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Regulation of uranium mining in the Northern Territory

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Abstract. In Australia, uranium and other 'prescribed substances', including thorium, and any element having an atomic number greater than 92, are the property of the Commonwealth under the Atomic Energy Act 1953. However, the regulation of mining in Australia is managed by the States. The Uranium Mining Environment Control Act, was passed by the NT in 1978 and this remains the primary legislation through which uranium mining is regulated. Under working arrangements with the Commonwealth, the NT carries out regulatory activities including monitoring, evaluation and surveillance, in respect of each of the operating mines. The monitoring is overseen, validated and its continuing relevance audited by the Commonwealth Office of the Supervising Scientist and the Northern Land Council representing the local traditional owners. Environment Impact Assessment is co-ordinated jointly by the Commonwealth and the NT and has recently been concluded for the Jabiluka Project. Delays in final approval on this project are occasioned by social concerns expressed by some of the traditional indigenous owners and anti-nuclear protestors. Although Jabiluka is not in a World Heritage area, the concerns have resulted in intervention by the World Heritage Commission. This has required the Company and the Government to modify the way they handle the approval process. This paper analyses the development of the regulatory system which evolved to ensure best practice environmental, occupational health and safety management on the NT uranium mines.

1. INTRODUCTION

The mining of uranium in the Northern Territory (NT) has been the subject of much debate and controversy since uranium ore was first discovered at Rum Jungle in 1949.

The effects of uranium mining on the NT have been enormously beneficial in economic and social terms, spurring regional development initially at Batchelor and Pine Creek and more recently in the uranium province at Jabiru. There has also been a significant flow-on effect elsewhere in the NT economy. An opportunity now exists to expand on this economic base and develop the considerable known additional resources.

Since the opening of the first uranium mines, the NT has taken a leading role in the development of occupational health and safety standards for miners as well as environment protection and rehabilitation practices. Extensive monitoring of the Nabarlek and Ranger Mines by numerous bodies has not identified any significant impact on the environment or threat to human health that can be attributed to uranium mining. This fact illustrates the effectiveness of the regulatory processes administered by the NT Government.

2. HISTORY OF URANIUM MINING IN THE NORTHERN TERRITORY

2.1. Background

The major known uranium deposits in the NT are all located within the Alligator Rivers Region (ARR), which covers about 22 500 square kilometres in the north-east portion of the Pine Creek Geosyncline. This region also contains the 20 000 square kilometre Kakadu National Park which surrounds but does not include the Ranger, Koongarra and Jabiluka deposits (Fig. 1).

Uranium was located at Rum Jungle in 1949 at a time when the mineral was eagerly sought on the world market primarily for the development of nuclear power and weapons technology. The initial discovery led to a uranium rush throughout the Territory with occurrences being identified in the South Alligator, Westmoreland, Adelaide River and Tennant Creek Regions. The discovery between 1969 and 1971 of the Nabarlek, Ranger, Jabiluka and Koongarra deposits reactivated interest in the

NT with much of the enthusiasm being subsequently lost due to adverse Commonwealth Government policy. In 1971 the Commonwealth Government imposed a freeze on exploration and development of the Alligator Rivers Region deposits to enable a regional development and orderly resource exploitation policy to be established. There has been negligible exploration done since that time and the resource exploitation is limited at the moment to a single mine, Ranger.

The origins of the Northern Territory regulatory regime began with the Ranger Uranium Environmental Inquiry (RUEI) in July 1975. It was required to report to the Government on probable environmental consequences of mining the Ranger deposits, and also to make recommendations as to what should be done. Following the production of a very detailed Environmental Impact Statement (EIS) by Ranger, public hearings began in September 1975 and evidence was received from 303 witnesses. The first report released in October 1976 found that the objections to the mining and sale of uranium based on perceived risk of nuclear war were not such as to justify a decision not to develop Australian uranium mines provided the activities were properly regulated and controlled. The second report was released in May 1977 and dealt with the environmental aspects of the Ranger project.

The review and recommendations of a second RUEI formed the basis of the Commonwealth Government's decision to allow the project to proceed. The Environmental Requirements (ERs) originating from the review were attached to a Section 41 Authority to Mine under the Atomic Energy Act 1953 and a Section 44 Agreement with the NLC under the Aboriginal Land Rights (NT) Act 1976.

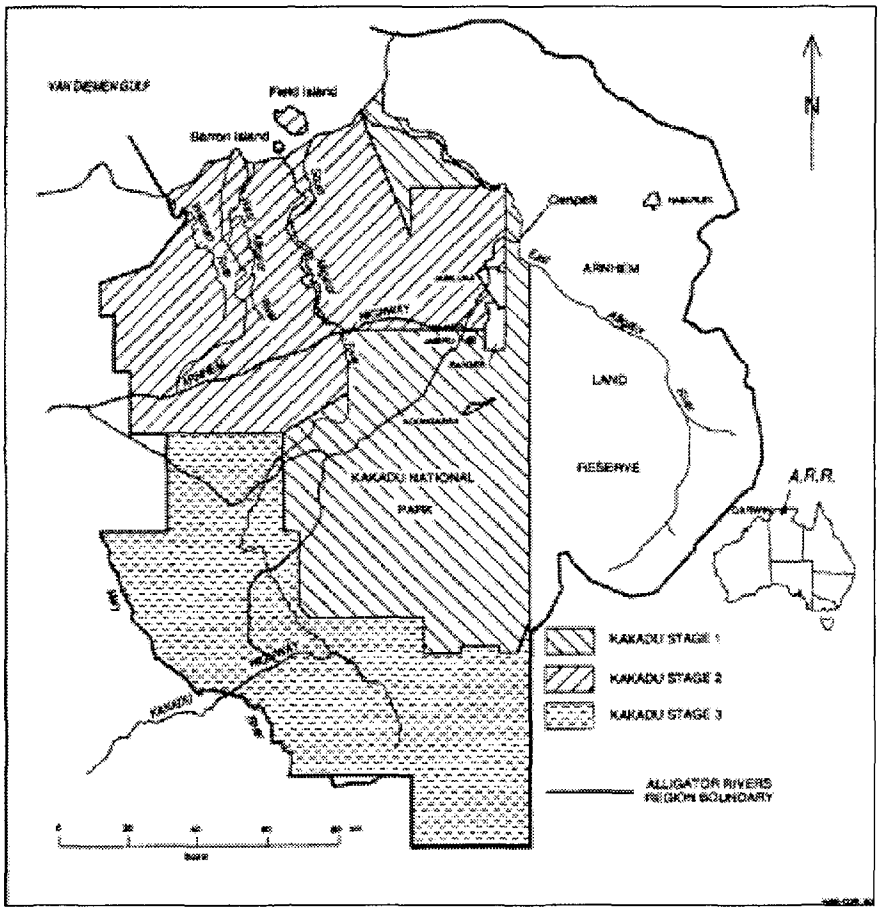

FIG. 1. Map of the Alligator Rivers Region showing Kakadu National Park and uranium mine leases.

In 1978, the NT was granted self-government and immediately passed the necessary legislation to enable the proposed new mines at Ranger and Nabarlek to proceed including the Uranium Mining (Environment Control) Act 1979 (UMEC). The ER's were subsumed within NT legislation as a schedule of UMEC. Under a Memorandum of Understanding with the Commonwealth, the new mines were to be regulated using the provisions of the new NT legislation. The Commonwealth retained a "watchdog" in the form of the Office of the Supervising Scientist (OSS) to overview the process and to conduct research through the Environment Protection (Alligator Rivers Region) Act 1978.

Mining of the Nabarlek deposit commenced in May 1979 and mining was completed in 128 days. The milling operation was completed in 1988. Approximately 14 000 tonnes of uranium oxide were recovered at an average ore grade of 2.3%. The total value of sales from this mine alone was about 1 billion dollars.

Ranger is located about 260 kilometres east of Darwin and within the ARR. Ranger commenced mining in 1980 with reserves of around 120 000 tonnes uranium in two orebodies, known as Ranger #1 and Ranger #3. The Ranger mine, and directly linked activities, accounted for no less than 7% of the whole of the NT's economic activity over the 11 years between 1981–82 and 1991–92. By June 1992 a total of $304 million (in 1991–92 money terms) had been paid to Aboriginal groups from the Ranger project [1]. This underlies the importance, from a cashflow perspective, of uranium mining to indigenous peoples.

3. LEGISLATION

Both Commonwealth and NT legislation are applied to uranium mining projects in the ARR. The powers of government used in the Northern Territory are not necessarily applicable anywhere else in Australia. The NT administers its responsibilities principally through UMEC using the Department of Mines and Energy (DME) as a "one stop shop".

3.1. Principal Commonwealth Legislation

3.1.1. Environment Protection (Impact of Proposals) Act 1974

This Act empowered the Commonwealth Government to inquire into the effect that a proposed operation might have on the environment and to make recommendations concerning the environmental conditions to which approvals and authorizations for a project should be subject. The Act has been replaced by the Environmental Protection and Biodiversity Conservation Act 1999.

3.1.2. Environmental Protection and Biodiversity Conservation Act 1999

This Act provides for protection of the environment, especially those aspects of the environment that are matters of national environmental significance and to promote the conservation of biodiversity and ecologically sustainable development through conservation and ecologically sustainable use of natural resources. Requirements for environmental approvals relate to matters of national environmental significance; activities on a declared World Heritage property or a declared Ramsar wetland; impact on listed threatened species and communities or listed migratory species and nuclear actions. These issues all coincide in the uranium province.

3.1.3. Atomic Energy Act 1953–1966

This Act empowers the Commonwealth Government to authorize the mining and milling of uranium ores subject to such conditions as it deems necessary. Part III of the Act refers to the Ranger project and allows for the Minister to Authorize mining for prescribed substances, on behalf of, or in association with the Commonwealth.

3.1.4. Environment Protection (Alligator Rivers Region) Act 1978

This Act established a 'Supervising Scientist' who has the power to:

- Carry out research and collect information relevant to the protection of the environment;
- Develop and/or advise on the development of standards and practices for the protection of and restoration of the environment;
- Co-ordinate and supervise the implementation of environmental protection requirements imposed by other legislation and
- Advise the Commonwealth Government about any of the above matters.

3.1.5. Environment Protection (Nuclear Codes) Act 1978

This Act gives the Commonwealth Government the power to produce "Codes of Practice", in association with the States/Territories and to make regulations to ensure that these codes are observed.

Three codes have been produced:

- Code of Practice on Radiation Protection in the Mining and Milling of Radioactive Ores 1987;
- Code of Practice for the Safe Transport of Radioactive Substances 1982;
- Code of Practice on the Management of Radioactive Wastes from the Mining and Milling of Radioactive Ores 1982.

The Act was repealed in 1998 and replaced by the Australian Radiation Protection and Nuclear Safety Act.

3.1.6. Aboriginal Land Rights (NT) Act 1976

The Act provides for the granting of traditional Aboriginal land in the Northern Territory for the benefit of Aboriginals, and for other purposes. It essentially prohibits an operator from seeking minerals or mining on Aboriginal land until he has concluded an agreement with the land council concerning those things related to the mining operation which may affect Aborigines.

3.1.7. The Environment Protection (NT Supreme Court) Act 1978

This Act gives the NT Supreme Court the power to make orders, at the suit of either the Commonwealth or Territory Parks and Wildlife organizations or the Northern Land Council (NLC), with respect to any relevant legislation which is pertinent to the protection of the environment in those parts of the Alligator Rivers Region in which they have a legitimate interest.

3.2. Principal NT Legislation

3.2.1. Uranium Mining (Environment Control) Act 1979

This is the prime Act for the day-to-day regulation of the uranium mining industry in the NT. The key to its operation is the requirement that "the owner or manager of a mine shall not construct or use any works, processes or equipment with respect to mining except with and in accordance with conditions of an authorization".

Authorizations under the Act, and any conditions attached to them, can be altered or revoked at any time but must be consistent with any conditions imposed under the Control of Waters Act and the Soil Conservation and Land Utilization Act.

The Act further stipulates that when issuing an authorization, primary consideration must be given to:

- Terms contained in any agreement between the mining company and the NLC, and
- The conditions attached to the relevant mining lease. In the case of Ranger and Nabarlek these are ERs attached as schedules to the Act. When exercising any power conferred on him by the Act, the Minister shall have primary regard to these ERs.

The ERs cover such areas as:

- Ensuring the numbers and qualifications of environmental protection staff are adequate
- Control of water such that radioactive materials should not be removed or allowed to escape from site except under approved conditions
- Atmospheric pollution control
- "Best practicable" technology (BPT) must be used
- Waste rock dump design and final rehabilitation programmes have to be submitted for approval
- Methods of blasting are to be approved and all blast levels monitored
- Vegetation and landscape protection
- A continuous monitoring programme to include measurements in relation to biota, water, sediments and air within the project area includes both personnel and environmental monitoring
- The company is to provide research programmes as directed by the government.

3.2.2. Environmental Assessment Act 1982

This Act provides for the assessment of the environmental effects of development proposals and for the protection of the environment.

3.2.3. Mine Management Act 1990 and Regulations

All mines in the NT are subject to the provisions of the Mine Management Act (MMA). All aspects of mining activity are covered including the environment, health and safety, engineering principles and mining practice to Australian Standards and Codes of Practice. This Act is now under review.

4. REGULATION OF NT URANIUM MINES AND PHILOSOPHY OF COMPLIANCE

Regulation of uranium mining and milling is effected principally through the MMA and UMEC.

The "philosophy of compliance", agreed between the NT, the Commonwealth and the mining companies, provides for the companies to comply with specified operating requirements, including a comprehensive monitoring regime, and to demonstrate their compliance through a reporting programme. This monitoring in turn is overseen, validated and its continuing relevance and adequacy audited by the DME in consultation with the OSS and relevant NT authorities.

4.1. Technical, Advisory and Supervisory Committees

In addition to the extensive monitoring programmes conducted by the companies and the DME, numerous committees assess and revise BPT and resolve technical issues on environmental matters and proposals for each uranium mine.

4.1.1. Alligator Rivers Region Advisory and Technical Committees

A Co-ordinating Committee for the ARR was replaced by an Advisory Committee (ARRAC) and a Technical Committee ARRTC) by amendment of the Commonwealth's Environmental Protection (Alligator Rivers Region) Act in 1994.

ARRAC is a forum for information exchange between the mining companies, government authorities of the NT and the Commonwealth, and environmental, Aboriginal and community groups. ARRTC examines the research needs of the region, recommends research programmes, and examines methods for the efficient co-ordination and integration of research.

4.1.2. Minesite Technical Committees

Minesite Technical Committee (MTC) meetings are chaired by the NT with committee members representing DME, OSS, the NLC and the respective mining company. Other parties with specialized contributions to make may be invited to attend specific meetings.

4.1.3. Ranger Water Management Working Group

Ranger Water Management Working Group meetings are chaired by Energy Resources of Australia (ERA) and are convened as required to review proposals for water management. ERA, OSS, NLC and DME are represented on the committee.

4.1.4. NT Legislative Assembly Sessional Committee on the Environment

The Sessional Committee on the Environment meets on an ad-hoc basis to gather information with which to advise the Legislative Assembly. The Committee conducted a major review in 1992 [2] and a one-day inquiry in 1996 into the environmental impact of uranium mining and milling in Australia and the effectiveness of environmental protection measures. The last review undertaken by the Committee was in 1999.

4.2. Monitoring programmes

Aquatic pathways are the most likely conveyors of any pollution from mine sites in the tropics (in which all the NT's uranium mines are situated) and downstream aquatic ecosystems and local communities are the major potential casualties. A primary emphasis of environmental monitoring has been to ensure the protection of aquatic ecosystems. Although environmental protection from water pollution is best provided by engineering controls, physico-chemical monitoring by ERA and DME of both underground and surface waters, plays a major role in detecting problems.

4.3. Water release

The Ranger Uranium Environmental Inquiry (Fox Report) [3] (p 89) stated that "The possibility that contaminated water from the mine site might cause environmental damage downstream was one of the main arguments advanced against the proposal". Nevertheless, less than 10% of the report addressed the issue of water management. Evidence put before the second RUEI, which it admitted contained inaccuracies and inconsistency, and its resulting recommendations, can now fruitfully be analysed with the benefit of hindsight.

The construction of dams to retain accumulated runoff water from around the mine site was not considered to be good engineering or environmental practice by the original mine designers and they proposed a system of silt-traps on undisturbed catchments, which overflow naturally, together with controlled release of water which ran off potentially contaminated catchments. Specific recommendations were included in the ERs as to how such controlled releases should be managed. This strategy was essentially supported in a review of Best Practice for Water Management undertaken by the Supervising Authorities in 1986. Despite this, the only releases which have taken place from the Ranger site have been from uncontaminated catchments.

Receiving water standards were developed for Magela Creek using information from ecotoxological studies, accepted water quality guidelines and in some instances from a statistical analysis of the

natural waters. A biological monitoring programme was established, using protocols developed by the OSS, to ensure the safety of the downstream ecosystem from any release from the mine.

Surplus runoff from the ore stockpiles and process plant areas is dispersed by wetland filtration and land irrigation which, together with natural evaporation have generally been sufficient to ensure that there has been little accumulation of water passed from one year to the next.

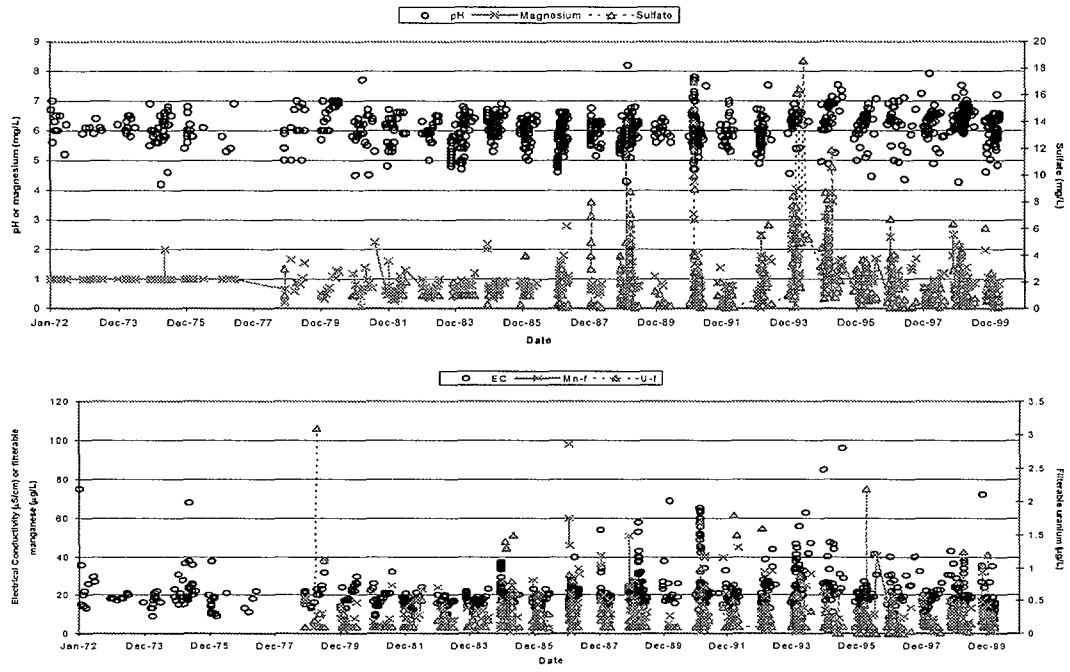

FIG.2. Water quality over time downstream of Ranger Uranium Mine.

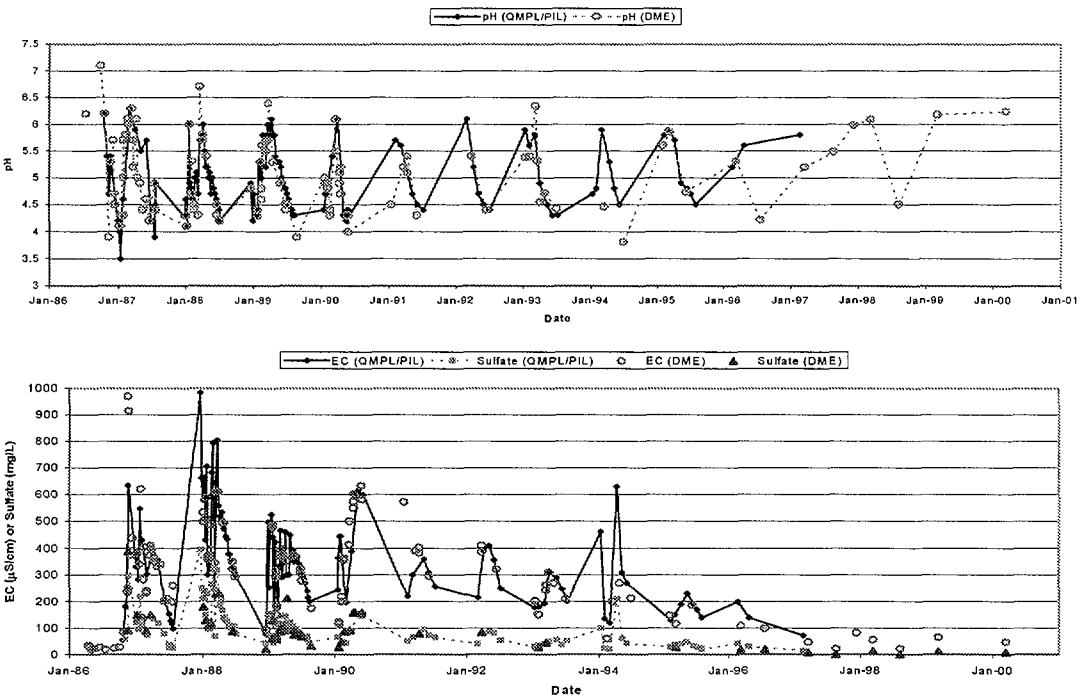

FIG. 3. Conductivity, sulfate and pH in Kadjirrikamarnda Creek, downstream of the former Nabarlek Uranium mine.

Site waters at Nabarlek were never released directly into the local creek system and evaporation was the main means of water reduction. Heavy rainfall in 1984 and 1985 meant large volumes of water were being stored and land application was introduced to disperse the excess water. The groundwater which was affected by the land application was intensively monitored and results to date show a decline in the solute levels is occurring over time.

5. IMPACT OF URANIUM MINING AND EFFECTIVENESS OF MONITORING

There has been no significant impact from uranium mines in the NT on downstream surface water quality (Figs. 2 and 3). All potential contaminants show little or no upward trends with time, and are below suggested criteria in Water Quality Standards manuals [4, 5]. Billabongs on the Ranger site itself show some impact, most particularly Djalkmarra Billabong.

Land application of minesite derived waters has been of concern at Ranger with respect to the impact of such a practice on the ground and surface water catchments. Water first passes through a constructed wetland filter or is irrigated before entering a billabong. Wetland sediments very effectively attenuate uranium, so that uranium concentrations in the billabongs have remained low. Data from land application at the former Nabarlek Uranium mine have shown that groundwater catchments recover quickly.

DME monitoring programmes and their efficiency have been extensively reviewed and continue to be reviewed periodically. The mining company monitoring has also been extensive and precise and thus the database on uranium mines in the ARR clearly shows trends in impact over time.

5.1. Public perception of uranium mining and environmental protection

In 1986, the Milton Committee investigated Ranger's water management system after a blatant dramatization in the media via elements of the environment movement. A constant misreporting of events, particularly by the Australian Broadcasting Corporation (ABC), has continued relentlessly often regurgitating previously incorrectly reported information.

Little coverage was given of the high level of scientific agreement between the OSS, DME and the mining companies on technical matters. Disagreements, mainly on procedural matters, which are highlighted in the overview of the OSS reports or from NGO press releases, tend to be covered in detail. When this information is taken without qualification, the media reports erroneously lead one to the conclusion that the ARR is in grave danger of destruction.

The misreporting has led to a view of the Australian public that the Ranger uranium mine causes damage to, or at least poses a threat to Kakadu National Park and there are clearly those who capitalize on this view.

Allowing that there may be some difference of opinion on details, those scientists and others charged with the responsibility of assessing the environmental performance of the mine have not found any evidence of environmental detriment to Kakadu National Park resulting from the past 20 years of operations at Ranger. Scientists have also not been able to quantify any realistic threat to Kakadu National Park from the operations. The Northern Territory Government and OSS Annual Reports have expressed general satisfaction with the level of environmental protection being achieved.

Clearly a huge credibility gap exists. It is therefore important to examine and understand why the difference between the general public's concern and the lack of quantifiable evidence to support that concern has arisen. To do so it is necessary to follow the path of information from the mine to the general public and investigate whether appropriate standards of professionalism are being employed in its transmission. If the misinformation results from a deliberate programme then it would also be instructive to understand why.

One reason for confusion may have arisen because both the media and the environmental movement see uranium mining as an issue of social/political conflict and the topic is newsworthy for that reason. The Ranger mine has all of the necessary ingredients for a good story – aboriginal issues, the nuclear debate, health and safety matters, Commonwealth/NT relations, industrial relations and of course environmental impact. All of the above have been addressed in the past by media-inspired public inquiries or significant reviews and all have shown that the Ranger mine is neither unusual nor performing badly for an operation of its type.

5.2. Occupational health and safety of mine workers

The occupational health and safety of workers in recent NT uranium mines has been extensively managed and studied. The record of the industry is excellent.

In 1987 Ranger held a 4-Star Health and Safety Management System Award from the National Safety Council of Australia. The mine achieved the maximum 5-Star rating in 1993, the only mine in Australia to have achieved this rating.

Ranger has participated in an initiative whereby the mining industry has adopted responsible self-regulation in relation to lost time injury frequency rates. Each mine develops its own specific safety framework while the role of the DME is to approve practices and provide guidance where necessary. By its performance in reducing the lost time injury frequency rate, the industry has proved the value of this approach. The DME conducts regular system and performance audits on the Ranger mine and a culture of safety and continuing improvement has developed on the mine.

5.3. Radiological considerations

Of the potential worker hazards on uranium minesites, radiation is the issue which is the most thoroughly researched, best understood and for which the best quantitative tools exist for modelling. The current maximum permissible dose (in addition to background) to radiation workers is 50 milliSievert per year and 20 mSv/year over five years.

The average background dose to people in the Jabiru region is about 2 to 3 mSv/year. Background doses vary dramatically due to frequent occurrences of uranium mineralization on or near the ground surface. The Australian public is exposed to an average background dose of 2 mSv/year, which is quite low by international standards.

The average dose (above background) to the most exposed workers at Ranger during the last five years was 6, 4.6, 5, 4.1 and 4.8 mSv/year respectively. About two-thirds of the dose is caused by radioactive dust, the remainder coming from external gamma radiation and radon daughters.

5.4. Radioactive dust management

Monitoring at Ranger has shown that by far the largest component of dose arises from radioactive dust. Dust reduction techniques have been devised, such as regular haul road watering and strict housekeeping in the mill, which reduce dust levels and reduce radiation doses.

At present, all radiological reports received from the mine are analysed and, where necessary, discussed with ERA. On some occasions, specific recommendations concerning radiological matters are made to ERA.

5.5. Impacts on communities adjacent to mines or mill sites

The current maximum permissible dose (in addition to background) to the general public is 1 mSv/year.

For communities near the Ranger Mine, detailed studies on radiological impact have shown that the mine is producing only a marginal increase in dose to the general public of about one tenth of a millisievert per year which is similar to a single diagnostic chest X ray.

6. SUMMARY

The value of potential uranium projects in terms of regional development, Aboriginal development and general wealth creation in the NT is huge. Uranium mining has been and can be conducted in the NT in a manner which is safe and environmentally sound. This paper demonstrates that:

- uranium mining in the NT is now conducted under environmental controls which are among the strictest in the world.
- the industry has a high level of commitment to the health and safety of those involved in, and affected by, the process of uranium mining and milling.
- the environmental controls and the commitment to the health and safety of those involved in, and affected by, uranium mining have resulted in minimal detriment and substantial benefits.
- history reveals the NT experience in meeting the challenges associated with uranium mining and in adapting to technical and social change so as to make the best use of available resources and assure environmental protection and quality of life for present and future residents.
- The Government is a leader in applying the multiple land use concept. The Government's record in facilitating Aboriginal involvement in resource development, in park management and, most particularly, in environmental protection, is second to none.
- the NT Government views uranium mining as an effective tool in ongoing regional development of the NT.

REFERENCES

[1] ACIL. The contribution of the Ranger Uranium mine to the Northern Territory and Australian economies (1993).

[2] SESSIONAL COMMITTEE ON THE ENVIRONMENT. Report to the Legislative Assembly of the NT September 1992, Appendix B (1992).

[3] FOX, R.W., KELLEHER, G.G., KERR, C.B., Ranger uranium environmental inquiry. 2nd report. Australian Government Publishing Service, Canberra (1977).

[4] AUSTRALIAN AND NEW ZEALAND ENVIRONMENT AND CONSERVATION COUNCIL, Australian Water Quality Guideline for fresh and marine waters. ANZECC (1992).

[5] NATIONAL HEALTH & MEDICAL RESEARCH COUNCIL. Australian Drinking Water Guidelines. NH&MRC and Agricultural and Resource Management Council of Australia and New Zealand (1996).

[6] McGILL, R.A. "A regulatory view of water management in the Alligator Rivers Region." (Proc. 29th Cong. Aust. Soc. Limnol) Jabiru, NT 1990 Office of the Supervising Scientist, Alligator Rivers Region Research Institute, Jabiru, Australia (1990).

[7] MINES DIVISION. Environmental Surveillance Monitoring in the Alligator Rivers Region - Report for the six month period ending 31 March 2000. Report number 39. Mines Division, Northern Territory Department of Mines and Energy (2000).

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