



Annual Report
1991 - 1992

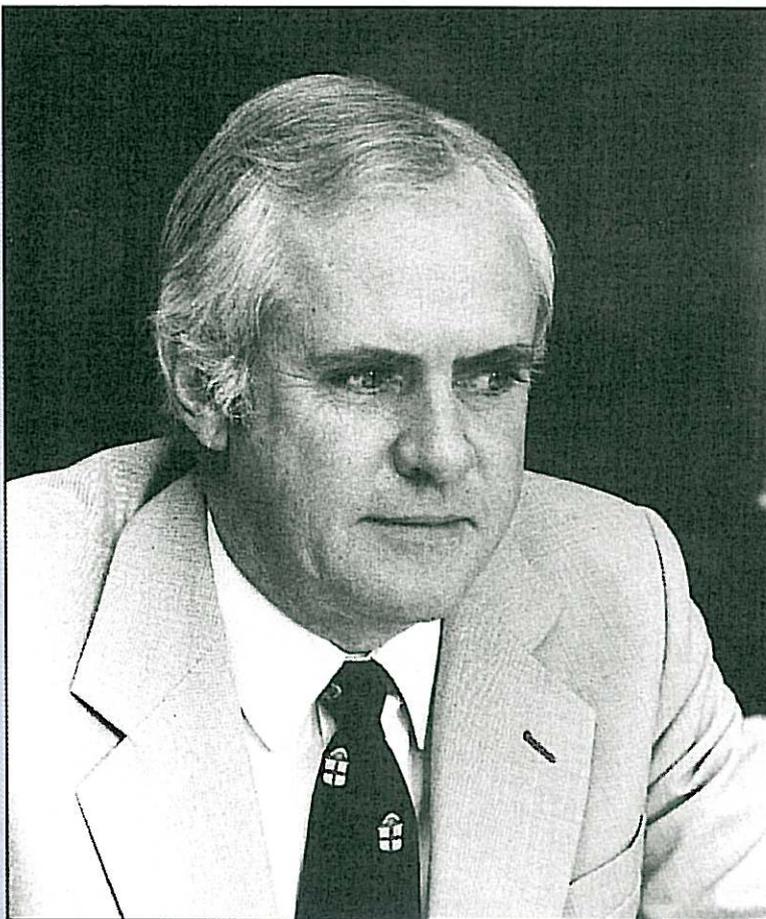
Council
for Nuclear
Safety

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Chairman's foreword

Prof. J B Martin, Chairman



After three years as an independent body the Council has reviewed its objectives and powers and the effectiveness with which its structure and staffing have enabled it to perform its functions. I am glad to say that it can be satisfied with the extent to which it has achieved its goals and that it has done so on a sound financial footing with a reduced requirement for State funding. Inevitably, to keep pace with changing circumstances we must make appropriate changes from time to time and so, as the scope and nature of licensing work have developed, certain legislative amendments have become necessary. These have been incorporated in a Nuclear Energy Bill which is now in its final stages of drafting.

As more doors open to us we realise that we have been successful in establishing and maintaining standards that compare favourably with the best internationally. Nevertheless, as our industry matures we must guard against complacency and it is paramount that the Council maintains its vigilance. Throughout the development of the nuclear industry, occupational and public safety concerns have provided a shifting focus with which the Council and its staff have maintained close awareness.

The Council stipulates that nuclear risks should not add significantly to the total risks to which society is exposed and should compare favourably with the risks imposed by other industries. To this end the engineered features of nuclear installations and the ever present human factors need to be continually scrutinised in order to ensure the efficacy of the full range of protective measures.

Nuclear damage, its probability and likely extent, the liability and compensation for such damage and the provision of financial security against possible claims for compensation, are matters receiving world-wide attention – intensified since the Chernobyl disaster – and the Council is keeping abreast of developments in this regard. Being geographically isolated as we are, our situation is different from that prevailing in the northern hemisphere, and particularly in Europe, where there is a large "nuclear neighbourhood" and consequently greater concern about transboundary conveyance of nuclear material and transboundary effects of possible nuclear accidents. Developments in these other areas are nonetheless closely followed in order to ensure that our own provisions take all relevant factors into account and that, apart from meeting our own regional requirements (vis-a-vis ourselves and our neighbours), they will ensure that our overall relationships, in respect of regulation of the use and the conveyance of nuclear materials, are in accordance with international practice.

Early in the year Mr B C Winkler, formerly Deputy General Manager of the Council, was appointed Executive Officer in succession to Mr J O Tattersall, who retired on 1 May 1991. Bert Winkler, who joined the staff of the Licensing Branch of the Atomic Energy Board in the very early days, has a long experience and a wide knowledge of nuclear licensing and of the Council's activities. I welcome him and wish him well in his new post and look forward to our association in the coming years.

Finally, I must express my thanks to the members of the Council and its staff for their efforts and support throughout the year and to the Minister of Mineral and Energy Affairs, the Minister of Finance and the Department of Mineral and Energy Affairs, for their co-operation and support.

Engineered
features
and human
factors are
continually
scrutinised

Executive Officer's review

Mr B C Winkler, Executive Officer



Right at the outset of this, the first annual report of the Council's activities under new leadership, I would like to pay tribute to the enormous contribution made by my predecessor, Mr J O Tattersall, who retired on 1 May 1991, to the licensing of nuclear facilities and activities in South Africa. Thanks to his unstinting efforts over the years, taking over from him has been made easier because it has meant taking up the reins of an organisation based on a sound philosophy embracing accepted scientific principles.

The South African licensing regime has developed gradually over the period since the formation of the Licensing Division of the Atomic Energy Board in 1969, with Mr J O Tattersall initially its only member of staff and when Koeberg was no more than a future project, to the present stage, with the Council for Nuclear Safety as an independent regulatory body. The latter's activities encompass, inter alia, Koeberg as a fully operational nuclear power station, the AEC's projects at Pelindaba and Vaalputs and a substantial number of operations involving the mining and processing of uranium and thorium bearing ores.

There have been many changes over that period, both in activities

and in staff and there will doubtless be further developments to come. We have been fortunate in developing a competent organisation with experienced people, whom I feel privileged to lead and with whom I look forward to the future with confidence. The staff constitute the Council's most valuable asset and I am exceedingly grateful to each and every one of them for their contributions towards the establishment of nuclear regulation in South Africa.

This past year has been a satisfactory one overall, and a summary of the Council's activities is given later in this report. The inevitable scrutiny of the organisational structure of the Council's staff and resultant restructuring was a source of uncertainty to them, but all of this is behind us and we can now face the future with new motivation and confidence.

It is not a simple matter to introduce complex regulatory control requirements into a well-established industry but good progress has nonetheless been made in the licensing of activities in the mining industry. The understanding shown by the industry and the co-operative spirit in which it has worked with the Council to make that progress have been greatly appreciated, as, indeed, have the corresponding attitudes of Eskom, the Atomic Energy Corporation and other licensees in their respective licensing areas.

My thanks are also due to the Department of Mineral and Energy Affairs and to its Director General, Dr P J Hugo, for guidance and help during the year, to the Minister of Mineral and Energy Affairs, Mr G S Bartlett for his understanding and support and to my Chairman, Prof. J B Martin and the Council.

The Council and its meetings

During the year Mr S W A Hanekom resigned from the Council, following his transfer within his department, and was replaced by Dr L A Dreyer, Chief Director, Land Transport Management, in the Department of Transport. Thus at the end of the year the Council consisted of the following members:

Chairman: Prof. J B Martin

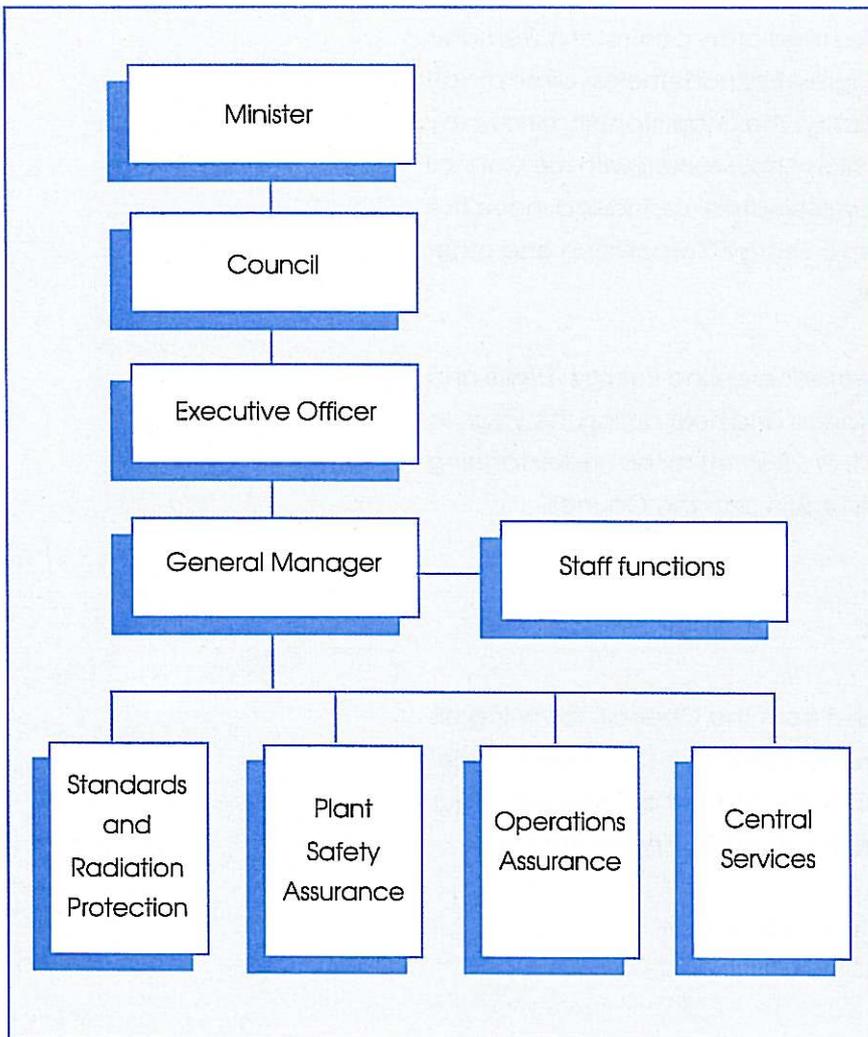
Dean, Faculty of Engineering, University of Cape Town

Vice-chairman: Mr L D Hobbs

Chairman, Rand Water Board

It is not a
simple
matter to
introduce
complex
regulatory
control into
a well-
established
industry

Diagram 1: Council Structure



Members

Dr L A Dreyer

Chief Director, Land transport Management, Department of Transport

Prof. R K Dutkiewicz

Director, Energy Research Institute, University of Cape Town

Mr M du Toit

Chief Director, Development Co-ordination, Office for Regional Development

Mr S A Gerber

Chief Director, Environmental Conservation, Department of Environment Affairs

Prof. R G Harley

Head, Department of Electrical Engineering, University of Natal

Dr P R Le Roux

Director, Radiation Control, Department of National Health and Population Development

Mr H J Matthysen

Chief Executive, Liquefied Petroleum Gas Safety Association of SA

Dr D Reitmann

Chief Director, National Accelerator Centre, CSIR

Mr P Scribante

Formerly Director, Mechanical Engineering, SA Bureau of Standards

Prof. A F Steyn (co-opted member)

Head, Department of Sociology, Rand Afrikaans University

Dr P D R van Heerden

President, SA Medical Research Council

The Council held six scheduled meetings in the course of the year. After the November meeting members visited Koeberg nuclear power station to attend a presentation on Reactor Operator Training and Licensing, given by Mr A C Hall, Manager of the Council's Operations Assurance Department. The presentation was followed by a visit to the Koeberg reactor simulator, where members of the Council's staff demonstrated emergency scenarios.

Structure and Staffing

Following the retirement of Mr J O Tattersall, the Minister appointed Mr B C Winkler as Executive Officer with effect from 2 May 1991.

Early in the year the organisational structure of the Council was changed in order to maximise the utilisation of its available human resources and to reflect more accurately the objectives of its technical departments. Under the revised organisation, which is shown in Diagram 1, Mr J Leaver was appointed General Manager, with overall responsibility for management of the administrative and technical functions of the Council.

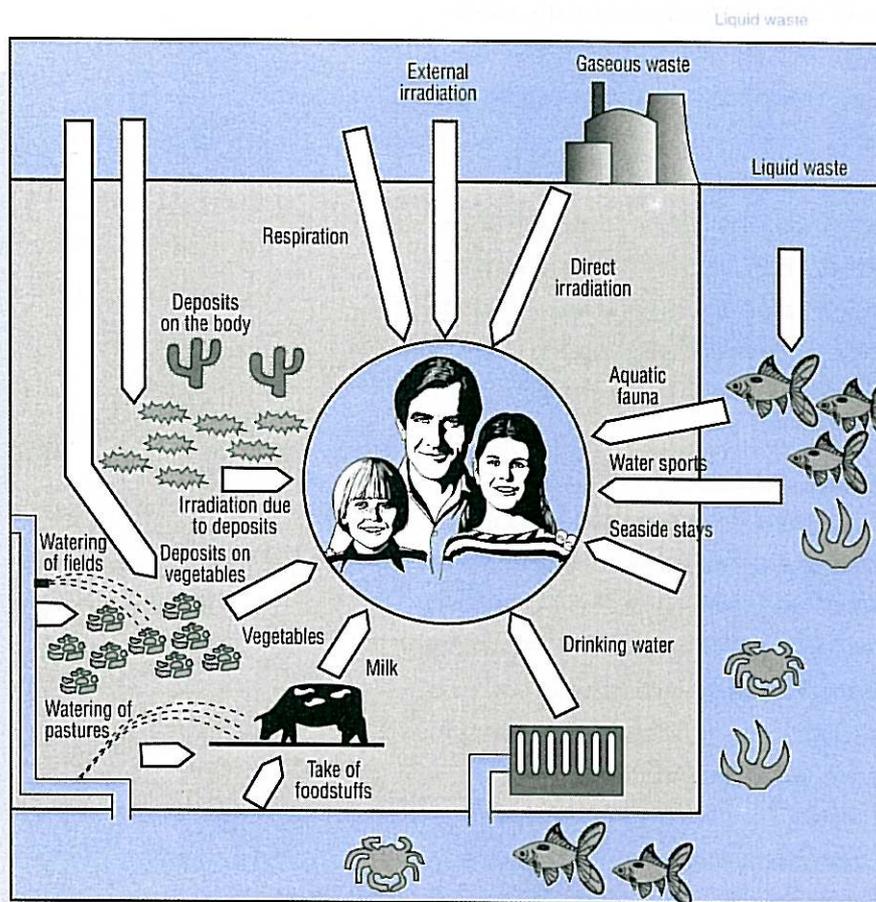
The three technical departments were renamed. The former Standards Department, now Standards and Radiation Protection Department, has overall responsibility for establishing fundamental safety standards and the derivation of applied radiological safety standards. This Department also assures that the operations and activities of licensees are consistent with these standards.

The Evaluation Department, renamed Plant Safety Assessment Department, has the objective of ensuring that the risk imposed on the public by nuclear installations and other activities involving nuclear-hazard material is at all times acceptable according to the safety standards determined by the Council. Its task in achieving this objective is to carry out in-depth studies and technical assessments of all aspects of nuclear installations and activities which have a bearing on safety and to assure that operational practices do not lead to unacceptable levels of risk to members of the workforce and the public.

The former Inspection Department, now Operations Assurance Department, has overall responsibility for conducting inspections and surveillances at

The
structure of
the Council
was
changed to
maximise
utilisation
of human
resources

Diagram 2: Typical environmental exposure pathways



licensed installations and to assure compliance with licence requirements and for reactor operator examinations and requalification. In addition to its head office staff this Department has a team of six staff members permanently resident at Koeberg nuclear power station and also maintains a permanent site office at the AEC's Pelindaba site.

Projects co-ordination, which was hitherto a staff function, has now been brought within the ambit of the Operations Assurance Department and Koeberg project co-ordination is the particular responsibility of the Assistant Manager of that Department.

Commensurate with the new approach taken by the Council to maximise the contribution of its staff, the members of the Generic Studies Division were appropriately transferred to the three technical departments.

The Council provides the national communication link with the International Atomic Energy Agency (IAEA) in respect of the Agency's Incident Reporting System (IRS), International Nuclear Event Scale (INES) and Power Reactor Information System (PRIS).

Fundamental safety standards

A detailed review of the fundamental safety standards established by the Council, and by which the acceptability of licensed practices is judged, has been initiated. This work has addressed both the philosophical basis of such standards and the mechanics of risk quantification.

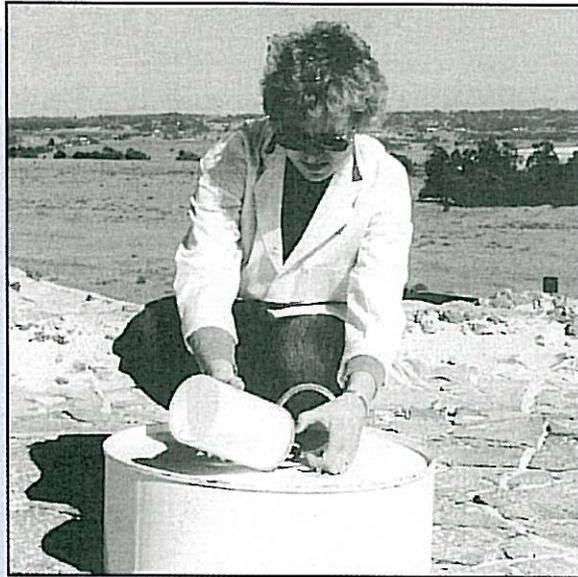
The implications of the most recent recommendations of the International Commission on Radiological Protection (ICRP) have been given the Council's careful consideration. These recommendations arise from continuing epidemiological studies of the Japanese atomic bomb survivors and other exposed groups and from developments in the philosophical basis of risk acceptance and in the practice of radiological protection. From the epidemiological studies, it has been concluded that the risk per unit exposure to radiation is almost three times higher than had previously been indicated. This, together with the more sophisticated consideration of the expression of such risk, which takes into consideration the absolute magnitude of fatality risk, the age at death, the number of years of life lost, non-fatal effects and genetic effects, has led the ICRP to recommend a reduction in individual radiation dose limits for the occupationally exposed workforce and the general public.

The ICRP continues to recommend that radiation doses be maintained as low as is reasonably achievable below these limits and that constraints on radiation exposure be established for particular practices. It also recommends that these provisions be applied to practices leading to such exposure as well as to those with the potential for accidental exposure. Developments in radiation protection practice have essentially demonstrated the arbitrary nature of some of the previous ICRP recommendations. It is now recommended that more flexibility be introduced into aspects such as classification of areas, monitoring surveillance, medical supervision of workers and individual personal dosimetry, in the interests of achieving an optimal degree of protection.

The Council has maintained close contact with the ICRP over the years and has already implemented many of the principles now included in the new recommendations. Certain aspects of the new recommendations, in particular those relating to occupational exposure within the mining industry, required further clarification, and developments in this regard are being carefully monitored

Licensing
standards
and
radiation
risk

Right: Monitoring for natural radon
Below: Water sampling at Hartbeespoort Dam



Courtesy: AEC

by the Council. In line with general international practice, the Council is considering implementation of the provisions of the new recommendations in consultation with licensees, the workforce and other potentially affected parties. Meanwhile, licensees have been advised to emphasize the need to maintain radiation exposures and risks as far below existing limits as is reasonably achievable.

Assessment of radiological risk

Radiological risks from licensed activities arise both in the course of normal operation and, potentially, from accidents and can apply to the workforce associated with the activity and to the general public. The licensing process establishes standards of acceptability of such risks and evaluates the provisions put in place by the licensee to ensure compliance with the standards. Realization of this process requires complex assessment mechanisms which must be subject to continual scrutiny and development. In this regard the Council has obtained a number of recently developed and updated radiation physics computer codes for use in the specific areas of

atmospheric dispersion and radiation transport associated with the assessment processes.

Extensive efforts have been expended in setting up these large and complex computer codes and in assembling the relevant input data. The latter process has highlighted significant problems in relation to the application of consistent and adequate meteorological quantification systems and to assess associated atmospheric dispersion parameters. The Council has instigated a national co-operative effort by various groups and organizations concerned with atmospheric dispersion modelling to assess the impact of radioactive and other toxic pollutants released into the atmosphere.

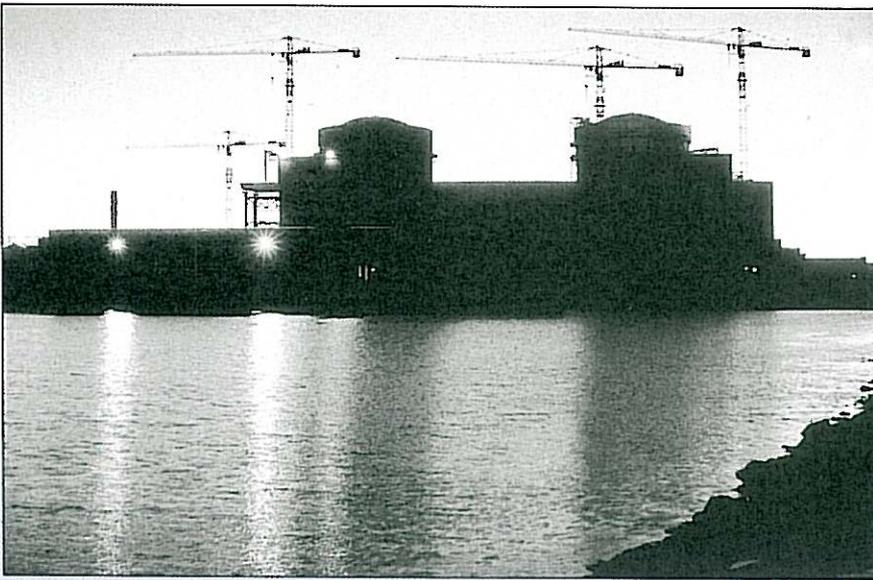
The
licensing
process
involves
complex
assessment
mechanisms

Koeberg

Operational control of occupational radiation exposure

The control over radiological hazards, both to the occupationally exposed workforce and to members of the public, as a result of normal operation of the Koeberg plant has been the subject of continual monitoring and review. The period under review has seen the fourth refuelling and maintenance outage for unit 2, and the beginning of the fifth for unit 1. The collective dose for the former was 1.14 man Sv and that for the latter, in respect of activities undertaken during the report period, was 0.98 man Sv. The annual collective dose for the calendar year 1991 was 1.64 man Sv. These figures are well within the Council's limits and, when compared worldwide with occupational exposure experience at other reactor sites, demonstrate the excellence of the operational radiological protection programme at Koeberg.

Koeberg Nuclear Power Station
(silhouette)



Courtesy: Eskom

Effluent discharge

The discharge of radioactive material to the environment in both liquid and gaseous effluent continues to be below authorised levels and radiation doses to members of the

public were correspondingly well within prescribed limits. Development work which is in progress in the modelling of radioactivity migration within the Koeberg facility will enable enhanced application of the principle of optimisation in the area of radiological effluent discharge control.

Environmental monitoring

As part of the assurance programme demonstrating the adequacy of control over radioactive effluent discharge to the environment, the environmental media, which are representative of the food chains and exposure pathways to the general public (see diagram 2), are the subject of a comprehensive monitoring programme conducted by Eskom. The Council satisfied itself from sample analyses carried out by Eskom, and independently from its own selected sample analyses, that the permissible levels of radioactivity have not been exceeded.

Radioactive waste

The Council continued its monitoring of the radioactive waste management programme at Koeberg, which was found to be both acceptable and successful. As a result of the completion of project work carried out by the Council on the quantification of radionuclide quantities, permission was granted for the disposal to the Vaalputs facility of solid radioactive waste in spent resins and filters from the waste treatment systems at Koeberg. Hitherto permission for such disposal had been given only in respect of evaporator concentrates from those systems.

Emergency planning and preparedness

Emergency planning involves not only the management and staff of a nuclear installation but also local authorities, neighbouring municipalities and numerous local, regional and national services. An emergency exercise, in which many, if not all, of these are activated, is designed with two principal objectives; one of these is to provide real time practice and so instil confidence, and

Environmental
media are
the subject
of a
comprehensive
monitoring
programme

Right: Koeberg annual emergency exercise, CNS umpire briefing.

Below: Emergency Control Centre, Koeberg Nuclear Power Station.



Courtesy: Eskom

improve competence in the carrying out of the necessary duties, and the other to identify deficiencies. In addition, it engenders mutual familiarisation between interfacing organisations and their individual members, which, in turn, improves understanding and communication. It is, therefore, an essential part of the regulatory process.

The Council's programme for surveillance and monitoring of emergency planning and preparedness at Koeberg was centred around the adequacy of communication with the public in the event of a major nuclear accident, and of emergency facilities together with a demonstration of their effective deployment. These were addressed through a public notification exercise, an audit of the facilities and a major demonstration exercise.

It was clear from this year's public notification exercise, and those carried out in previous years, that it is imperative to give detailed consideration to all aspects of communication in order to ensure its adequacy in all areas that could be affected by a nuclear accident. A special work group has been formed to ensure that all relevant facets of public notification are sufficiently provided for.

The full-scale emergency exercise was successful in identifying the nature of improvements which would benefit the making of protective action decisions based on plant and radiological conditions, and the plotting of the radioactive plume and associated data in such a manner as to reflect a more accurate and timely picture of the situation to the decision makers and civil protection authorities.

Late phase emergency nuclear planning for Koeberg

In line with international practice, it has been recognized that considerations for response to major nuclear accidents should be extended beyond the time frame associated with the initial plume passage. These considerations should encompass long term control and monitoring provisions locally, regionally and nationally. Over the past year, it was agreed with the National Co-ordinating Centre (Office of the State President) and the Department of Mineral and Energy Affairs that the Western Cape Joint Co-ordinating Centre will act as facilitator for late phase emergency planning. Subsequently the Council drafted a concept plan - "Late Phase Off-Site Nuclear Emergency Plan for Koeberg Nuclear Power Station" - which was distributed for comment and discussion to all the parties concerned. A work-group, named the *Cape Nuclear Emergency Committee* (CANEC), held its first meeting in March 1992 with a view to establishing the mechanism for co-ordinating the actions to be addressed during late phase planning.

Plant safety assessment and operations assurance

As an integral part of the licensing process associated with a major nuclear installation, the Council requires the licensee to gather information and data on a continuous basis in order to monitor the extent to which nuclear safety is established as an organisational culture, to be manifested through all the activities conducted by all the licensees' employees.

Reporting systems have been set up as a condition of licence and provide for the submission of information on the full range of safety-related behaviour of

A nuclear
emergency
plan must
function
effectively
and
coherently

Radiation protection monitoring operations. Koeberg Nuclear Power Station



Courtesy: E

both plant and personnel. As part of this programme, the licensee submits details of occurrences in his installation which are deserving of further investigation, with the view to improving plant safety. The Council routinely undertakes a study of the root causes of such occurrences in order to identify areas of weakness which could be precursors to more serious events. In this regard the Council arranged for an IAEA seminar on root cause analysis to be given in South Africa to representatives from the Council, Eskom and the AEC.

In addition, the demands of operating plants necessitate the implementation of modifications and procedural changes from time to time and the licence has to be updated to reflect these. The Council performs safety analyses on plant modifications and considers requests for procedural changes to assure that any associated risk implications remain within acceptable limits. Requests for fifty-four such changes were approved by the Council during the year.

The concept of a "living" probabilistic risk assessment (PRA) is one of increasing international interest. Work on the development of a living PRA for Koeberg progressed well, to

the stage where safety implications of requests for changes to the licence to cater, for example, for plant modifications, can be addressed on a dynamic basis. As part of this work a computer model for the Koeberg plant has been developed for analysing the impact on the containment building of possible accidents and the consequential release of radioactive products.

A programme of work to examine the environmental degradation of reactor pressure vessel steels and thermal ageing and crack initiation in cast austenitic steels has been initiated with the AEC. A further materials-related problem, receiving international attention in the nuclear industry, is that of microbiologically induced corrosion in certain items of nuclear power plant and the Council has completed an extensive report on this topic.

In line with world-wide practice, steps are being taken to incorporate an analysis of external hazards, such as fires, into the regulatory probabilistic risk assessment. For this purpose the PHOENICS computer code has been installed to develop a Koeberg-specific fire propagation model which will enable the Council to assess, more realistically, the consequences of potential fires in critical safety areas of the plant.

Neutronic studies to investigate the implications of reactor operation at reduced water inlet temperatures, with a view to extension of plant life, were carried out during the year and thermal hydraulic studies were undertaken to quantify safety margins within the reactor core.

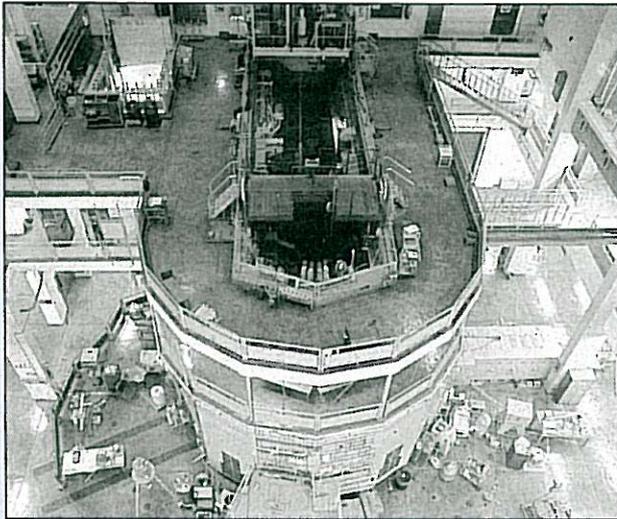
Other studies were successfully conducted, using PRA techniques, to determine the material integrity of certain mechanical components whose functions are essential to the reliable operation of safety-related plant systems.

During the year the Koeberg in-service inspection activities associated with the fifth outage of unit 1 and the fourth outage of unit 2 were assessed and found to be satisfactory.

The Council, continually aware of the significance of the human factor in nuclear-related operations, commenced work on improvements to the psychological testing of licensed reactor operators and on the group dynamics of shift operating. Work continued on an investigation into alcohol and drug

Steps are
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external
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regulatory
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risk
assessment

Right: SAFARI Research
Reactor, Pelindaba.
Below Uranium Enrichment
facility at Pelindaba



Courtesy: AEC

abuse testing with the objective of establishing the feasibility of, and necessity for, such programmes in South African nuclear establishments.

The Council also continued its close monitoring of the plant's reactor operators. Operator licensing examinations conducted during the year resulted in eight licences being issued to reactor operators and senior reactor operators and sixty-five licences being renewed.

The Council participated in the Operational Safety Review Team (OSART) mission to Koeberg, carried out by the IAEA, by providing the IAEA with co-ordination and liaison services, and were thereby able to monitor the mission's progress and to contribute to the final report findings.

Licensing of AEC facilities at Pelindaba

The licence granted to the AEC in respect of the operation of its facilities was varied to accommodate the design, manufacture, testing and examination of nuclear fuel which has been used in the Koeberg reactors. Fifteen requests for licence changes were approved during the year under review. These were to permit the use of the first four operational phases of the Hot Cell Complex and of the neutron radiography facility at the SAFARI research reactor and to allow variations in operating procedures at other facilities on the Pelindaba site.

Occupational exposures to the AEC workforce have remained consistently low and well within prescribed limits. Effluent discharges to the environment have been equally well controlled, in order to ensure that exposure of members of the public to radiation does not exceed limits laid down by the Council.

A licensing review commenced on the environmental monitoring programme for the Pelindaba site and the procedures employed in the analysis of environmental media.

Vaalputs radioactive waste disposal facility

Further work has been conducted on the radionuclide modelling process which forms the basis of the safety assessment for the Vaalputs site. During the year stringent monitoring, required under the licence, demonstrated compliance with the conditions of the licence.

Atomic
Energy
Corpora-
tion
(AEC)

Mining industry

Licensing of activities involving nuclear-hazard material

A programme of regulatory control over radiological hazards in the mining industry commenced in 1990 after lengthy discussions with the Government Mining Engineer and the mining industry.

As a result of its introduction, the Council had, by March 1991, issued nuclear licences to five mines, for activities involving nuclear-hazard material.

During the past year the Council issued licences to a further twelve mines and mineral processing facilities and one licence was surrendered, giving a total of seventeen licensed facilities. Twelve of these facilities are primary gold producers, one is a processor of uranium concentrate, one the site of a redundant sulphuric acid plant and the remaining three are producers of a variety of minerals including copper, monazite, zircon, baddeleyite, titanium, uranium and rare earths.

The Council has expended considerable effort on assisting mines and the Chamber of Mines Research Organisation and has produced a total of sixteen draft guidelines and

Opencast mining, Northern Transvaal



performed surveys in underground areas and in acid, gold and uranium plants at eight mines .

In addition, Council staff have extensively reviewed, and redrafted, a Chamber of Mines' training course on radiation surveys to enable mine staff to undertake measurement of various radiological parameters.

Underground surveys carried out by the Council in gold mines have confirmed that workers are occupationally exposed to radon and thoron daughters, gamma radiation and airborne long-lived alpha emitting nuclides at levels that cannot be disregarded from a radiological protection point of view.

The assessment of worker exposures underground in the gold mines is complex because of the number of workplaces and workers, their physical location and environment and the variability of exposure levels. The Council is maintaining close liaison with the industry to produce workable guidelines for the assessment of underground sections.

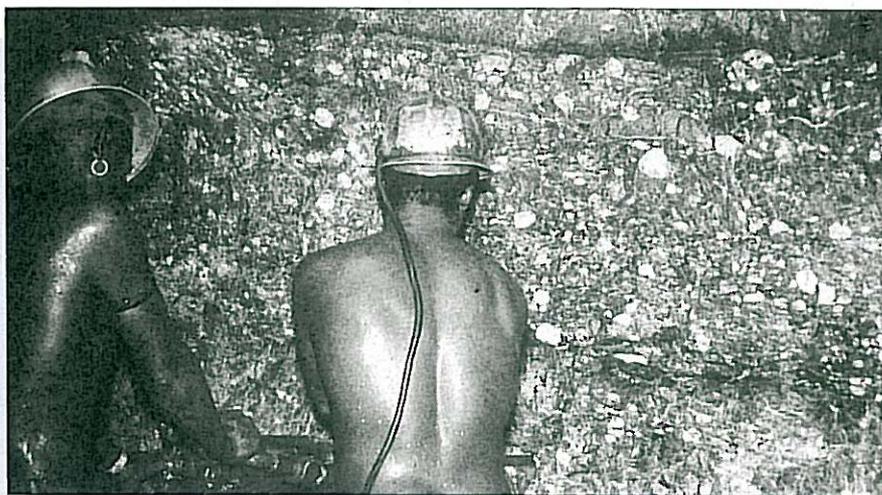
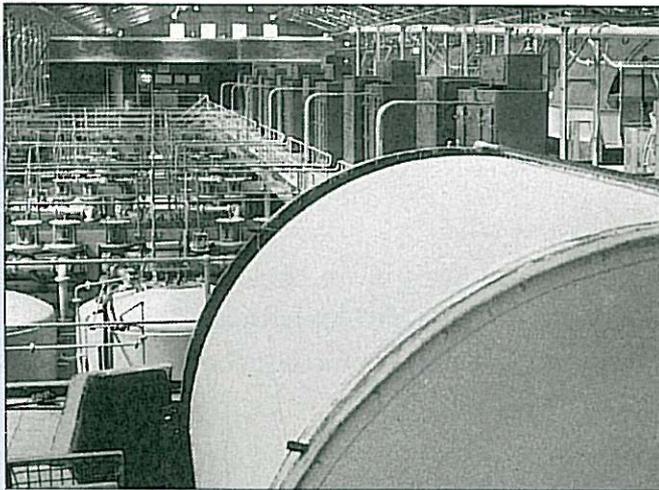
More progress has been made in the assessment of surface works and, in particular, the decommissioning and disposal of acid, uranium and gold plants contaminated with nuclear-hazard material, and projects have commenced at several mines.

Processing of ores which contain radioactive nuclides gives rise to large volumes of contaminated residues of relatively low specific activity but nevertheless of very long radioactive half life present potential radiological hazards that cannot be overlooked. In addition, moderate quantities of more highly contaminated wastes have been generated and as more facilities associated with uranium extraction and processing are being decommissioned large amounts of contaminated equipment and structures are having to be considered for disposal.

The whole issue of disposal of radioactive waste arising from mining activities is currently a matter of concern in most countries which have in the past been producers of uranium. The Council and the Chamber of Mines have been involved in a Technical Committee established by the International Atomic Energy Agency to consider the implications associated with this problem and

The safe disposal of radioactive waste arising from mining activities is being evaluated

Right: Ammonium Diuranate on a drum filter in a uranium plant
Below: Underground mining at the rockface.



the radiological protection aspects that need to be addressed in its resolution.

The Council has also been involved with the consideration of land previously used for mining purposes, which is being developed for future commercial, residential and industrial purposes. This work is being carried out in co-operation with the Government Mining Engineer and various local authorities.

Contamination of land with mine residues containing uranium and thorium may give rise to unacceptable levels of radon daughter products within structures built on such residues. A mechanism has been established for the Council to evaluate assessments of the extent of contamination and to formulate controls that may be necessary in order to develop the land safely.

Users of small quantities of nuclear-hazard material

During the year two new licences for the use of small quantities of nuclear-hazard material were issued, while two licences were surrendered by licensees who were no longer using such material. Four licences were amended during the year. At the year end there were 22 licensed users of small quantities of nuclear-hazard material in the country.

Inspections were carried out at the premises of three licensees to ensure compliance with the licence conditions, while one informal inspection was carried out upon the request of a user in a neighbouring state to assess their facilities and to advise them on the safe handling and disposal of nuclear-hazard material.

CNS - radiation workers

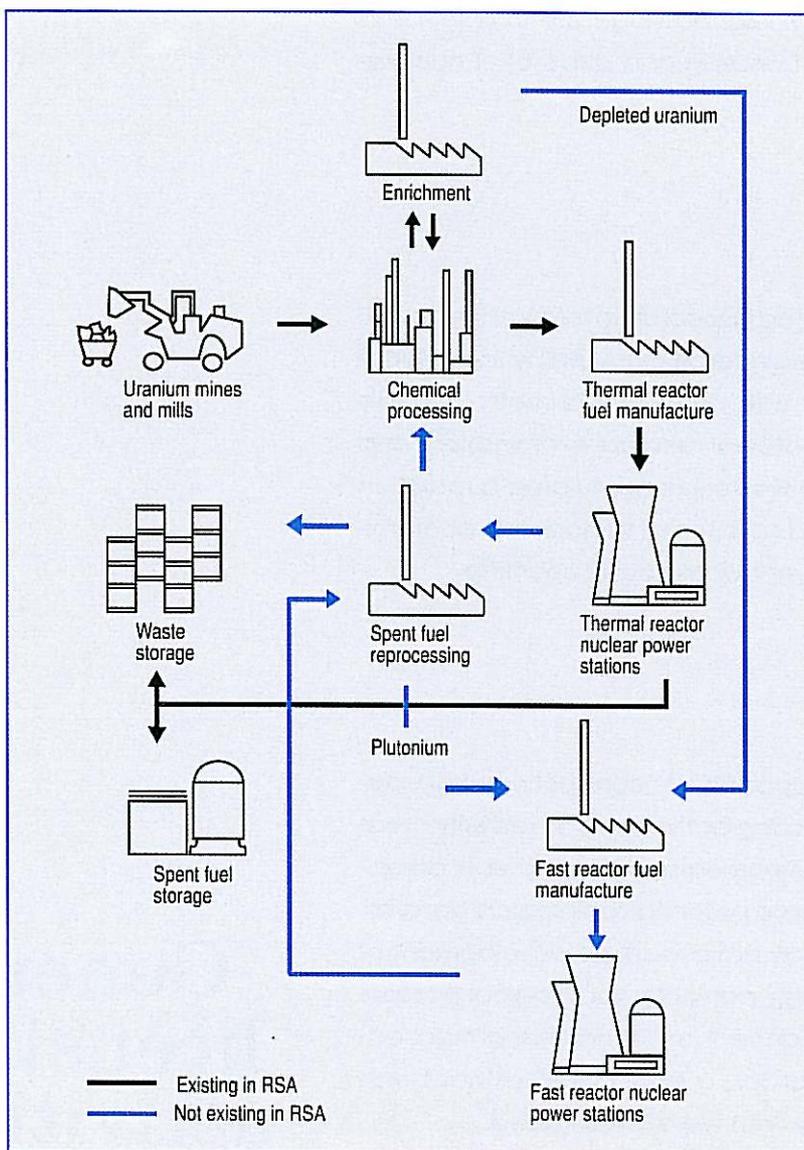
Employees of the Council who are designated inspectors in terms of Section 46 (1) of the Nuclear Energy Act, and who are perforce classified by the Council as radiation workers, are issued routinely with personal dosimetry and are subject to medical surveillance, including annual medical examinations and whole body counts. None of the radiation workers accumulated a radiation dose greater than 1mSv over the year and no internal radioactive contamination was detected in those who underwent whole-body counting.

Technical facilities

The Council maintains an independent capability for conducting radiochemical analysis and various radiation monitoring activities so as to verify measurements on effluent discharges and environmental measurements associated with licensed activities and to investigate potential radiological hazards. Considerations related to the mining industry have required development of various techniques and methods to quantify particular radiological hazards germane to that industry. In order to enhance the Council's analytical capabilities in respect of alpha-emitting nuclides, a PERALS system has been acquired and critical parameters for this system were investigated.

General
licensing
activities

Diagram 3: Nuclear fuel cycle



Legislation

Work has continued, in co-operation with the AEC, on amendments to the present Nuclear Energy Act with a view to having a Nuclear Energy Bill tabled in Parliament during 1993. The concept of a separate Nuclear Licensing Act, referred to in the last annual report, has been put aside for the present.

The questions of liability and compensation for nuclear damage and the provision of financial security in respect of claims for compensation have received much attention in recent years. Whilst the situation in Southern Africa is less complex than that prevailing in areas with more widespread nuclear activities, the same fundamental principles apply in determining equitable and practical statutory provisions. The Council has continued to address these matters.

Participation in meetings and conferences

Developments and needs in the nuclear industry are studied and discussed at a variety of international conferences, symposia and technical meetings every year and, as far

as is practicable, the Council encourages its staff to participate in these, as appropriate, so as to keep abreast of matters pertinent to nuclear safety and regulatory control, required for the effective discharge of their responsibilities.

During the year under review several staff members attended conferences, training courses and technical meetings in Austria, China, France, Japan, the USA and UK on various aspects of probabilistic safety assessment, reactor technology and accident management and on fire safety in nuclear power plants.

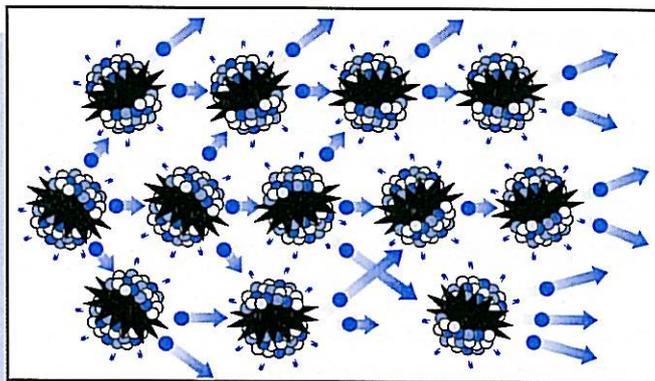
- Mr A C Hall, Manager, Operations Assurance Department, provided consulting services to the IAEA in Vienna on safety culture and human performance indicators, and also undertook a research visit to the US Nuclear Regulatory Commission and several US nuclear plants to investigate alcohol and substance abuse programmes and their applications.
- Mr H G Svanström visited Spain, Germany, France and Switzerland to investigate the latest reactor operator training and examination methods.
- Mr B C Winkler, Executive Officer, as Vice-chairman of Committee 4 of the International Commission on Radiological Protection, attended the regular meetings of the Commission held in Austria and Monaco.
- Mr N R Henderson, as National Co-ordinator for South Africa, attended the National Officers' meeting at the IAEA in Vienna on *Incident Reporting Systems* and the *International Nuclear Event Scale*.
- Mr R S Elk, Legal Advisor, attended the Biennial Congress of the International Nuclear Law Association (Nuclear Interjura 1991) held in Bath, England.
- Dr K D Bogie, as project co-ordinator of the International Co-operative Group on Radiation Assisted Cracking, presented the results of phase 1 of the Group's Round Robin at Zurzach, Switzerland.
- Mr J Leaver, General Manager, was an advisor to the South African Delegation to the Fourteenth Meeting of the Contracting Parties to the

Work has continued towards having a Nuclear Energy Bill tabled in Parliament

Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, held in London.

- Mr H G F S Parish, Assistant Manager, attended the 19th Water Reactor Safety Meeting, held at Bethesda, Maryland, USA.

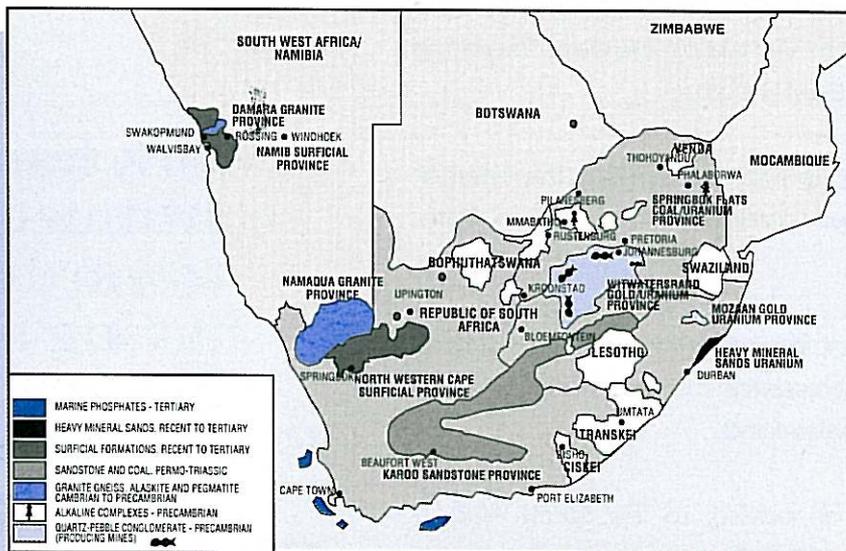
Right: Self-supporting fission reaction
Below: Uranium provinces in Southern Africa



Publications

The following papers were presented by staff members:

- *The use of Level 1 PSA for Regulatory decision-making in the Republic of South Africa*, by Miss H M Kussman, and
 - *The use of Level 2 PSA for Regulatory Decision-making in the Republic of South Africa*, by T F Hill,
- at the "International Conference on the Use of Probabilistic Safety Assessment for Operational Safety - PSA 91", at the IAEA in Vienna.
- *Late Phase Off-site Nuclear Emergency Planning*, by S W P de Waal,
 - *Radiological Environmental Monitoring in Mining and Industry*, by R J N Brits,



Courtesy: AEC

- *Underground Radiation Survey in a South African Gold Mine*, by J Guzek, and
- *Radiation Hazards in Mines and Works*, by M S C Guy
at the Summer School and Congress of the South African Association of Physicists in Medicine and Biology, in March 1992.
- *The Licensing of Mines and Works*, by M S C Guy, and
- *Results of an Underground Screening Survey in a Gold Mine*, by J Guzek
at a meeting of the Western Transvaal Ventilation Society in March 1992.
- *Licensing of Activities Involving Nuclear Hazard Material within the Mining Industry*, by P E Metcalf,
at the Mine Safety and Health Congress in October, 1991.
- *The Effect of Frequency and Temperature on the Environmental Assisted Cracking of a 316L Nuclear Grade Stainless Steel*, by K D Bogle (CNS), D Alexander (CNS), E Protopappas (AEC) and C Smal (AEC),
at the fifth Symposium on Environmental Degradation of Materials in Nuclear Power Plants; Monterey, USA, in August 1991.

In addition, the following papers were published during the year:

- *Containment Integrity of Nuclear Power Plant*, by J G Smyth,
in the *South African Mechanical Engineer*, August 1991
- *Ageing of Cast Stainless Steel Components*, by K D Bogle, D Alexander and R A Kirk,
in *The International Journal on Pressure Vessels and Piping*, Vol. 50 No. 1-3

There is
ongoing
interaction
with the
international
nuclear
safety
community

Financial statements

It has been the Council's policy to fund its activities essentially from licence fees and to phase in fee payments over a period of years, with the objective of meeting 70 % of its budget from this source, the balance being contributed from State funds. In a satisfactory approach to this objective the proportion of State funding for the year decreased to 32 % of the Council's income. The annual financial statements were approved by the Council and were signed on its behalf by Mr B C Winkler, Executive Officer and Mr E L Langford, Manager: Central Services Department.

Certification

The accounts of the Council for Nuclear Safety have been audited in terms of section 5 of the Auditor-General Act, No. 52 of 1989, read with section 26(4) of the Nuclear Energy Act, No. 92 of 1982, as amended, and in my opinion the annual financial statements are, subject to the effect of the aspects referred to in paragraph 2 of this report*, a fair representation of the financial position of the Council as at 31 March 1992 and the results of its operations for the year then ended.



Auditor-General (Pretoria)

* 82nd Annual Report of the Auditor-General

| | Notes | 1991/92 R | 1990/91 R |
|---|-------|-------------------|------------------|
| Capital employed | | | |
| Income funds | 2 | 10 157 891 | 9 816 818 |
| Capital funds | 3 | 180 799 | 180 799 |
| | | <u>10 338 690</u> | <u>9 997 617</u> |
| Employment of capital | | | |
| Fixed assets | 4 | 2 402 570 | 2 395 808 |
| Net current assets | | 7 936 120 | 7 601 809 |
| Current assets | | | |
| | | 8 922 798 | 7 964 297 |
| Debtors | 5 | 1 793 284 | 1 686 682 |
| Deposits and immediate claimable amounts | | 2 020 | 2 020 |
| Bank balance and cash | | 7 127 494 | 6 275 595 |
| Less: | | | |
| Current liabilities | | 986 678 | 362 488 |
| Creditors and provisions | | 986 678 | 362 488 |
| | | 10 338 690 | 9 997 617 |

Balance Sheet

as at
31 March
1992

Income State- ment

| | Notes | 1991/92 R | 1990/91 R |
|---|-------|-------------------|-------------------|
| Income | | 13 200 721 | 13 725 628 |
| State contribution | | 4 270 000 | 6 553 000 |
| Licence fees | 6 | 7 571 996 | 6 058 693 |
| Interest | | 1 313 553 | 1 095 856 |
| Sundry | | 45 172 | 18 079 |
| Less: Expenditure | | 12 859 648 | 11 366 244 |
| Service contracts and maintenance | | 181 416 | 224 349 * |
| Sundry expenditure | | 659 896 | 723 572 |
| Rent, accommodation | | 644 370 | 648 826 |
| Consultancy | | 226 385 | 142 383 |
| Research contracts | | 142 104 | 259 249 |
| Audit fees | | 70 963 | 7 076 * |
| Personnel expenses | | 7 492 493 | 6 394 420 |
| Postal, telex and telephone services | | 99 761 | 78 584 |
| Publications | | 57 165 | 44 737 |
| Subsistence and transport expenses | | 2 447 827 | 2 048 081 |
| Consumable stores | | 52 687 | 59 453 |
| Provision for capitalisation of leave | | 200 000 | - |
| Depreciation | 7 | 584 581 | 735 514 |
| Income over expenditure for the year | | 341 073 | 2 359 384 |
| Adjustment in respect of the previous year | | - | 305 993 |
| Income over expenditure - beginning of year | | 9 816 818 | 7 151 441 |
| As reported previously | | 8 950 290 | - |
| Adjustment of fundamental error | 6 | 866 528 | - |
| Income over expenditure - end of year (carried forward to income fund) | | 10 157 891 | 9 816 818 |
| * Restated figures | | | |

1. Accounting policy

The financial statements are, unless otherwise indicated, compiled on the historical cost basis in accordance with the undermentioned policy which was applied consistently in every material respect.

1.1 Income acknowledgment in general

Income is acknowledged according to the accrual basis

1.2 State contributions received

State contributions are accounted for in the period with which the allocation is associated

1.3 Fixed assets and depreciation

Fixed assets are shown at cost price less accumulated depreciation. Fixed assets are written off over the expected useful life according to the fixed instalment method

1.4 Research and development expenditure

These expenditures are written off directly in the Income Statement in the year incurred

2. Income Funds

Accumulated funds

1991/92
R

10 157 891

1990/91
R

9 816 818

3. Capital funds

Represent the book value of assets taken over from the AEC

180 799

180 799

4. Fixed assets

Furniture and equipment at cost price
Less: Accumulated depreciation

4 449 714

3 858 371

2 047 144

1 462 563

2 402 570

2 395 808

Notes to
the
financial
state-
ments

Notes to the financial state- ments

| | 1991/92 R | 1990/91 R |
|---|------------------|------------------|
| 5. Debtors | | |
| Outstanding licence fees | 1 499 769 | 1 597 917 |
| Other debtors | 112 768 | 88 765 |
| Payments made in advance | 180 747 | - |
| | <u>1 793 284</u> | <u>1 686 682</u> |
| 6. Fundamental error adjustment | | |
| Income in respect of previous years was not acknowledged in accordance with the accounting policy as indicated in note 1.1. | | |
| The effect of the adjustment in respect of the previous years is reflected by: The restating of the comparative figures for 1990/91 in respect of licence fees as follows: | | |
| Amount as reflected previously | 5 498 158 | |
| Plus: amount not accounted for in 1990/91 | 560 535 | |
| | <u>6 058 693</u> | |
| The adjustment of the opening balance for the income over expenditure for the financial year 1989/90 | - | 305 993 |
| 7. Depreciation | | |
| Depreciation for the year | 1 034 581 | 735 514 |
| Excess depreciation in previous years written back | 450 000 | - |
| | <u>584 581</u> | <u>735 514</u> |

