C7+ (10^6 kL)		GAS C1-C4 (10^9 m^3)		CONDENSATE C5+C6 (10^6 kL)	
Status Probability of recovery	**90%**	**50%**	**90%**	**50%**	**90%**	**50%**
Proved (Developed)						
Barrow Island	6.682	7.862	0.307	0.489	0	0
Beharra Springs*	0	0	0.071	0.451	0	0
Blina	0.088	0.202	0	0	0	0
Boundary	0	0.001	0	0	0	0
Chervil	0.125	0.137	0	0	0	0
Cowle	0.004	0.047	0	0	0	0
Dongara	0.013	0.015	0.553	0.575	0	0
Harriet	2.609	2.712	0.221	0.271	0	0
Lloyd	0	0.001	0	0	0	0
Mt Horner	0.065	0.104	0	0	0	0
North Herald	0.035	0.057	0	0	0	0
North Rankin	0	0	139.417	159.947	13.593	16.893
North Rankin W	0	0	7.600	13.700	1.300	2.300
Rosette	0	0	0.340	0.410	0.072	0.083
Saladin	0.989	2.992	0	0	0	0
South Pepper	0.442	0.491	0	0	0	0
Sundown	0.014	0.014	0	0	0	0
Talisman	0	0.001	0	0	0	0
Tubridgi	0	0	2.090	2.110	0	0
West Terrace	0	0.001	0	0	0	0
Woodada	0	0	1.064	2.424	0.006	0.016
Yammaderry	0	0.193	0	0	0	0
TOTAL	**11.066**	**14.830**	**151.393**	**180.377**	**14.971**	**19.292**
Proved (Undeveloped)						
Bambra	0	0	0.48	0.618	0.058	0.068
Campbell	0	0	1.5	1.9	0.21	0.26
Chinook	0.57	2.15	0.091	0.648	0	0
Cossack	3	4.9	0	0	0	0
Goodwyn Main	0	1	95.2	107.3	36.4	42.1
Griffin	8.07	14.92	0.647	1.206	0	0
Ramillies	0	0.126	0	0	0	0
Roller	3.404	5.448	0.033	0.053	0	0
Skate	0.253	0.421	0.004	0.007	0	0
Scindian	0.640	2.58	0.118	0.587	0	0
Sinbad	0	0	0.88	1.5	0.16	0.27
Tanami	0.44	0.77	0.016	0.028	0	0
Wanaea	0	23.1	0	4.3	0	0
TOTAL	**6.377**	**55.415**	**98.969**	**118.147**	**36.828**	**42.698**
Probable						
Angel	0	0	0	42.1	0	12.5
Dockrell	0	0.4	0	0	0	0
Echo-Yodel	0	0	0	8.5	0	5.7
Egret	0	0.3	0	0	0	0
Goodwyn-Smith	0	0.6	0	0	0	0
Lambert	0	0.7	0	0	0	0
Tidepole	0	0.3	0	11.6	0	3.2
Wilcox	0	0	0	8.6	0	3.4
TOTAL	**0**	**2.3**	**0**	**70.8**	**0**	**24.8**
TOTAL RESERVES	**27.443**	**72.545**	**250.362**	**369.324**	**51.799**	**86.79**

*: Reserves currently being re-assessed

STATISTICS

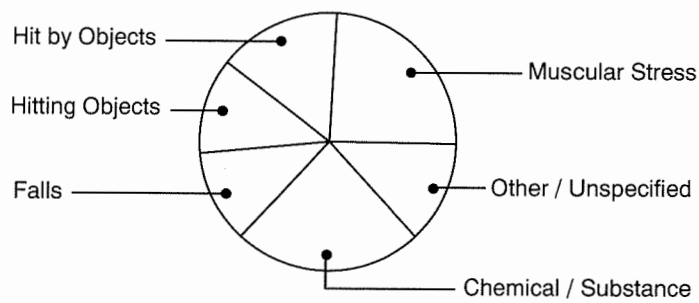
PETROLEUM INDUSTRY ACCIDENTS

Accident Frequency

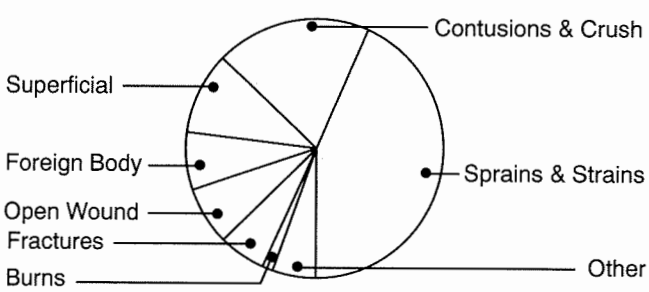


Lost-time accidents / million hours worked

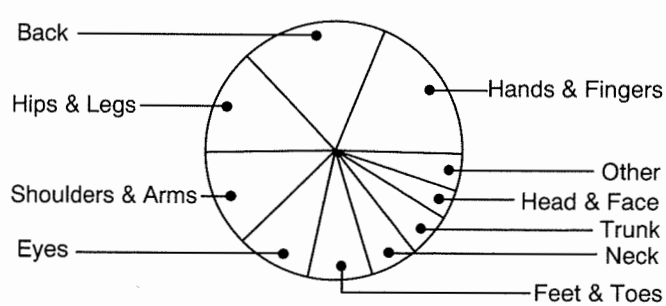
Type of Accident



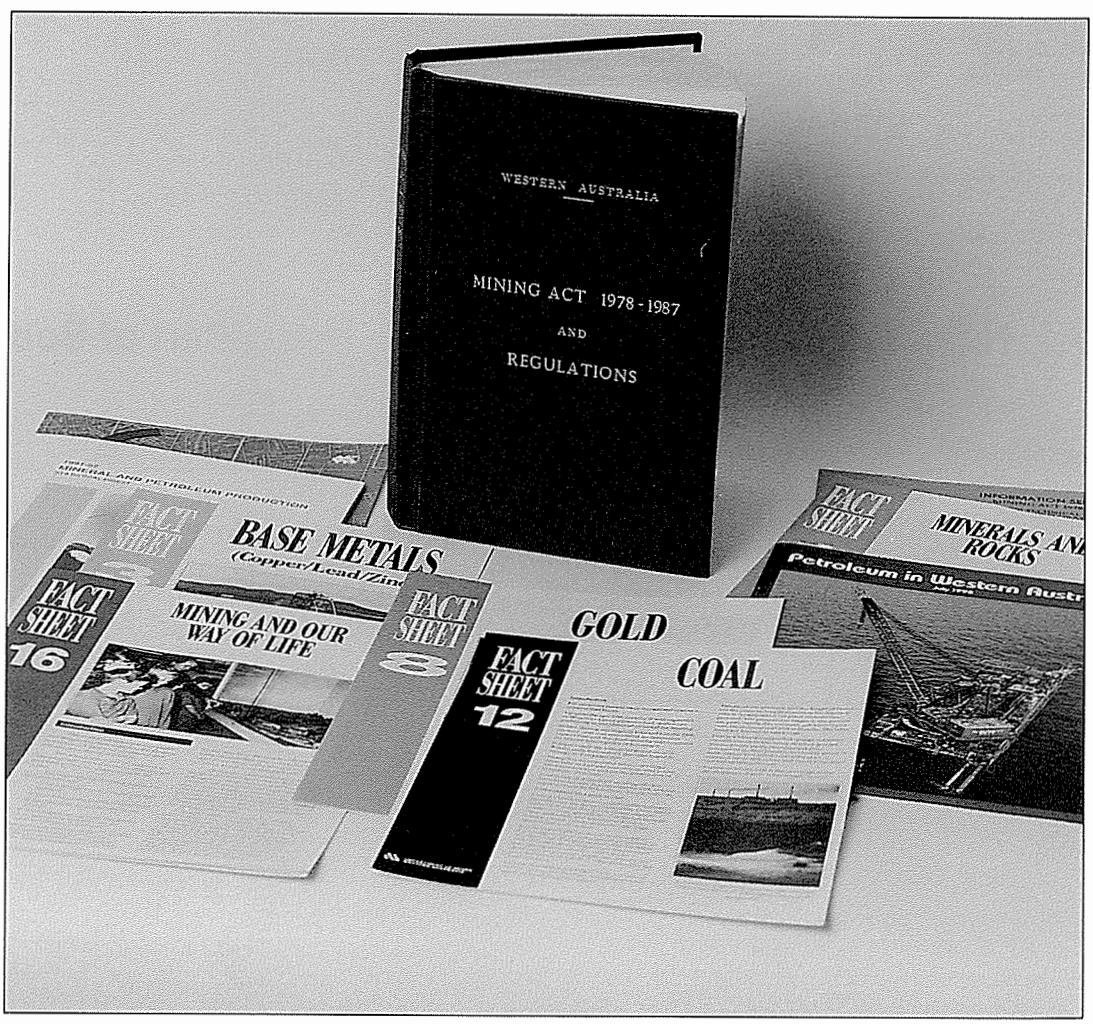
Nature of Injury



Part of Body



APPENDICES



APPENDIX 1

RESEARCH & DEVELOPMENT PROJECTS

The Chemistry Centre (WA)

The Chemistry Centre (WA) provides high quality chemical and related scientific investigative and analytical information and advice to Government agencies, industry and the public. These activities assist the development of the State's mineral, water and agricultural resources, the monitoring and improving of public and occupational health, environmental and materials standards within the community and the improvement of law, order and public safety by providing scientific support to the law enforcement and racing agencies.

Research and development projects are important functions of the Chemistry Centre's activities as these help to ensure that client investigations are effective and that solutions are provided for client problems. Many are collaborative projects with clients, Universities and/or CSIRO.

The Chemistry Centre is a partner in the AJ Parker Cooperative Research Centre for Hydrometallurgy along with the CSIRO Division of Mineral Products, Curtin and Murdoch Universities and the Australian Mineral Industries Research Association (AMIRA). It is also a partner in the Research Centre for Advanced Mineral and Materials Processing based at the University of WA.

Significant external funding has also been attracted for other research projects. Funding has been obtained from several organisation including AMIRA, MERIWA, National Institute of Forensic Science, Agricultural Research Funding Groups as well as from industry.

The results of R&D projects have generally been published in the scientific literature. Further information can be obtained from the Director of the Chemistry Centre by telephoning 325 5544 or writing to 125 Hay Street, East Perth.

Geological Survey

A large part of the work of the Geological Survey Division involved research and development projects to investigate, interpret, and record the geology of Western Australia by relating mineral, petroleum, and groundwater occurrences and potential to that geology. This research provides a platform for the further exploration and development of the State.

For a full listing of current and proposed projects see "Record 1992/1 : Summary of progress of the Geological Survey of Western Australia during 1991-92 and plans for 1992-93 to 1996-97". This publication can be viewed in the departmental library, or purchased at the sales counter, first floor, Mineral House.

Petroleum Division

Technical assessments and reservoir engineering studies were completed for a range of new petroleum projects and recovery methods. Work also commenced on development of a policy concerning the flaring of gas from petroleum developments.

Explosives and Dangerous Goods

Hazard reviews were completed to various stages for the Nufarm chlorine plant, BP Refinery, the ELMINA aluminium fluoride plant and Tiwest's titanium dioxide plant.

Mining Engineering

A range of studies was completed covering chemical use in laboratories, underground asbestos fibres, thorium retention in mineral sands employees and methods to reduce particulates in diesel emissions for diesel engines used underground.

Guidelines were also issued covering mercury vapour exposure in gold plants and noise control in mines.

Surveys and Mapping

Projects completed for the year included the Hamersley Range GIS Project in June 1992. A total of fourteen (14) different maps were produced to meet the demands of the project brief.

Computer-generated, three-dimensional colour plans were also prepared representing models of mines, thus allowing underground or open cut mine models to be viewed from any direction.

A pilot study to produce the first geological map in Australia entirely on a computer was successful and widely acclaimed following release of the Cheriton's Find 1: 100 000 map.

APPENDIX 2

PUBLICATIONS

The Department compiled or revised publications covering a variety of topics during the year. The following list is representative of the topics covered. More details can be obtained as shown below or through the Department's Library (09 222 3330), the public counter at Mineral House, 100 Plain Street, East Perth, or regional offices elsewhere in the State.

Mining Registration

The Mining Registration Division revised information pamphlets during the year to reflect changes to the Mining Act. These cover the basic provisions of the Act and provide guidance to the operation of the Act.

Geological Survey

A total of 99 technical publications were printed and released by the Geological Survey in 1991-92. Of these, 73 were maps. Some highlights were:

Bulletins:

138 The geology of the Sylvania Inlier and the southeast Hamersley Basin (180 p); and

140 Miospore assemblages from the Devonian reef complexes, Canning Basin, Western Australia (139 p).

Reports:

27 The Silurian Tumblegooda Sandstone, Western Australia (124 p); and

29 Geology of the offshore Bonaparte Basin, northwestern Australia (47 p).

Explanatory Notes for Geological Maps:

A total of five Explanatory Notes were released during the year, covering the following maps:

- Robertson (2nd ed.) 1:250 000 geology;
- Turee Creek (2nd ed.) 1:250 000 geology;
- Newman (2nd ed.) 1:250 000 geology;
- Broome 1:250 000 hydrogeology; and
- Perenjori 1:250 000 hydrogeology.

Maps Published:

- two-colour geological maps at 1:100 000 scale in the Eastern Goldfields and Southern Cross Province;
- twelve 1:100 000 Aeromagnetic contour maps in the Eastern Goldfields Province;
- two regolith maps in the Eastern Goldfields;
- two hydrogeological maps at 1:250 000 scale at Broome and Derby;
- two maps showing groundwater contamination sites (1:500 000) in the Perth Basin; and
- forty-seven seismic-structure maps in the Canning, Eucla, Bremer and Carnarvon Basins.

A list of all publications released by the Geological Survey is contained in "Record 1992-1: Summary of progress of the Geological Survey of Western Australia during 1991-92 and plans for 1992-93 to 1996-97". This publication can be viewed in the departmental library, or purchased at the sales counter, 1st floor Mineral House.

Petroleum

The Petroleum Division produced:

- Environmental Approvals for Petroleum Operations;
- List of Permittee/Licensee/Lessee companies and titles;
- Industry Safety Memoranda;
- Petroleum in Western Australia magazine;
- Exploring for Petroleum in Western Australia; and
- North West Shelf Oil and Gas Map.

Explosives and Dangerous Goods

The Explosives and Dangerous Goods Division produced:

- Summary of Accident Reports;
- Guidelines on many aspects of explosives, flammable liquids, dangerous goods (road transport) regulations and risk hazards; and
- "Explosay" - quarterly divisional newsletter.

The Chemistry Centre (WA)

Chemistry Centre staff from all Laboratories contributed 16 articles to scientific journals, four chapters to books, major components of three monographs and 27 papers to national or

APPENDIX 2

PUBLICATIONS

international scientific conference proceedings in 1991-92.
The breadth of areas covered by the publications are illustrated by the following:

- three chapters on glass, paint and fibres in forensic science books;
- one chapter on alkaloids in crops in an agriculture book;
- three monographs in the Western Australian Food Monitoring Program dealing with Mineral Water, Sulphur Dioxide and Cadmium in Potatoes;
- six papers dealing with mineral processing were presented to Australasian Institute of Mining and Metallurgy conferences;
- seven papers were presented to the 19th Australian Polymer Symposium; and
- four papers were presented to the 9th International Conference of Racing Analysts and Veterinarians in USA.

Mining Engineering

The Mining Engineering Division produced a range of publications. Highlights included:

- A publication relating to "Alcohol and Other Drugs - a Legislative Perspective" - November 1991;
- Fatal Accidents in the Western Australian Mining Industry 1980-1981: a retrospective study (produced in conjunction with the Chamber of Mines and Energy of Western Australia);
- Guidelines on underground mine ground control procedures - June 1992;
- Mining Engineering Division fatal and lost time injuries - 1990-1991;
- Mining Engineering Division fatal and lost time injuries - 1991;

Several papers dealing with safety in mining were published in national and international conference proceedings.

Royalties and Policy Development

The Royalties and Policy Development Division produced a number of publications during the year relating to departmental activities. They included the Department's Annual Report and Annual Review, the Statistical Digest of Mineral and Petroleum Production in WA, an in-house newsletter to staff, and several brochures including a series of Fact Sheets on mineral-related topics.

Further information about these publications can be obtained by telephoning (09) 222 3106.

Surveys and Mapping

The Surveys and Mapping Division produced numerous publications and maps during the year.
They included a supplement relating to Petroleum Exploration and Development of the State, a Tengraph brochure and a Technical Advice brochure.
Maps included:

Informative Maps

- Mineral Tenement Maps
- Department Public Plans
- Mine Plans - surface and underground
- Index to Public Plans
- Mining Act - Section 57(4) Areas
- Graticular Section Plans
- Petroleum Exploration and Development
- Tenement Map of the State (1:2 500 000)
- Petroleum Graticular Section Maps
- Petroleum Tenement Maps (1:1 000 000)

Thematic Maps

- Areas which have been held under Gold Mining Leases
- Administrative Divisions
- Historic Map - Wiluna to Kimberley Stock route
- Index to Special Agreement Acts
- Map Sheet Index
- Mineral Production
- Petroleum in Western Australia Tenement Map
- Western Australian Localities Map with Gazetteer
- Conservation Reserves of Western Australia, State Map
- Conservation Reserves of Western Australia, South West Region
- Aboriginal Reserves of Western Australia, State Map

APPENDIX 3

PRINCIPAL MINERAL & PETROLEUM PRODUCERS

Principal mineral and petroleum producers 1991, head office postal address, telephone number and location of minesite.

Base Metals

Copper

Murchison Zinc Co. Pty Ltd, C/- Normandy Poseidon Ltd, 8 Kings Park Rd, West Perth 6005, (09) 480 3232: Golden Grove.

Newcrest Mining Ltd, 600 St Kilda Rd, Melbourne 3004, (03) 522 5333: New Celebration, Telfer.

Western Mining Corp. Ltd, 191 Great Eastern Hwy, Belmont 6104, (09) 479 0711: Kambalda.

Lead - Zinc

BHP Minerals Ltd, 44 Hamersley St, Broome 6725, (091) 92 2006: Cadjebut.

Murchison Zinc Co. Pty Ltd, C/- Normandy Poseidon Ltd, 8 Kings Park Rd, West Perth, 6005, (09) 480 3232: Golden Grove

Bauxite - Alumina

Alumina

Alcoa of Australia (WA) Ltd, PO Box 252, Applecross 6153, (09) 316 5111: Del Park, Jarrahdale, Willowdale.

Worsley Alumina Pty Ltd, PO Box 344, Collie 6225, (097) 34 8311: Boddington.

Clay

Attapulgite

Mallina Holdings Ltd, 249 Stirling Hwy, Claremont 6010, (09) 384 7077: Lake Nerramyne.

Cement Clay

Boral Resources Ltd, 136 Great Eastern Hwy, South Guildford 6055, (09) 279 0000: Armadale.

Kaolin

Greenbushes Ltd, 16 Parliament Pl, West Perth 6005, (09) 481 1988: Greenbushes.

White Clay

Pilsley Investments Pty Ltd, Military Rd, Midland 6056, (09) 250 2111: Middle Swan

Coal

Griffin Coal Mining Co. Ltd, 28 The Esplanade, Perth 6000, (09) 325 8155: Collie

Western Colleries Ltd, 40 The Esplanade, Perth 6000, (09) 327 4511: Collie.

Construction Materials

Aggregate

The Readymix Group (WA), 75 Canning Hwy, Victoria Park 6100, (09) 472 2000: Boodarrie, Boulder, Oscar Range.

Gravel

Leslie Salt Company (Inc), 225 St Georges Tce, Perth 6000, (09) 321 1668: Port Hedland.

Vinci and Sons Pty Ltd, Lot 3 Pickering Brook Rd, Pickering Brook 6076, (09) 293 8295: Pickering Brook.

Rock

County B.S., C/- Specified Services, 123 Burswood Rd, Victoria Park 6100, (09) 362 1100: Yeeda Station.

Specified Services Pty Ltd, 123 Burswood Rd, Victoria Park 6100, (09) 362 1100: Learmonth, Mt Regal.

Sand

Amatek Ltd, 1 Newburn Rd, Kewdale 6104, (09) 353 3030: Gnangarra, Jandakot.

B & J Catalano Pty Ltd, Southwest Hwy, Brunswick Junction 6224, (097) 26 1247: Wellington.

Quinton Pty Ltd, Lot 117 Cnr Great Eastern Hwy Coolgardie Rd, Kalgoorlie 6430, (090) 213 961: Coolgardie.

The Readymix Group (WA), 75 Canning Hwy, Victoria Park 6100, (09) 472 2000:

APPENDIX 3

PRINCIPAL MINERAL & PETROLEUM PRODUCERS

Boodarrie Station, Christmas Creek, Comet Vale, Karratha, Newman, Rocklea, Sullivan's Creek, Turner River, Warrawanda Creek, Widgiemooltha.

Tuma Holdings Pty Ltd, 42 Noel Rd, Gooseberry Hill 6076, (09) 293 3948: Chidlow.

Diamond

Argyle Diamond Mines, 2 Kings Park Rd, West Perth 6005, (09) 482 1188: Argyle.

Poseidon Bow River Diamond Mines Ltd, 100 Hutt St, Adelaide, S.A., (08) 236 1700: Bow River.

Dimension Stone

Black Granite

City West Holdings Ltd, C/- 102 Railway Pde, West Perth 6005, (09) 481 5760: Lennard.

De Biasi D, P.O Box 351, Broome 6725, (091) 935 562: Lennard.

Fraser Range Granite NL, 164 Burswood Rd, Victoria Park 6100, (09) 4704487: Mt Malcom.

Quartz rock

Commercial Minerals Ltd, 26 Tomlinson Rd, Welshpool 6106, (09) 362 1411: Mukinbudin.

Spongolite

Woodbridge Investments Pty Ltd, PO Box 591, South Perth 6151: Mt Barker

Gem, Semi-precious & Ornamental Stone

Amethyst

Soklich F, Lot 326 Dale Pl, Orange Grove 6109, (09) 459 1449: Gascoyne.

Chrysoprase

Aplo Pty Ltd, 132 Broome St, Cottesloe 6011, (09) 383 2551: Marshall Creek.

WA Gem Explorers, 326 Hay St, Perth 6000, (09) 325 4988: Boyce Creek.

Gold

Arimco NL, 20 Berry St, North Sydney NSW 2060 (02) 955 1722: Gidgee.

Asarco Australia Ltd, 15 Altona St West Perth 6005, (09) 481 2050: Wiluna.

Ashton Mining Ltd, 441 St Kilda Rd, Melbourne Vic 3004, (03) 867 5500:

Bardoc - Davyhurst, Harbour Lights, Laverton.

Aztec Mining Company Ltd, 99 Shepperton Rd, Victoria Park 6100, (09) 470 1444: Bounty.

Bellevue Project, C/- Forsayth NL, 221 St Georges Tce, Perth 6000, (09) 322 7211: Bellevue:

Big Bell Mines Ltd, PO Box 2135, Geraldton 6530, (099) 63 1144: Big Bell.

Broken Hill Metals Ltd, 28 The Esplanade, Perth 6000, (09) 324 1370: Hopes Hill-Corinthian.

Burmine Ltd, Copperhead Mine, Bullfinch 6484, (090) 49 5066: Copperhead.

Centaur Mining and Exploration Ltd, 47 Collins St, West Perth 6005, (09) 481 5870: Davyhurst Lady Bountiful Extended.

Central Kalgoorlie Gold Mines NL, 49 Stirling Hwy, Nedlands 6009, (09) 381 1311: Bullabulling.

Central Norseman Gold Corp. NL, PO Box 56, Norseman 6443, (090) 39 1101: Central Norseman.

Consolidated Exploration Ltd, 47 Colin St, West Perth 6005,(09) 481 5870: Davyhurst, Lady Bountiful.

Coolgardie Gold NL, 56b Bayley St, Coolgardie 6429, (090) 26 6132: Bayley's Reward.

Dominion Mining Ltd, 10 Richardson St, West Perth 6005, (09) 426 6400:

Bannockburn, Gabanintha, Labouchere, Meekatharra, Mt Morgans, Redcastle, Tower Hill.

Eltin Minerals Pty Ltd, PMB 31, Kalgoorlie 6430, (090) 21 4844: Norris.

Eon Metals NL, C/- Jeffrey Herbert (Official Receiver & Manager) Arthur Anderson, 225 St Georges Tce, Perth 6000, (09) 483 2222: Matilda

APPENDIX 3

PRINCIPAL MINERAL & PETROLEUM PRODUCERS

Forsayth Pty Ltd, 221 St George's Tce, Perth 6000, (09) 322 7211: Cox's, Lawlers, McCafferys.

Golden Kilometre Mines JV, 4/100 Hay St, Subiaco 6008, (09) 382 3300: Mt Pleasant, Lady Bountiful South, Racetrack/Royal Standard.

Golden Valley Mines NL, 174 Hampden Rd, Nedlands 6009, (09) 389 1999: Frasers.

Hampton Australia Ltd, C/- Poseidon Gold Ltd, 8 Kings Park Rd, West Perth 6005, (09) 480 3232: Jubilee.

Hannans Gold Ltd, 49 Stirling Hwy, Nedlands 6009, (09) 389 1311: Comet - Pinnacles.

Hedges Gold Pty Ltd, Cnr Davy and Marmion Sts, Booragoon 6153, (09) 364 0111: Hedges.

Herald Resources Ltd, 45 Richardson St, West Perth 6005, (09) 322 2788: Sandstone, Tindals, Three Mile Hill.

Hill 50 Gold Mine NL, PO Box 83, Mt Magnet 6638, (09) 63 4104: Mt Magnet.

Homestake Gold of Australia Ltd, 191 Fullarton Rd, Dulwich SA 5065, (08) 332 7811: Fortnum.

Kalgoorlie Consolidated Gold Mines Pty Ltd, Fimiston, Kalgoorlie 6430, (090) 22 1100: Super Pit, Fimiston, Mt Charlotte, Mt Percy.

Kitchener Mining NL, Suite 21, Piccadilly Sq, cnr Short St & Nash St, Perth 6000, (09) 325 4997: Bamboo Creek.

Leader Resources NL, 3/18 Kearns Cr, Applecross 6153, (09) 364 9222: Double A-Goanna Patch.

Metana Minerals, 191 Great Eastern Hwy, Belmont 6104, (09) 277 9944: Kurara, Penny West. Reedy, Youanmi.

Mt Edon Gold Mines (Aust) NL, 30 Ledgar Rd, Balcatta 6021, (09) 345 1588: Tarmoola.

Mt Gibson Management Pty Ltd, 28 The Esplanade, Perth 6000, (09) 322 2313: Mt Gibson.

Newcrest Mining Ltd, 600 St Kilda Rd, Melbourne 3004, (03) 522 5333: New Celebration, Orban JV, Ora Banda - Gimlet South, Telfer, Tuckabianna.

North Broken Hill - Peko Ltd, 476 St Kilda Rd, Melbourne Vic 3004, (03) 829 0000: Kanowna, Peak Hill.

Orion Resources NL, 42 Ardross St, Applecross 6153, (09) 364 8355: Yilgarn Star.

Pancontinental Gold (0perations) Pty Ltd, PO Box 1161, Kalgoorlie 6430, (090) 24 2000: Kundana, Paddington.

Placer (Granny Smith) Pty Ltd, PO Box 33, Laverton WA 6440, (090) 31 3111: Granny Smith.

Plutonic Resources Ltd, PMB 46 Meekatharra 6642, (09) 370 8201: Plutonic.

Poseidon Gold Ltd, 8 Kings Park Rd, West Perth 6005, (09) 480 3232: Golden Crown, Kaltails, Karonie.

Ramsgate Resources Ltd, 229 Stirling Highway, Claremont 6010, (09) 383 4321: Mt Monger.

Reynolds Yilgarn Gold Oprerations Ltd, 28 The Esplanade, Perth 6000, (09) 322 2313: Edwards Find, Marvel Loch, Transvaal.

St Barbara Mines Ltd, Gt Northern Highway, Meekatharra 6642, (099) 81 8111: South Junction.

Samantha Gold NL, 28 The Esplanade, Perth 6000, (09) 481 5288: Higginsville.

Sons of Gwalia NL, 16 Parliament Pl, West Perth 6005, (09) 481 1988: Barnicoat, Sons of Gwalia.

Southern Goldfields Ltd, 35 Outram St, West Perth 6005, (09) 321 5115: Burbidge, Nevoria.

Sundowner Minerals NL, 221 St George's Tce, Perth 6000, (09) 322 7211: Darlot.

Western Mining Corp. Ltd, 191 Great Eastern Hwy, Belmont 6104, (09) 479 0711: Emu, Kambalda, Lancefield.

Worsley Alumina Pty Ltd, PO Box 48, Boddington 6390, (098) 83 8260: Boddington.

APPENDIX 3

PRINCIPAL MINERAL & PETROLEUM PRODUCERS

Gypsum

H.B. Brady & Co. Pty Ltd, PO Box 42, Bayswater 6053, (09) 279 4422: Lake Brown.

Swan Portland Cement Ltd, Burswood Rd, Rivervale 6103, (09) 361 8822: Lake Hillman.

Westdeen Holdings Pty Ltd, 7 Armstromg Rd, Applecross 6153, (09) 364 4951: Wyalkatchem

Heavy Mineral Sands

Garnet Sand

Target Minerals NL, PO Box 188, Geraldton 6530, (099) 23 3644: Port Gregory.

Ilmenite, Rutile, Zircon, Leucoxene & Monazite

RGC Mineral Sands, 45 Stirling Hwy, Nedlands 6009, (09) 389 1222: Capel, Eneabba North, Eneabba South

Cable Sands (WA) Pty Ltd, PO Box 133, Bunbury 6230, (097) 21 4111: Capel.

ISK Minerals Pty Ltd, PO Picton 6229, (097) 25 4899: Waroona.

TiWest Pty Ltd, 1 Brodie Hall Dve, Bentley 6102, (09) 365 1390: Cooljarloo.

Westralian Sands Ltd, PO Box 96, Capel 6271, (097) 27 2002: Yoganup.

Industrial Pegmatite Minerals

Felspar

Commercial Minerals Ltd, 26 Tomlinson Rd, Welshpool 6106, (09) 362 1411: Mukinbudin, Pippingarra.

Mica

Commercial Minerals Ltd, 26 Tomlinson Rd, Welshpool 6106, (09) 362 1411: Pippingarra.

Iron Ore

BHP Iron Ore (Goldsworthy) Ltd, 200 St George's Tce, Perth 6000, (09) 320 4444: Shay Gap.

BHP Iron Ore Ltd, 200 St George's Tce, Perth 6000, (09) 320 4444: McCameys, Newman, Yandi.

BHP Minerals Ltd, P.O Koolan Island 6733, (091) 910 575: Koolan Island.

Channar Mining Pty Ltd, 191 St George's Tce, Perth 6000, (09) 327 2327: Channar

Hamersley Iron Pty Ltd, 191 St George's Tce, Perth 6000, (09) 327 2327: Tom Price, Paraburdoo, Brockman.

Robe River Iron Associates, 12 St George's Tce, Perth 6000, (09) 421 4747: Pannawonica.

Limesand - Limestone

Cockburn Cement Ltd, Russell Rd, South Coogee 6166, (09) 410 1988: Cockburn Sound, Coogee.

Success Restaurant Pty Ltd, 18 Harvest Terrace, West Perth 6005,: Moore River.

Limestone Building Blocks Co. Pty Ltd, 41 Spearwood Ave, Bibra Lake 6163, (09) 418 4440: Nowerup.

Swan Portland Cement Ltd, Burswood Rd, Rivervale 6103, (09) 361 8822: Wanneroo.

Westdeen Holdings Pty Ltd, 7 Armstromg Rd, Applecross 6153, (09) 364 4951: Dandaragan, Gingin, Irwin, Yanchep.

Manganese Ore

Portman Mining Ltd, Level 13, 256 Adelaide Tce, Perth 6000, (09) 268 3333: Woodie Woodie.

Nickel

Western Mining Corp. Ltd, 191 Great Eastern Hwy, Belmont 6104, (09) 478 0711: Blair, Carnilya Hill, Kambalda, Leinster.

Peat

Peat Resources of Australia Pty Ltd, P.O Box 203, Bentley 6102, (09) 453 3388: Manjimup.

APPENDIX 3

PRINCIPAL MINERAL & PETROLEUM PRODUCERS

Petroleum

Arrow Petroleum Ltd, 99 Shepparton Rd, Victoria Park 6010, (09) 470 0400: Mt Horner

Consolidated Gas Pty Ltd, 174 Hamden Rd, Nedlands 6009, (09) 389 8344: Woodada.

Doral Resources, 31 Ventnor Ave, West Perth 6005, (09) 481 5866: Tubridgi.

Hadson Energy Ltd, 35 Ventnor Ave, West Perth 6005, (09) 481 8555: Harriet.

Marathon Petroleum Aust. Ltd, 239 Adelaide Tce, Perth 6000, (09) 325 1988: Talisman.

Petroleum Securities Energy Ltd, C\- Ozco Pty Ltd, 15 Whelk Place, Mullaloo 6025, (09) 307 1345: Blina, Lloyd, Sundown/West Terrace.

Sagasco Holdings Ltd, 60 Hindmarsh Sq, Adelaide SA 5000, (08) 235 3700: Beharra Springs.

West Aust. Petroleum Pty Ltd (WAPET), 233 Adelaide Tce, Perth 6000, (09) 325 0181: Barrow Island, Dongara, Saladin.

Western Mining Corp. Ltd, 28 Ventnor Ave, West Perth 6005, (09) 482 2444: Airlie Island.

Woodside Offshore Pet. Pty Ltd, 1 Adelaide Tce, Perth 6000, (09) 244 4111: North Rankin.

Salt

Dampier Salt (Operations) Pty Ltd, 177A St George's Tce, Perth 6000, (09) 327 2299: Dampier, Lake Macleod.

Leslie Salt Company (Inc), 225 St George's Tce, Perth 6000, (09) 325 4888: Port Hedland.

Shark Bay Salt Joint Venture, 22 Mount St, Perth 6000, (09) 322 4811: Useless Loop.

WA Salt Koolyanobbing Pty Ltd, Cockburn Rd, Hamilton Hill 6163, (09) 430 5495: Lake Deborah East.

Silica - Silica Sand

Silica

Simoca Operations Pty Ltd, P.O Box 1389 , Bunbury 6230, (097) 912 588: Dalaroo.

Silica Sand

ACI Operations Pty Ltd, 35 Baille Rd, Canning Vale 6155, (09) 455 1111: Lake Gnangara.

Amatek Ltd, 1 Newburn Rd, Kewdale 6104, (09) 353 3030: Jandakot, Gnangara.

Boral Resources WA Ltd, 136-138 Gt Eastern Hwy, South Guildford 6055, (09) 279 0000: Jandakot.

The Readymix Group (WA), 75 Canning Hwy, Victoria Park 6100, (09) 472 2000: Jandakot.

Western Mining Corp. Ltd, 191 Great Eastern Hwy, Belmont 6104, (09) 478 0711: Mt Burgess.

Talc

Western Mining Corp. Ltd, PO Box 116, Three Springs 6519, (099) 54 5047: Three Springs.

Tin - Tantalum - Lithium

Spodumene

Lithium Australia Ltd, 16 Parliament Pl, West Perth 6005, (09) 481 1988: Greenbushes.

Tantalite - Tin

Goldrim Mining Australia Ltd, 317 Hunter St, Newcastle NSW 2300, (049) 29 2433: Wodgina.

Greenbushes Ltd, 16 Parliament Place, West Perth 6005, (09) 481 1988: Greenbushes.

Pan West Tantalum Pty Ltd, Gateway, 1 Macquarie Place, Sydney NSW 2000, (02) 256 2000: Wodgina.

Vermiculite

Vermiculite Industries Pty Ltd, 15 Spencer St, Jandakot 6164, (09) 417 9900: Young River.

APPENDIX 4

DEPARTMENT DIRECTORY

Head Office

Department of Minerals and Energy
Mineral House Complex
100 Plain Street (cnr Adelaide Terrace)
EAST PERTH Western Australia 6004
Telephone (09) 222 3333
Fax (09) 222 3430

Metropolitan Offices

Chemistry Centre (WA)
125 Hay Street
EAST PERTH Western Australia 6004
Telephone (09) 325 5544
Fax (09) 325 7767

Baldivis Explosives Reserve
Stakehill Road
BALDIVIS Western Australia 6171
Telephone (09) 524 1301
Fax (09) 524 1792

Exploration Safety and Drilling
91 Briggs Street
WELSHPOOL Western Australia 6106
Telephone (09) 470 0300
Fax (09) 362 5694

Mineral Processing Laboratory
19 Catherine Street
BENTLEY Western Australia 6102
Telephone (09) 351 5777
Fax (09) 351 8197

Regional Offices

Collie

Coal Industries Council
66 Wittenoom Street
COLLIE Western Australia 6225
Telephone (097) 344 599
Fax (097) 344 142

Regional Mining Engineer
66 Wittenoom Street
COLLIE Western Australia 6225
Telephone (097) 341 222
Fax (097) 34 606

Kalgoorlie

Regional Mining Engineer
Brookman Street (Box 671)
KALGOORLIE Western Australia 6430
Telephone (090) 219 411
Fax (090) 213 612

Kalgoorlie Metallurgical Laboratory
95 Egan Street (Box 881)
KALGOORLIE Western Australia 6430
Telephone (090) 805 120
Fax (090) 912 762

Mining Registrar
Brookman Street (Box 364)
KALGOORLIE Western Australia 6430
Telephone (090) 213 066
Fax (090) 912 428

Kalgoorlie Explosives Reserve
Piccadilly Street West
KALGOORLIE Western Australia 6430
Telephone (090) 218 246
Fax (090) 913 222

Geological Survey of WA Regional Office
Egan Street
KALGOORLIE Western Australia 6430
Telephone (090) 219 425
Fax (090) 914 499

Karratha

Regional Mining Engineer
Hedland Place (Box 518)
KARRATHA Western Australia 6714
Telephone (091) 868 243
Fax (091) 868 251

Broome

Mining Registrar
Court House (Box 28)
BROOME Western Australia 6725
Telephone (091) 921 137
Fax (091) 921 878

Carnarvon

Mining Registrar
Court House (Box 35)
CARNARVON Western Australia 6701
Telephone (099) 411 082
Fax (099) 412 779

Coolgardie

Mining Registrar
40 Bayley Street (Box 41)
COOLGARDIE Western Australia 6429
Telephone (090) 266 066
Fax (090) 266 204

Kununurra

Mining Registrar
Court House (Box 917)
KUNUNURRA Western Australia 6743
Telephone (091) 681 011
Fax (091) 681 103

Leonora

Mining Registrar
Rochester Street (Box 4)
LEONORA Western Australia 6438
Telephone (090) 376 106
Fax (090) 376 248

Marble Bar

Mining Registrar
Bohemia Road (Box 7)
MARBLE BAR Western Australia 6760
telephone (091) 761 044
Fax (091) 761 048

Meekathara

Mining Registrar
Main Street (Box 7)
MEEKATHARRA Western Australia 6642
Telephone (099) 811 008
Fax (099) 811 482

Mt Magnet

Mining Registrar
Richardson Street (Box 13)
MT MAGNET Western Australia 6638
Telephone (099) 634 040
Fax (099) 634 488

Norseman

Mining Registrar
Princep Street
NORSEMAN Western Australia 6443
Telephone (090) 391 082
Fax (090) 391 657

Southern Cross

Mining Registrar
Great Eastern Highway
SOUTHERN CROSS Western Australia 6426
Telephone (090) 491 107
Fax (090) 491 431

ORGANISATION CHART