Gundjehmi Aboriginal Corporation

Submission to Senate Environment, Communications, Information Technology and the Arts References Committee Inquiry into the Environmental Regulation of Uranium Mining

August 2002

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ACRONYMS

ALARA	As Low As Reasonably Achievable
ARRTC	Alligator Rivers Region Technical Committee
BPT	Best Practicable Technology
DBIRD	Department of Business, Industry & Resource Development (formerly DME – Department of Mines & Energy)
ECITA	Environment, Communications, Information Technology & Arts (Senate Committee)
EIS	Environmental Impact Statement
ERA	Energy Resources of Australia Ltd
ERISS	Environmental Research Institute of the Supervising Scientist
ERs	Environmental Requirements
EWLS	Earth Water Life Sciences Pty Ltd ('EWL Sciences') (Formerly ERA Environmental Services Pty Ltd – a 100% ERA subsidiary)
GCH	Gulungul Creek Highway
HDPE	High Density Polyethylene
IWMP	Interim Water Management Pond (Jabiluka)
JAER	Jabiluka Annual Environment (Management) Report
JMA	Jabiluka Mill Alternative
JMTC	Jabiluka Minesite Technical Committee
MLAA	Magela Land Application Area
NLC	Northern Land Council
NTSA	Northern Territory Supervising Authorities (part of DBIRD)
OSS	Office of the Supervising Scientist
PER	Public Environment Report
RAER	Ranger Annual Environment (Management) Report
RL	Reduced Level (relative to mean sea level)
RMA	Ranger Mill Alternative
RO	Reverse Osmosis
RP	Retention Pond (eg. RP1, RP2, RP3)
RPI	Routine Periodic Inspection
SC	Swift Creek
TDSRC	Tailings Dam South Road Culvert (Ranger)

EC	Electrical Conductivity (measured in '? S/cm')
g	gram (1 kg = 10^3 or 1,000 g)
ha	hectares (100x100 metres, or 10,000 m^2)
L	litre (mass of 1 kg)
mg/L	milligrams per litre (or parts per million, ppm)
ML	mega litre (1,000,000 litres or 10^6 L)
Mt	mega tonnes (1,000,000 tonnes or 10^6 t)
SS	Suspended Solids (measured in 'mg/L')
Turb.	Turbidity (measured in 'NTU')
t	tonnes (1,000 kg)
U_3O_8	Uranium Oxide ('Yellowcake')
? g/L	micrograms per litre (or parts per billion, ppb)

Al	Aluminium	Pb	Lead
Ca	Calcium	pH	acidity / alkalinity
Cu	Copper	^{226}Ra	Radium-226
Fe	Iron	^{222}Rn	Radon-222
Mg	Magnesium	SO_4	Sulfate
Mn	Manganese	U	Uranium
NO_3	Nitrate	Zn	Zinc

EXECUTIVE SUMMARY

There is perhaps no other group of people in Australia which has more experience with uranium mining on its` country than the Mirrar People. As Traditional Owners with responsibilities to protect and manage their country, the Mirrar have a unique and important role to play in the environmental regulation, monitoring and reporting regimes at Jabiluka and Ranger.

The willingness of the Mirrar community to engage in this current process, i.e. contribute to improved environmental performance at the Ranger mine and proposed Jabiluka mine, in no way disqualifies Mirrar opposition to further uranium mining on traditional country. The Mirrar still say no to Jabiluka.

In this submission, the Mirrar will address the problems with the current regime from a Traditional Owner perspective and propose reform measures to enhance the protection of the World Heritage environmental and cultural values of the Alligator Rivers region.

Section One provides a short history of the Mirrar experience with uranium mining at Jabiluka and Ranger. Section Two is an overview of the current regulatory systems at Ranger and Jabiluka.

Section Three represents a critique of the current regulatory system from the Mirrar perspective. It is argued that the current arrangements prevent Traditional Owners effectively managing those parts of Mirrar land subject to uranium mining interests.

Mirrar provide evidence that the current system is inconsistent, lacking in accountability and outdated. Mirrar argue that agreements under the *Land Rights Act* do not operate effectively and are not sufficiently supported by legislation. Mirrar also provide evidence that social impact monitoring, crucial to the maintenance of World Heritage values, is almost non-existent.

Section Four details Mirrar concerns, from a Western scientific perspective, at the inadequacies of the present environmental monitoring and reporting regimes at Ranger and Jabiluka. The nature and extent of these regimes is critically examined and suggestions provided as to how they may be improved. The Mirrar consider that such improvements are necessary under any environmental regulatory regime, whether or not the legislative overhaul suggested in this submission is adopted.

Section Five introduces and outlines a proposal for a new Commonwealth Act to reform the regulation of uranium mining in the Alligator Rivers Region of the Northern Territory.

The Mirrar experience of environmental regulation of uranium mining is that it is governed by ad hoc agreements between the Commonwealth and Northern Territory Governments, is essentially reactive to the development agenda and excludes the considerations of Traditional Owners. The ad hoc and reactive nature of the regimes in force at Ranger and Jabiluka has resulted in environmental mismanagement and an ever-increasing area of impact at both sites, examples of which are detailed below.

MAJOR RECOMMENDATIONS

Legislative Regime

Recommendations

The Commonwealth Parliament urgently develop and implement an Act to reform the regulation of uranium mining in the Alligator Rivers Region, in accordance with the provisions detailed in Section 5.

Ranger - Waste Inventories, Ore Reserves and Expected Life

Recommendations

The annual quantities of materials utilised at Ranger needs to be more thoroughly reported by ERA and OSS in their respective annual reports, specifically including the following :

- the quantities of ore, low grade ore and non-mineralised rock mined from Pit #3 including uranium grade (and other minerals of concern such as sulfide or copper).
- the annual use of industrial chemicals and reagents used in the processing mill at Ranger (acid, ammonia, lime, etc.).
- the short and long-term plans for mining need to be publicly stated each year, focusing on full transparency of issues such as the timing of tailings management, ores mined versus predicted quantities, heap leaching (and/or beneficiation) and the potential for underground mining.
- the OSS and DBIRD continue to ensure significant commitments from ERA to fund environmental monitoring and ensure that a rigorous environmental monitoring and reporting program is always in place.

Ranger - Tailings Management

Recommendations

The management of radioactive uranium mill tailings is a major challenge and needs to be undertaken with full transparency. To enhance both short and long-term management of tailings, the following should be adopted :

- the incorporation of a deadline for removing the tailings from the above ground dam into Authorisation 82/3 and the Environmental Requirements (i.e. by the end of 2007).
- detailed analysis and reporting of the existing contamination of groundwater by seepage from tailings storage facilities (above ground dam and Pit #1), especially with regards to the use of contaminant plume maps.
- the OSS need to undertake specialist research on groundwater flowpaths, such as fracture zones and faults zones, to allow more detailed quantification of contaminant migration rates. This will allow more realistic design and

implementation of tailings storage within Pit #3 as well as long-term groundwater monitoring needs after rehabilitation (around 2016 ?).

- the incorporation of the current RL 0 m limit for Pit #1 into Authorisation 82/3 and the Environmental Requirements and should also be legally binding with no escape or modification clause. A similarly appropriate limit should also be introduced for tailings Pit #3 (when this proceeds).
- all detailed studies and reports that already exist within ERA, DBIRD and OSS should be made publicly available.
- detailed field studies should be undertaken by the OSS to quantify radon flux, microbiological behaviour and the physical properties of tailings (especially permeability).
- more rigorous horizontal and vertical monitoring and reporting of all groundwater units around tailings facilities (dam and Pit #1).
- a more suitable technique be developed and applied to measure tailings density in Pit #1, incorporating known mill data (such as t ore milled and t reagents used).
- correct terminology be ensured by ERA, DBIRD and OSS at all times (eg. do not refer to the above ground dam as an 'evaporation pond').

Ranger - Water Management

Recommendations

The monitoring and management of contaminated minesite waters at Ranger needs to be significantly improved. The Mirrar believe this can best be achieved through use of the following :

- the re-incorporation of load limits into water quality criteria which are no more than twice the average natural loads in a system (preferably lower).
- the trigger system for water quality be expanded to include other important contaminants from Ranger such as NO_3, PO_4, Cu, Pb, Zn and others.
- the limit for uranium at gauging station 8210009 in Magela Creek should be lowered from 5.8 µg/L to 0.5 µg/L.
- a greater number of monitoring sites be established, especially along critical drainage features such as Gulungul, Corridor and Georgetown Creeks and Coonjimba and Djalkmarra Billabongs. More data will allow ongoing analysis and checks on sources of contaminants, loads, dilution, reactions and uptake by the ecosystem, and therefore possible impacts.
- a separate system of trigger levels be developed and applied for important discharge sites such as Corridor Creek, RP1 and Gulungul Creek.
- greater emphasis be placed on collecting hydrology data (stream flow rates and total volumes) for joint interpretation with water quality data.
- ERA adopt event-based monitoring to ensure compliance of all necessary water management system components.

- water samples be more thoroughly analysed for various indicator and important contaminants, such as Mn, ^{226}Ra and major solutes (Mg, SO_4).
- a more suitable upstream site for Magela Creek should be developed and standardised in Authorisation 82/3 and the Environmental Requirements.
- OSS need to undertake a wider and more detailed surface water monitoring program around the Ranger site, especially the creeks and billabongs.
- greater use of upstream data should be made in analysing water quality, especially with reference to flow (hydrology) data.
- the OSS and DBIRD continue to ensure significant commitments from ERA to fund environmental monitoring of minesite and adjacent surface waters and ensure that a rigorous environmental monitoring and reporting program is always in place.

Ranger - Contaminated Water Treatment

Recommendations

The treatment of contaminated minesite waters and monitoring of the areas used for this at Ranger needs to be significantly improved. The Mirrar believe this can best be achieved through use of the following :

- the incorporation of maximum cumulative load limits into specific areas for disposal, specific to the use of irrigation (land application) or wetlands.
- release of all reports and data on known environmental problems at treatment areas (wetlands, irrigation).
- detailed studies on the long-term future of existing sites to continue to be able to perform effectively, including all contaminants (Mg, SO_4, Mn, U, ^{226}Ra, etc.).
- incorporation of more rigorous sampling (more sites and frequency) of wetland and irrigation areas in Authorisation 82/3 and the Environmental Requirements.
- need to reduce reliance of OSS and DBIRD on company data and assertions in managing these contaminated areas.
- OSS and DBIRD should undertake check monitoring and analysis of wetlands and irrigation sites.
- the Corridor Creek wetlands need to be investigated as to whether they have any capacity to continue to perform as wetland filters in the future.

Ranger - Stockpile and Waste Rock Management

Recommendations

The stockpiling of ore, low grade ore and non-mineralised material is proving a significant challenge from Pit #3. To ensure that operations at Ranger do not lead to repeat situations of 2002 and earlier incidents, the following improvements are recommended :

- the 'Ranger Mining Manual' be available publicly, or its successor the Mining Management Plan (MMP) under new NT legislation.

- development and implementation of a more rigorous inspection programs be developed by the OSS and DBIRD which physically checks all stockpiles prior to, during and immediately after each wet season. Such a program should not be reliant on ERA statements or incompetence.
- more thorough reporting of stockpile locations, plans and quantities by ERA, OSS and DBIRD, including water management aspects for each site.
- the discharge of runoff from southern stockpile not be permitted to enter the Corridor Creek system until the wetlands have been ascertained to be suitable for the remaining period of the Ranger operation (eg. 15 years) and increased environmental monitoring has been properly implemented.

Ranger - Groundwater Management

Recommendations

The management and protection of groundwater could be enhanced through the following improvements :

- development and implementation of check groundwater monitoring program by the OSS.
- greater frequency of groundwater bores in areas of and downgradient from higher permeability zones, including broader analysis of water quality.
- more thorough reporting of groundwater data, both horizontally and vertically, by ERA, OSS and DBIRD, including cross-sections, plume maps and groundwater elevations (i.e. piezometric surfaces).
- more detailed field studies aimed at quantifying groundwater flow paths to enable more accurate short and long-term (>10,000 years) models.

Ranger - Soil Monitoring

Recommendations

The management and protection of soils could be enhanced through the following improvements :

- development and implementation of check soil monitoring programs by the OSS and DBIRD.
- more sampling points located in areas of active water treatment, such as wetlands or irrigation.
- more detailed field studies aimed at quantifying long-term contaminant retention characteristics of soils.

Jabiluka - Water Management

Recommendations

The water quality monitoring program within Swift Creek be enhanced through implementation of the following :

- The statutory monitoring point for the determination of the impact of Jabiluka downstream on Swift Creek be moved within the Jabiluka Mineral Lease.
- Separate trigger levels should be applied for the North and Central Tributaries at the sampling locations closest to the site (ie. JSCTN2, JSCTC2).
- The statutory program for Jabiluka should include upstream monitoring of water quality in the North and Central Tributaries, including radium activities.
- An additional statutory monitoring location should be established within the West Branch of Swift Creek.
- The frequency for statutory water quality monitoring (for parameters currently listed as monthly as per the authorisation) be changed to at least weekly during the first month, followed by at least three samples per month for the remainder of the wet season.
- Analysis of radium should be included with metals.
- A succinct and accurate location plan of sampling sites should always be given with relevant reports, publications or scientific papers.
- Adequate people and financial resources be allocated by ERA to ensure that personnel are available at times of first flush or other necessary and opportune times to obtain water quality or other environmental samples. Detailed electronic and automatic sampling equipment should be implemented across the Swift Creek catchment.

Jabiluka - Water Quality Triggers

Recommendations

The water quality trigger levels be revised to reflect legitimate Mirrar concerns and provide enhanced scientific scrutiny through the following changes :

- The 'Limit' value for uranium should be revised to a concentration much closer to the extremely low background in Swift Creek. A value of 0.05 µg/L is proposed.
- The trigger levels for NO_3 should be re-assessed, including the addition of NH_4 trigger levels, utilising a data set which includes sufficiently low detection limits and the effects of blast residues leaching removed to provide concentrations more closely representative of natural NO_3 and NH_4 in Swift Creek.
- Trigger levels for radium and other contaminants (eg. Al, Mn, P, Re, Zn) should be developed.
- The trigger system should include the loads of contaminants as well as concentrations.

- The trigger system should be enhanced to include statistical analysis of difference between upstream and downstream water quality monitoring locations.

Jabiluka - Water Quality Onsite

Recommendations

The water quality monitoring program for the Interim Water Management Pond should be enhanced through the following changes :

- A concept of guideline triggers be established for the IWMP to establish potential levels of intervention to manage on-site water quality.
- Analysis of radium and radon should be included with metals, and all tested monthly.
- Detailed studies be undertaken to characterise in sufficient detail the quality of various sources of seepage into the decline to allow more realistic quantification of proposals for long-term water management. This work must be reported publicly and promptly.
- Studies documenting the biological and goechemical (limnological) processes within the IWMP should be undertaken and reported publicly. This should enable an accurate mass balance for contaminants such as U, SO_4, ^{226}Ra and others.

Jabiluka - Water Quantity

Recommendations

The public reporting of volumes of contained water in the IWMP is very poor and needs to be improved by inclusion of sufficiently detailed tables and graphs within the Annual Environmental Interpretative Report.

The annual reports “Water Management Systems Operation Manual” and “Water Management” should also be made public documents.

Jabiluka - Contaminated Water Treatment

Recommendations

That Reverse Osmosis water treatment (or another technology) of a high quality be established on the Jabiluka site, with a view to ensuring that there is, under any possible scenario, NO NEED for irrigation of water containing significant uranium concentrations (that is, water >5 µg/L uranium).

Jabiluka - Water Quality and Effects of Irrigation

Recommendation

The OSS, DBIRD and ERA adopt an approach to ensure that the expected monitoring and reporting requirements, can be enforced legally to the satisfaction of the Mirrar and broader public.

In order to prevent increasing uranium (and other) contamination of the tributaries and hence Swift Creek and Kakadu National Park, direct irrigation of IWMP water be suspended immediately and a high quality RO or equivalent technology be re-established on the Jabiluka site.

Detailed investigation of the soils at Jabiluka needs to be undertaken, assessing issues such as retention capacity (ie. cation exchange capacity, adsorption, complexing, etc.) and the rates at which uranium might leach from existing irrigation impacted areas.

The uranium grade of the non-mineralised stockpile must also be reported and this investigated as a future source of continuing uranium into the Central Tributary (which could happen regardless of whether irrigation is continued). All irrigation of this site must cease.

The OSS, DBIRD and ERA need to pro-actively move towards backfilling the decline with the mineralised ore and undertake proper rehabilitation of the Jabiluka site. The plugging of the decline could be an important first step in this direction.

SUMMARY OF KEY ENVIRONMENTAL MANAGEMENT ISSUES

1) MORE FREQUENT SAMPLING

2) MORE COMPREHENSIVE ANALYSIS

3) EVENT-BASED MONITORING

4) IMPROVED TRIGGER LIMITS

5) SEVERAL SITES FOR TRIGGER LIMITS

6) STATUTORY : LEGAL FORCE

7) TRANSPARENCY & ACCOUNTABILITY

8) MORE RIGOROUS RESEARCH ON SPECIFIC ISSUES

THE GUNDJEHMI ABORIGINAL CORPORATION

This submission has been prepared by the Gundjehmi Aboriginal Corporation.

The Gundjehmi Aboriginal Corporation is an organisation established, managed and controlled by the Mirrar People.

The Gundjehmi Aboriginal Corporation assists the Mirrar to protect and advance their rights and interests (clause 6.1 of GAC Constitution) and ensure that the Mirrar responsibilities and obligations to other Aboriginal people are carried out (clause 7.2 of GAC Constitution).

Gundjehmi Aboriginal Corporation does this by undertaking activities in accordance with the direction given by Mirrar people through their elected governing committee.

SECTION 1: SHORT HISTORY OF THE REGULATION OF URANIUM MINING ON MIRRAR LAND

Although one of the first Aboriginal nations to 'regain' part of their land under the *Aboriginal Land Rights (Northern Territory) Act 1976* (Cth) the Mirrar have not enjoyed a peaceful occupation of their traditional estate. In fact, over the past 30 years, well-intentioned land rights legislation in the Northern Territory has been manipulated to the detriment of the Mirrar People.

In April 1974, Justice Woodward delivered his Second Report to the Whitlam Government recommending, *inter alia*, the creation of a new form of Aboriginal statutory title in the Northern Territory to be granted by Aboriginal Land Commissioners to Aboriginal land trusts on the basis of claims from traditional Aboriginal owners. While the land trusts could act only at the direction of the land councils, the traditional owners would possess a right of veto over mining on their land. Woodward stated that, "to deny to Aborigines the right to prevent mining on their land is to deny the reality of their land rights".[1]

In 1972, however, the proponents of the Ranger uranium mine, Peko and EZ, entered into contracts to supply Japanese nuclear utilities with uranium in the years 1977-86. The Commonwealth Government approved these contracts in November 1972. In October 1974, long before Woodward's recommendations were enacted in the ALRA, the Whitlam Government signed the so-called Lodge Agreement with Peko and EZ that provided for a 50% equity stake for the Commonwealth and the joint venturers (with Peko and EZ holding 25% apiece) and for 72.5% of capital costs to be met by the Commonwealth. The Lodge Agreement was elaborated and supplemented with a Memorandum of Understanding between the Commonwealth and the joint venturers in October 1975 which provided, *inter alia*, that the Commonwealth would grant any necessary authorities under the *Atomic Energy Act 1953* (Cth). The Ranger mine was a *fait accompli*, regardless of local Aboriginal opposition.

In July 1975 the Commonwealth announced that a public inquiry would be conducted into, "the proposal for the development by the AAEC in association with Ranger Uranium Mines Pty Ltd of uranium deposits in the Northern Territory" [2] – the Ranger Uranium Environmental Inquiry or 'Fox inquiry', after the presiding commissioner. Over 18 months the Fox inquiry heard evidence from 287 witnesses and produced 12,000 pages of testimony. In October 1976, Fox delivered his first report to the Government, now under the leadership of Liberal leader Malcolm Fraser. While not ruling out Ranger, Fox recommended the Government proceed with caution. The Deputy Prime Minister and Minister for Natural Resources, Doug Anthony, interpreted this as a green light for the mine, as did the media. The *Australian Financial Review*

[1] Woodward, A.E. *Aboriginal Land Rights Commission: Second Report*, AGPS, Canberra, 1974 p.108.

[2] Ranger Uranium Environmental Inquiry. *First Report*, p.1.

declared, “Fox Gives Uranium the Go-ahead” and the *Sydney Morning Herald* exclaimed, “Way Open to Uranium Sale”. However, recommendation five clearly stated that, “any decision about mining for uranium in the Northern Territory should be postponed until the Second Report of this Commission is presented”.[3]

In May 1977, Fox delivered his second report and, while again not specifically recommending that the Ranger mine proceed, paved the way for its development. Fox recommended that construction of uranium mines in Kakadu commence sequentially, that a national park be created, the Aboriginal land claimants be granted title[4], and much more. In a major win for industry, the Ranger and Jabiluka mining areas were to be excluded from the national park. The Fraser Government cemented the deal by removing the Mirrar right of veto over the Ranger Project when enacting the *Aboriginal Land Rights (Northern Territory) Act 1976*. Subsection 40(6) of the Act stated, “If the land… being known as the Ranger Project Area, becomes Aboriginal land, subsection (1) [*the mining veto provision*] does not apply in relation to that land”[5].

Despite being defeated on Ranger by the most powerful forces in the country, the Mirrar maintained their opposition to the development of a second uranium mine at the Jabiluka mineral lease. This time the *Land Rights Act* was cleverly administered, rather than specifically altered, to allow mining interests to prevail. During compulsory *Land Rights Act* consultations the Mirrar were told that land claims over remaining areas of Mirrar traditional country were likely to fail unless an agreement was reached on Jabiluka[6]. In the midst of confusion and unconscionable pressure, a *Land Rights Act* agreement for mining at Jabiluka was signed by the NLC in 1982. Such events prompted Nugget Coombs to state: “what is happening in the [Kakadu] region bears little resemblance to the picture envisaged in the Woodward-Fox scenario”[7].

The Australian Labor Party ‘buried’ the Jabiluka project upon coming to office in 1983 and for 13 years the Mirrar believed their country at Jabiluka was protected from uranium mining. However, when the Howard Government was elected in 1996, the Mirrar were subjected to yet another tainted exercise of mining company power under the *Land Rights Act*. This time mining company North Limited (through its subsidiary ERA) dusted off the old 1982

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[3] Ranger Uranium Environmental Inquiry. *First Report*, p.185.

[4] The Fox Inquiry had been empowered to hear the Alligator Rivers Stage 1 Land Claim and make findings and recommendations, which were treated as if they had been made by the Aboriginal Land Commissioner.

[5] The ALRA has been substantially amended since 1976, however the removal of the Mirrar right to veto mining at Ranger has been ‘grandfathered’ into the current Act by section 8 of the *Aboriginal Land Rights (Northern Territory) Amendment Act (No. 3) 1987* .

[6] Northern Land Council, *Transcript of Djarr Djarr Meeting*, 27 January 1981.

[7] Coombs, H.C., *How to Balance the Aboriginal Interest in Resource Development*, paper presented to Australian National University Public Affairs Conference, Resource Development and the future of Australian Society, 21 & 22 August 1981.

Agreement[8], despite it being repudiated by the Mirrar and rendered near unworkable after 14 years of mothballing, and started development of a 'new' Jabiluka uranium mine using 'change in concept' provisions of the 1982 Agreement. Legal proceedings instigated by the Mirrar failed to prevent the commencement of construction.[9]

Notwithstanding constant public denials from North/ERA, it was common knowledge in 1996 that the 'new' Jabiluka project was only economically viable if uranium from Jabiluka was processed at the existing milling facilities at the Ranger mine, some 20 kilometres away. The Mirrar formally advised the company and the Commonwealth that, in accordance with the provisions of the *Land Rights Act* and associated agreements[10], they would not give permission for a road to be built between the two projects.

The Mirrar veto was exercised on the basis of two principles. Firstly, the Mirrar were determined to do everything in their power to prevent Jabiluka proceeding. Secondly, the Mirrar had serious concerns about radioactive waste management at Ranger and did not want processing to continue at Ranger beyond the life of the existing Ranger mine.

In an act of astounding environmental irresponsibility, North/ERA, with the approval of the Commonwealth and Northern Territory Governments, began construction at Jabiluka in June 1998 despite the Mirrar exercising their right to prevent milling at Ranger. The Mirrar were then subjected to a campaign of corporate and government intimidation to force a reversal of the veto, culminating in the World Heritage Committee of UNESCO declaring in July 1999 that it was '…gravely concerned about the serious impacts on the living cultural values of Kakadu National Park posed by the [Jabiluka] proposal…[11].

In September 1999, having knowingly desecrated an identified sacred site and extracted 47,000 tonnes of radioactive material and 57,000 tonnes of non-mineralised material, North/ERA ceased work on the Jabiluka construction site.

In August 2000, North Limited was absorbed by mining giant Rio Tinto, which has now conceded that Jabiluka cannot proceed without support from

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[8] The Northern Land Council and Pancontinental Ltd entered into the original Jabiluka Agreement (under the *ALRA*) in 1982. Energy Resources of Australia Ltd then bought the Jabiluka Mineral Lease (and the agreement) in 1991. ERA was a subsidiary of North Limited and became a subsidiary of Rio Tinto in August 2000.

[9] See for example *Yvonne Margarula v Hon Eric Poole, Minister For Resource Development and Energy Resources Australia Ltd* [1998] (unreported) NTSC 87 (16 October 1998).

[10] The 'veto' over the milling of Jabiluka uranium at Ranger is ultimately empowered by the *ALRA*, in conjunction with a 1991 Deed of Agreement between the Northern Land Council and ERA

[11] Clause (e), Declaration of the 3rd Extraordinary Session of the UNESCO World Heritage Committee, July 1999.

Traditional Owners[12]. Most analysts now agree that the Jabiluka project will never go ahead.

However, while the Mirrar have the effective power to prevent Jabiluka proceeding, they can seemingly do nothing at law to force Rio Tinto and the Northern Territory Government to rehabilitate a six hectare radioactive mine site on their country. In addition, while the company assures Traditional Owners that Jabiluka is being managed to the same 'high standard' as Ranger, in March of this year it was reported that the mining company incorrectly placed some 84,500 tonnes (or 1,000 truckloads) of uranium ore at Ranger, leading to the contamination of waterways feeding the Magela Creek, which flows through Aboriginal communities in Kakadu. This and other contemporary examples of environmental mismanagement at both Ranger and Jabiluka are detailed in Section Four.

It is against this background that the Gundjehmi Aboriginal Corporation has prepared this submission.

[12] The *Australian Financial Review* reported on 19 April 2002 in an article entitled 'Rio Tinto concedes defeat on Jabiluka' that 'steadfast opposition from traditional owners and poor global economics' had led to the company 'mothballing development of the Jabiluka uranium deposit in the Northern Territory for at least the next decade'.

SECTION 2A: RANGER REGULATORY ARRANGEMENTS

2A(a): Atomic Energy Act 1953 (Cth)

The Act, as it currently stands, performs four main functions. Firstly it vests title of all prescribed substances[13] in the territories of Australia in the Commonwealth[14]. Secondly, it requires those who discover prescribed substances in any part of Australia to notify the Commonwealth[15]. Thirdly, it gives the Commonwealth power to obtain information about prescribed substances from a person possessing or controlling such substances[16]. Fourth, the Act provides authority for commercial exploitation of prescribed substances on the Ranger Project Area[17].

Atomic Energy Act 1953 *(Cth)*

[13] Section 5(1) defines a 'prescribed substance as: uranium, thorium, an element having an atomic number greater than 92 or any other substance declared by the regulations to be capable of being used for the production of atomic energy or for research into matters connected with atomic energy'.

[14] Section 35. Under section 42, compensation is payable to those from who property in acquired.

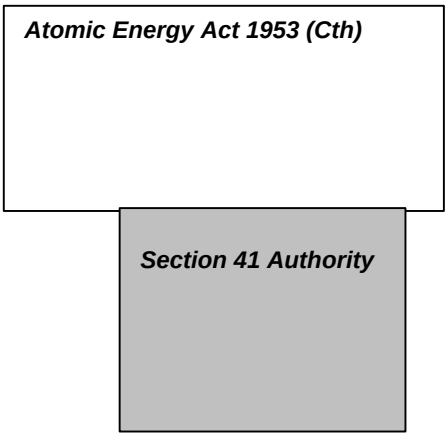
[15] Section 36.

[16] Section 37.

[17] PART III, including sections 41, 41A-D. In addition, section 5(1) defines the 'Ranger Project Area' as the land described in Schedule 2 to the *Aboriginal Land Rights (Northern Territory) Act 1976*.

2A(b): s.41 Authority

The Commonwealth Minister is empowered to grant authority to a person or persons to discover, mine, recover, treat and process prescribed substances, however this power is restricted to the Ranger Project Area (RPA).[18] The Minister is also empowered to vary and revoke the authority. Section 41A(4) provides that where those holding the authority have refused or failed to comply with or observe a condition or restriction to which the authority is subject the Minister may vary the conditions or restrictions of the authority, even if this results in indefinite suspension of operations on the RPA. However section 41A(5) provides that the Minister must not vary the conditions under section 41A(4) unless the Minister has provided written notification of the breach of the authority and given the holders of the authority an opportunity to secure compliance with the condition within a specified timeframe.

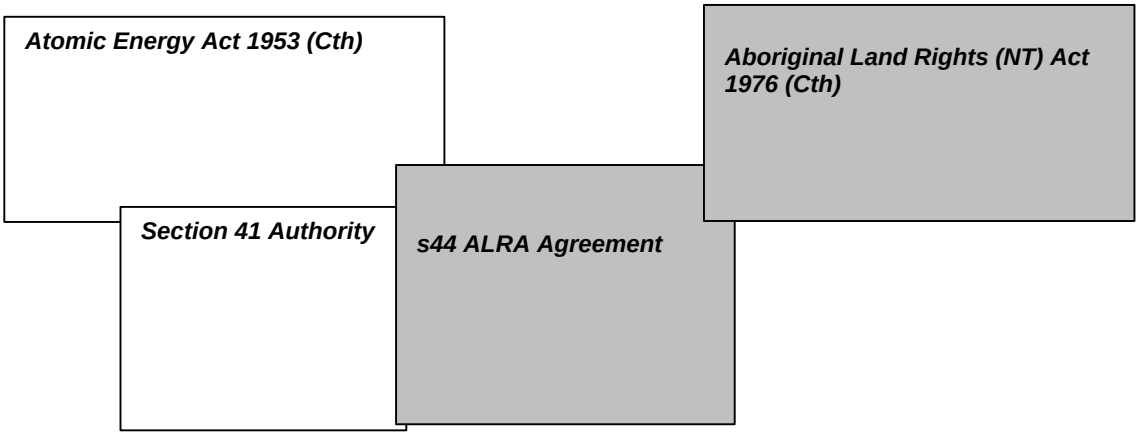


[18] Section 41.

2A(c): Atomic Energy Act & s.44 Land Rights Act Agreement

In exercising powers under section 41A, the Minister is not permitted to act in a manner that is inconsistent with the obligations of the Commonwealth under the ALRA section 44 agreement[19].

Section 41 (2AA) creates the 'statutory fiction' that those named in the 's.41 authority' are carrying out operations on behalf of the Commonwealth[20]. This 'fiction' was created to deal with the fact that, because the Ranger Project Area is on Aboriginal Land, and because the Ranger Project Area is dealt with separately and uniquely under the *Aboriginal Land Rights (Northern Territory) Act 1976* (Cth), an agreement between the Commonwealth and the NLC is required for mining operations to take place on the RPA[21].



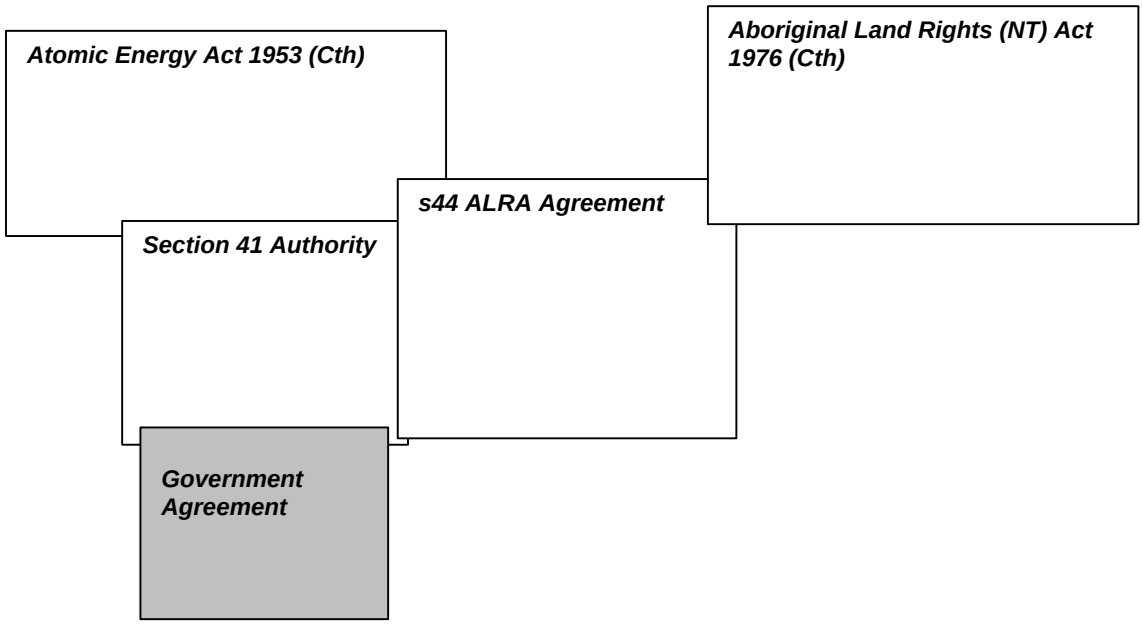
[19] Section 41A(8).

[20] In Northern Land Council v The Commonwealth (1986) 161 CLR 1, the High Court upheld the "statutory fiction" enacted by s 41(2AA) as a drafting device supported by the Territories' power in s 122 of the Constitution.

[21] When the ALRA was enacted, section 40(6) of the ALRA provided that s 40(1) (relating to the conditions for the grant of mineral interests on Aboriginal land) was not to apply if the land known as the Ranger Project Area became Aboriginal land. The main effect of this section was to remove the power of the traditional owners to 'veto' mining operations on the RPA. Instead, an agreement was reached on 3 November 1978 pursuant to (the then) s.44(2) of the ALRA, which provided for agreements only between the Commonwealth and the relevant Land Council for the Ranger Project Area.

2A(d): Atomic Energy Act & Government Agreement

It is presumed that creating this statutory fiction was favoured over the option of requiring the operators of the Ranger Mine to enter into a new, direct agreement with the Land Council. Instead the Commonwealth has a separate agreement with ERA, "the Government Agreement" and as long as this agreement is complied with, the statutory fiction prevails[22].



[22] Sections 41(2AA) and 41(2AB).

2A(e): Atomic Energy Act, s.41 Authority & Complementary Agreement/Extension Agreement & Mining Agreement

Section 41C entitles those holding a s.41 authority to have a new authority conferred upon them for a period not exceeding that of the existing authority provided, *inter alia*, not later than 9 months before the expiration of the mining period the existing *Land Rights Act* section 44 agreement is extended or a new section 44 agreement is entered into between the Commonwealth and the Land Council.

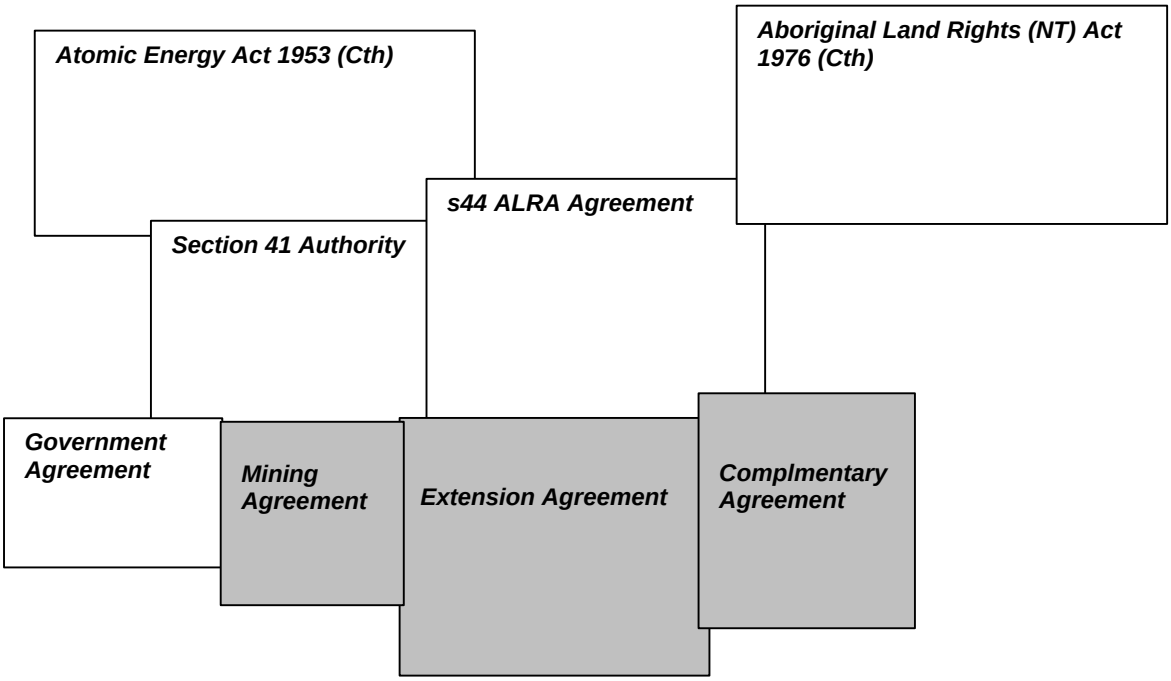
The original authority was granted on 9 January 1979 for a period of 26 years (including five years for rehabilitation). It was therefore due to expire on 9 January 2000. ERA applied for a new Authority on 15 December 1995. On 19 March 1999 an agreement was entered into between the Commonwealth and the Northern Land Council to extend the original *Land Rights Act* s.44 Agreement dated 3 November 1978.

The *Land Rights Act* section 44 Agreement was extended in compliance with section 41C of the *Atomic Energy Act* by the 'Extension Agreement', which is in turn subject to the 'Complementary Agreement', which provides for substantial re-negotiation of the extended section 44 Agreement. The re-negotiation of the s.44 Agreement (between the Commonwealth and NLC) also involves the creation of a Mining Agreement (between ERA and the NLC).

The Extension agreement amended the s.44 Agreement by, *inter alia*, inserting the following:

> 25A.2 The New s.41 Authority shall provide that the terms and conditions of the Authority shall, with the consent of ERA, be amended or revised to ensure that the Authority is at all times consistent with the Commonwealth's obligations under this Agreement.
>
> 25A.3 The New s.41 Authority shall contain a condition substantially in accordance with the following:
>
> > Notwithstanding anything contained elsewhere in this Authority, ERA shall comply with such other conditions and restrictions as may be determined pursuant to the agreement described as the "Complementary Agreement" made between the Commonwealth, the NLC and ERA. In the event of any inconsistency with other conditions or restrictions contained in this Authority, those determined as referred to in this condition and restriction shall prevail.
>
> 25A.4 The Commonwealth shall enforce, and shall use its best endeavours to ensure that ERA undertakes the Operations in accordance with, the Authority.
>
> 25A.5 The Commonwealth shall use its best endeavours to ensure that ERA undertakes Operations in accordance with the Mining Agreement and the New s.41 Authority shall contain a condition to the effect that ERA must undertake Operations in accordance with the Mining Agreement.

On 14 November 1999, a new s.41 Authority was granted to ERA. Conditions and restrictions include a condition giving effect to Clause 25A(3) of Extension Agreement (Condition 2.2). Also the Authority would seem to get around the cumbersome restrictions in the *Atomic Energy Act* (s.41A) in relation to varying the Authority by creating a condition in the Authority that additional conditions may be made by the Minister from time to time (Condition 2.5).



2A(f): Power sharing between the Commonwealth and the Northern Territory

The *Atomic Energy Act 1953* demonstrates an intention at s.41(4) not to exclude or limit the operation of any provision of a law of a State or Territory that is capable of operating concurrently with the Atomic Energy Act. This principle has been confirmed by the Federal Court in *Yvonne Margarula v Minister for Resources & Energy & Ors* [1998] (unreported) 1029 FCA (14 August 1998).

Accordingly, Northern Territory Acts such as the *Mining Act 1982 (NT)* and the *Mining Management Act 2001* (NT) are capable of operating in respect of the Ranger Project Area. While there is no mineral lease issued under the *Mining Act 1982* (NT) in respect of the Ranger operations (authority to carry out the current Ranger operations being sufficiently supported by the *Atomic Energy Act 1953* (Cth)), the Northern Territory has issued an authorisation for operations at Ranger under the *Uranium Mining (Environmental Control) Act 1979* (NT), which has now been repealed and replaced by the *Mining Management Act 2001* (NT).

Section 34 (3) of the *Mining Management Act 2001* (NT) provides that:

> 34 (3) Before exercising a power or performing a function under this Part in relation to an Authorisation that relates to uranium or thorium, the Minister -
> (a) must consult with the Commonwealth Minister about matters agreed in writing between them relating to the mining of uranium or thorium; and
> (b) must act in accordance with any advice provided by the Commonwealth Minister.
> (4) In granting or varying an Authorisation that relates to the Ranger Project Area, the Minister must ensure that the Authorisation incorporates or adopts by reference (with the necessary modifications) the Ranger Project Environmental Requirements.

Section 175 of the *Mining Act 1982* (NT) similarly provides:

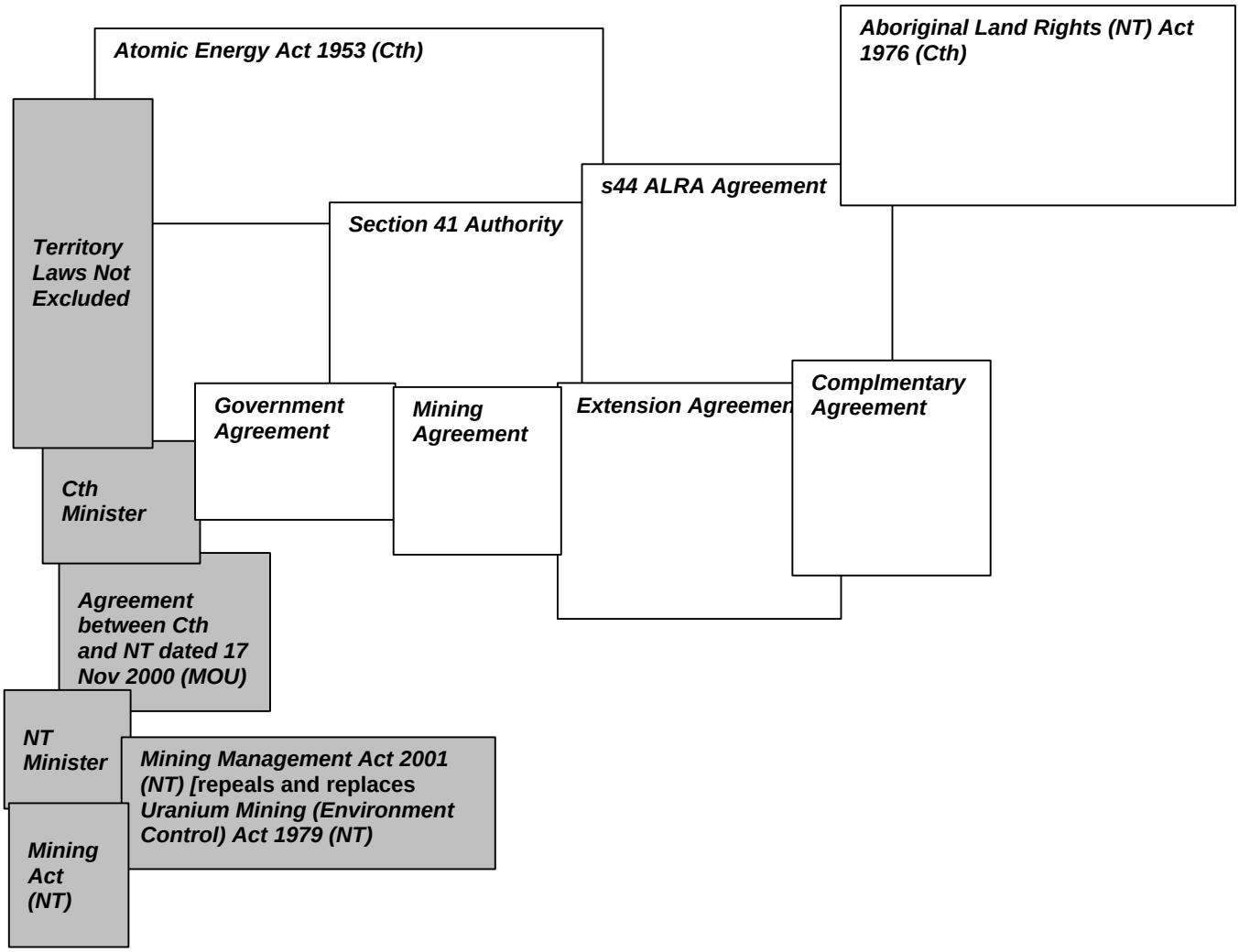
> (1) Subject to subsection (2) [which relates to exploration licences], but notwithstanding anything elsewhere contained in this Act (other than subsection (3) [which relates to the payment of royalties] or the Regulations, in respect of a prescribed substance within the meaning of the *Atomic Energy Act 1953* of the Commonwealth, the Minister –
> (a) shall exercise his powers in accordance with, and give effect to, the advice of the Minister of the Commonwealth for the time being administering section 41 of that Act; and
> (b) shall not exercise his powers otherwise than in accordance with such advice.

The 'matters agreed in writing between' the Commonwealth and Northern Territory Minister (as referred to in section 34(4) above) are principally contained in the *Agreement between the Commonwealth of Australia and the Northern Territory of Australia in relation to principles to be applied in the regulation of Uranium Mining in the Northern Territory of Australia* (dated 17

November 2000). In this document the Commonwealth and the Territory agree at Clause 5 to:

> recognise the basic principle that the Territory shall consult with the Commonwealth in respect of matters agreed in writing between them relating to the mining of prescribed substances in the Territory. The Territory Minister shall act in accordance with any advice on the matter which is provided by the Commonwealth Minister.

This document contains a number of other statements, obligations and intentions relating to the sharing of responsibility between the Commonwealth and the Northern Territory in relation to uranium mining, which are discussed in more detail later in this submission.



2A(g): Working Arrangements between the Commonwealth Office of the Supervising Scientist and the Northern Territory Supervising Authority (and associated instruments)

In broad terms, the analysis above provides an outline of the foundation regulatory framework for Ranger, while the following describes the system for ongoing monitoring, reporting and research in relation to environmental aspects of the Ranger mine.

The Commonwealth and the Northern Territory share responsibility via the Revised Working Arrangements for Co-ordinating the Regulation of Environmental Aspects of Uranium Mining in the Alligator Rivers Region (September 1995) ["the Working Arrangements"].

The purpose of the Working Arrangements is to establish procedures for consultation between the Commonwealth Office of the Supervising Scientist and the Northern Territory Supervising Authority (currently the Department of Business, Industry and Resource Development) in the performance of their legislative functions with 'maximum efficiency and minimum duplication'.

The Working Arrangements set out reporting, information exchange and decision-making procedures agreed between the Commonwealth and Northern Territory agencies in relation to uranium mining in the region.

The Working Arrangements establish the functions of the Ranger Minesite Technical Committee (RMTC), which is chaired by the NT Supervising Authority and comprises representatives of OSS, ERA Ltd and the Northern Land Council. They also make provision for Ad Hoc Technical Working Groups comprised of the same representatives (and others as necessary).

The primary function of the RMTC is the review and development of Environmental Performance Reviews, which are twice-yearly reviews of the impact of uranium mining operations on the environment of the region carried out by the OSS and the NT Supervising Authority.

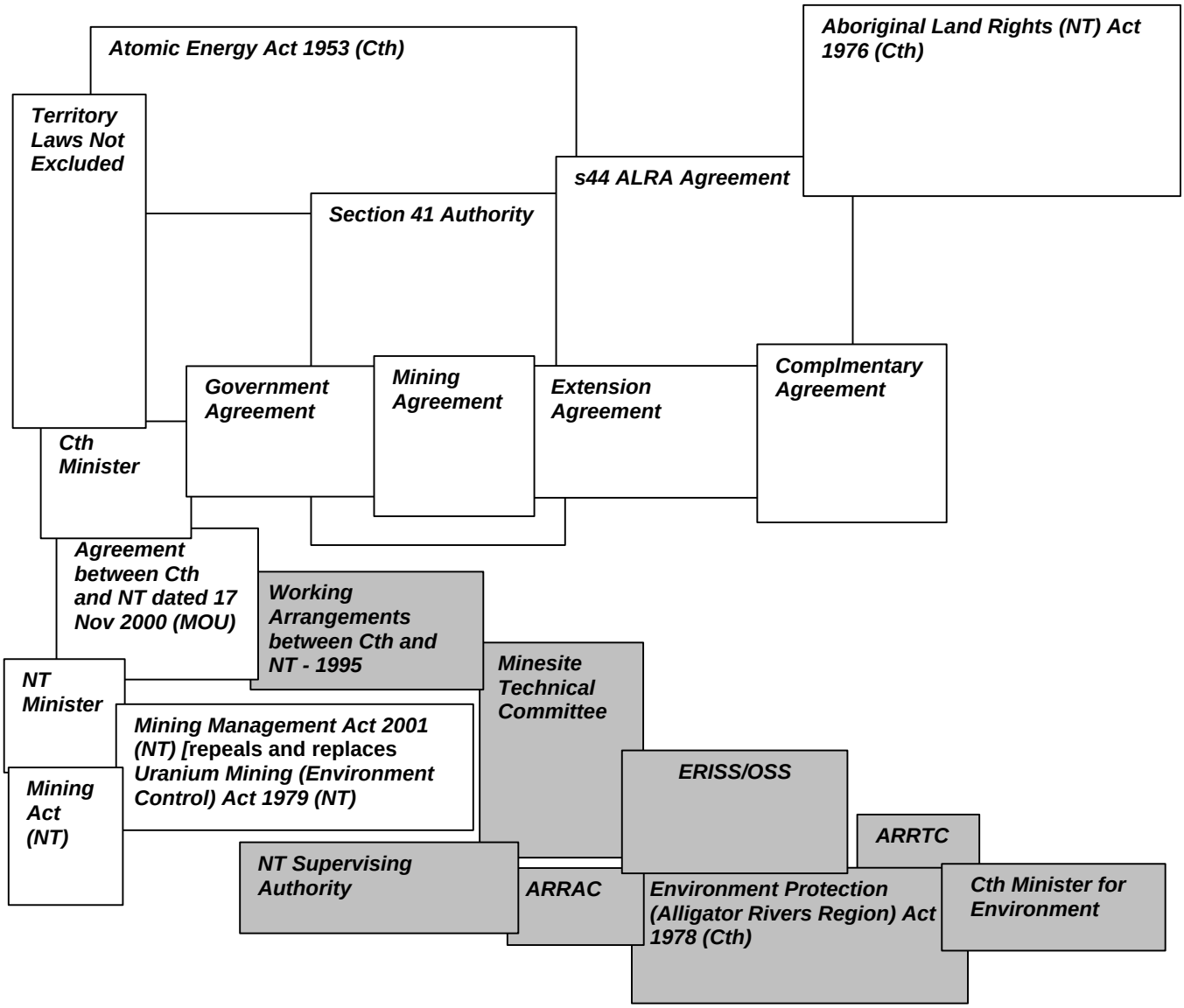
The Working Arrangements also reiterate the functions of the Alligator Rivers Region Advisory Committee (ARRAC), which is established in the *Environment Protection (Alligator Rivers Region) Act 1978* (Cth), and consists of the Supervising Scientist, the Director of National Parks, the representatives of Territory authorities, mining companies, unions, Aboriginal organisations, conservation groups and such other members who may be appointed by the Commonwealth Minister for the Environment.

The Working Arrangements also refer to the Alligator Rivers Region Technical Committee, which is now also established in the *Environment Protection (Alligator Rivers Region) Act*. The functions of the Technical Committee include considering programs for research into the (non-social) effects of uranium mining operations and to make recommendations to the

Commonwealth Environment Minister on the nature and extent of research necessary to protect and restore the environment in the region. The Technical Committee consists of people with appropriate scientific or technical qualifications appointed by the Minister. At least one member must be nominated by the NLC.

The *Environment Protection (Alligator Rivers Region) Act 1978* (Cth) also establishes the functions and responsibilities of the Supervising Scientist and the Environmental Research Institute of the Supervising Scientist (ERISS).

The Working Arrangements establish that the NT Supervising Authority is responsible for ensuring that the mining companies directly and immediately notify the NT Supervising Authority, the Supervising Scientist, the Commonwealth Department responsible for the *Atomic Energy Act* and the NLC if there is any mine-related event which results in significant risk to biological integrity or has the potential to cause harm to people in the area or may cause concern to traditional owners or the public.



2A(h): s.41 Authority Environmental Requirements and the Ranger General Authorisation Number A82/3 Issued under the Uranium Mining (Environment Control) Act 1979 (NT) and now governed by the Mining Management Act 2001 (NT)

The Environmental Requirements for the Ranger uranium mine are conditions of the Authority issued under s41 of the *Atomic Energy Act 1953* and also reflect the Commonwealth's role in the Alligator Rivers Region under the *Environment Protection (Alligator Rivers Region) Act 1978.*

The operational procedures and practices, and environmental standards, guidelines, codes, regulations or limits relevant to meeting these conditions are set out in Northern Territory legislation and (currently) Ranger General Authorisation Number A82/3 issued under the *Uranium Mining (Environment Control) Act 1979 (NT),* which has been repealed and replaced with the *Mining Management Act 2001* (Cth).

The Environmental Requirements that the Traditional Owners have identified as requiring strict adherence and enforcement, as well as interpretation from an Aboriginal Traditional Owner perspective, are the following:

1. Primary Environmental Objectives

1.1 The company must ensure that operations at Ranger are undertaken in such a way as to be consistent with the following primary environmental objectives:

(a) maintain the attributes for which Kakadu National Park was inscribed on the World Heritage list;
(c) protect the health of Aboriginals and other members of the regional community;

16. Reporting Incidents

16.1 The company must directly and immediately notify the Supervising Authority, the Supervising Scientist, the Minister and the Northern Land Council of all breaches of any of these Environmental Requirements and any mine-related event which:
(a) results in significant risk to ecosystem health; or
(b) which has the potential to cause harm to people living or working in the area; or
(c) which is of or could cause concern to Aboriginals or the broader public.

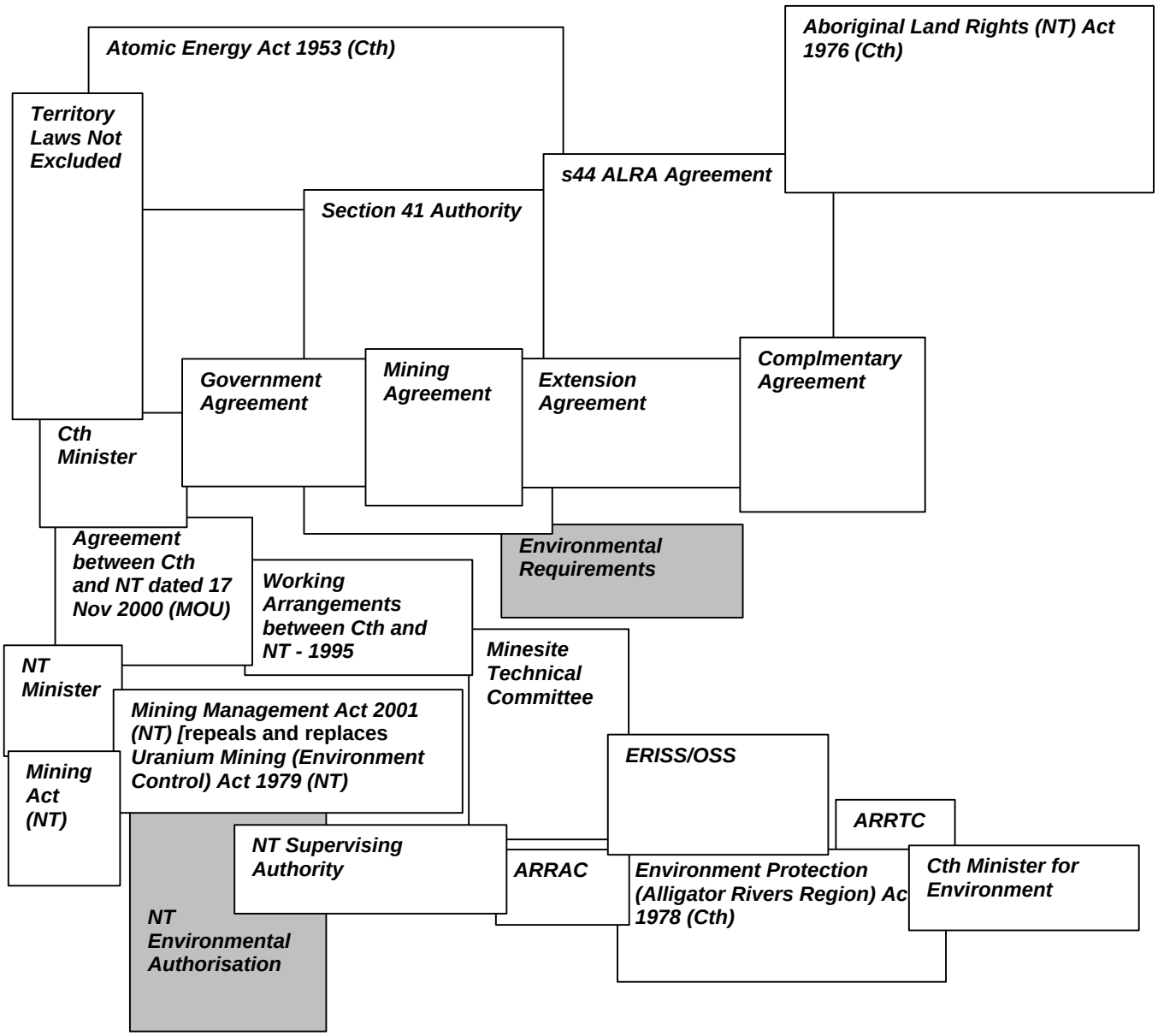
18. Environmental Management Report

18.2 The report required under clause 18.1 must deal specifically with the following matters:
(g) social impact monitoring;

Section 34(4) of the *Mining Management Act 2001* (NT) states:

> In granting or varying an Authorisation that relates to the Ranger Project Area, the Minister must ensure that the Authorisation incorporates or adopts by reference (with the necessary modifications) the Ranger Project Environmental Requirements.

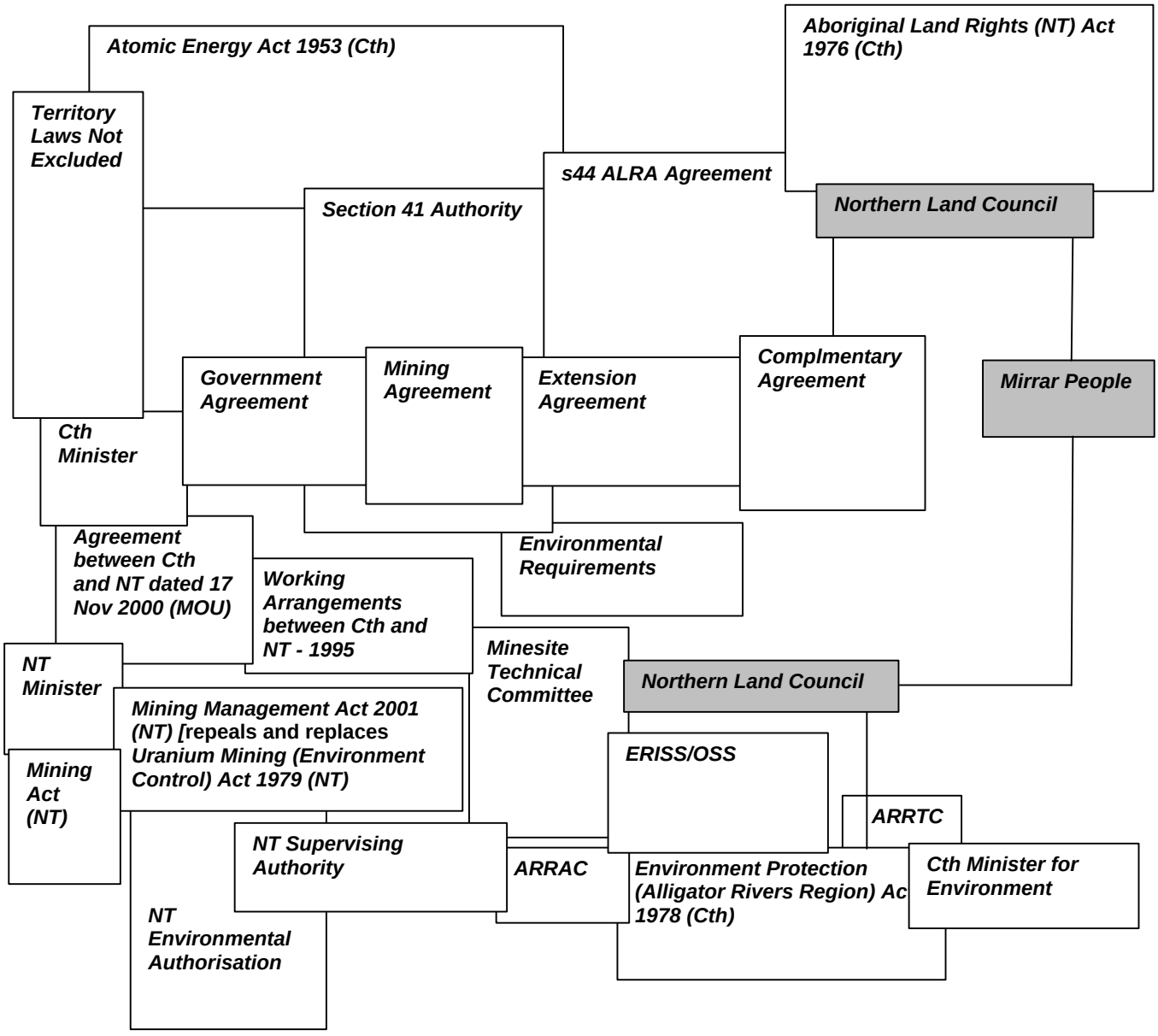
In compliance with this section, Ranger General Authorisation Number A82/3 includes Primary Environmental Objectives and requires an Environmental Management Report in the same terms as both the Commonwealth Environmental Requirements. It does not directly incorporate the Environmental Requirement relating to the reporting of incidents.



2A(i): Traditional Owners and the regulatory regime for the Ranger Mine

The Traditional Owners of the Ranger Project Area are the Mirrar People, who manage and control the Gundjehmi Aboriginal Corporation.

The Traditional Owners have no direct role in the regulatory system. The Mirrar receive information emanating from the reporting process via the Northern Land Council. The Mirrar may also attempt to assert rights and interests, via the Northern Land Council, pursuant to the terms of the s.44 Land Rights Act Agreement.



SECTION 2B: JABILUKA REGULATORY ARRANGEMENTS

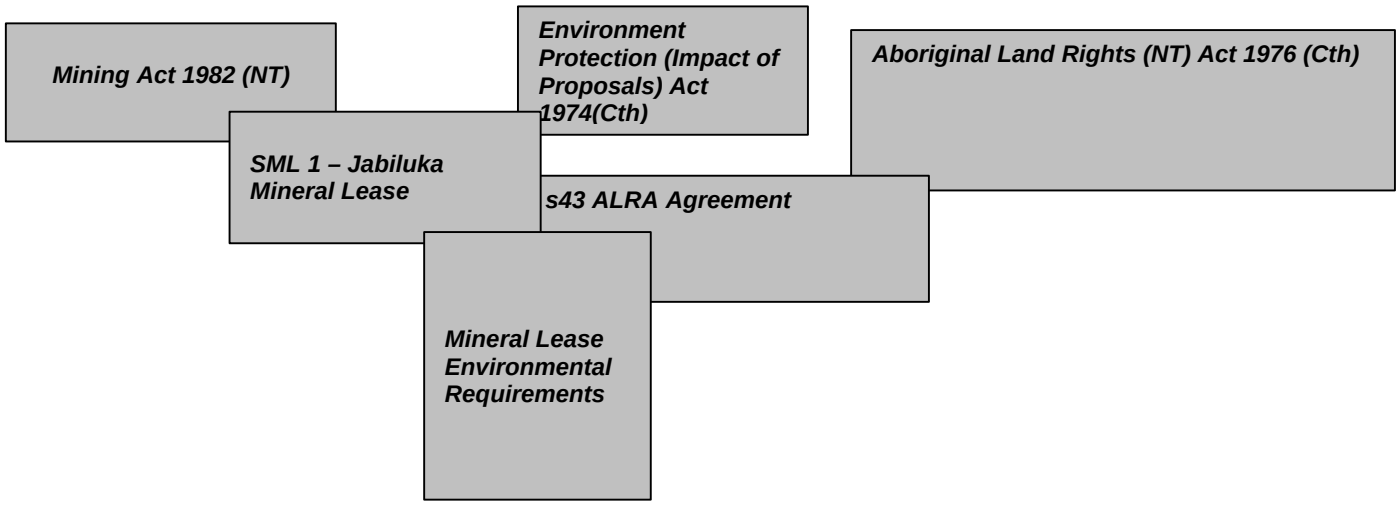
2B(a): Jabiluka Mineral Lease and s.43 ALRA Agreement

The regulatory frameworks at Jabiluka and Ranger are markedly different.

Most significantly, there is no provision in the *Atomic Energy Act 1953 (Cth)* for the Commonwealth to authorise uranium mining operations at Jabiluka[23]. Instead, authority for mining operations at Jabiluka derives from the Jabiluka Mineral Lease (ML N1) issued under the *Mining Act 1982* (NT).

As the Jabiluka Mineral Lease is on Aboriginal Land, an agreement under the *Aboriginal Land Rights (Northern Territory) Act 1976* (Cth) is required for mining to take place. This agreement is known as the s.43 Jabiluka Agreement. Unlike Ranger, the agreement is directly between the Northern Land Council and ERA – the Commonwealth is not a contractual party.

The Environmental Requirements attached to the Jabiluka *Land Rights Act* Agreement are attached to the Jabiluka Mineral Lease in identical terms. These Environmental Requirements were developed as part of a Commonwealth environmental impact assessment process carried out in 1979 pursuant to the terms of the (now repealed and 'grandfathered'[24]) *Environment Protection (Impact of Proposals) Act 1974* (Cth).



[23] However the *Atomic Energy Act 1953 (Cth)* does operate to vest ownership of uranium at Jabiluka in the Commonwealth: section 35.

[24] The *Environment Reform (Consequential Provisions) Act 1999* (Cth) and the *Environment Protection & Biodiversity Conservation Act 1999* (Cth) make provision for proposals considered under the *Environment Protection (Impact of Proposals) Act 1974* (Cth) to continue to be considered under the earlier Act.

2B(b): Jabiluka Change of Concept process, the new Jabiluka Environmental Requirements & NT Authorisation

In 1996, following a change in Commonwealth Government policy on uranium mining, ERA Limited developed a new proposal to mine uranium at Jabiluka. The company's preferred option was to mill uranium from Jabiluka on the Ranger Project Area (the so-called Ranger Mill Alternative or RMA) and ERA developed an Environmental Impact Statement for this proposal under the *Environment Protection (Impact of Proposals) Act 1974* (Cth). On 8 October, 1997 the Commonwealth Minister for Resources and Energy approved the proposal as described in the EIS, subject to the (primarily environmental) 'Jabiluka Requirements'.

The new proposal to mine at Jabiluka was radically different from that proposed in the 1982 s.43 *ALRA* Agreement. The company chose not to enter into a new *ALRA* Agreement with the Traditional Owners, presumably because the Mirrar People were absolutely opposed to the development of the Jabiluka deposits. Instead, ERA triggered 'Change of Concept' provisions in the 1982 Agreement, which allowed the new project to proceed under the old agreement (despite the opposition of the Traditional Owners, local Aboriginals and the NLC) in conjunction with a '1998 Jabiluka Deed Poll'.

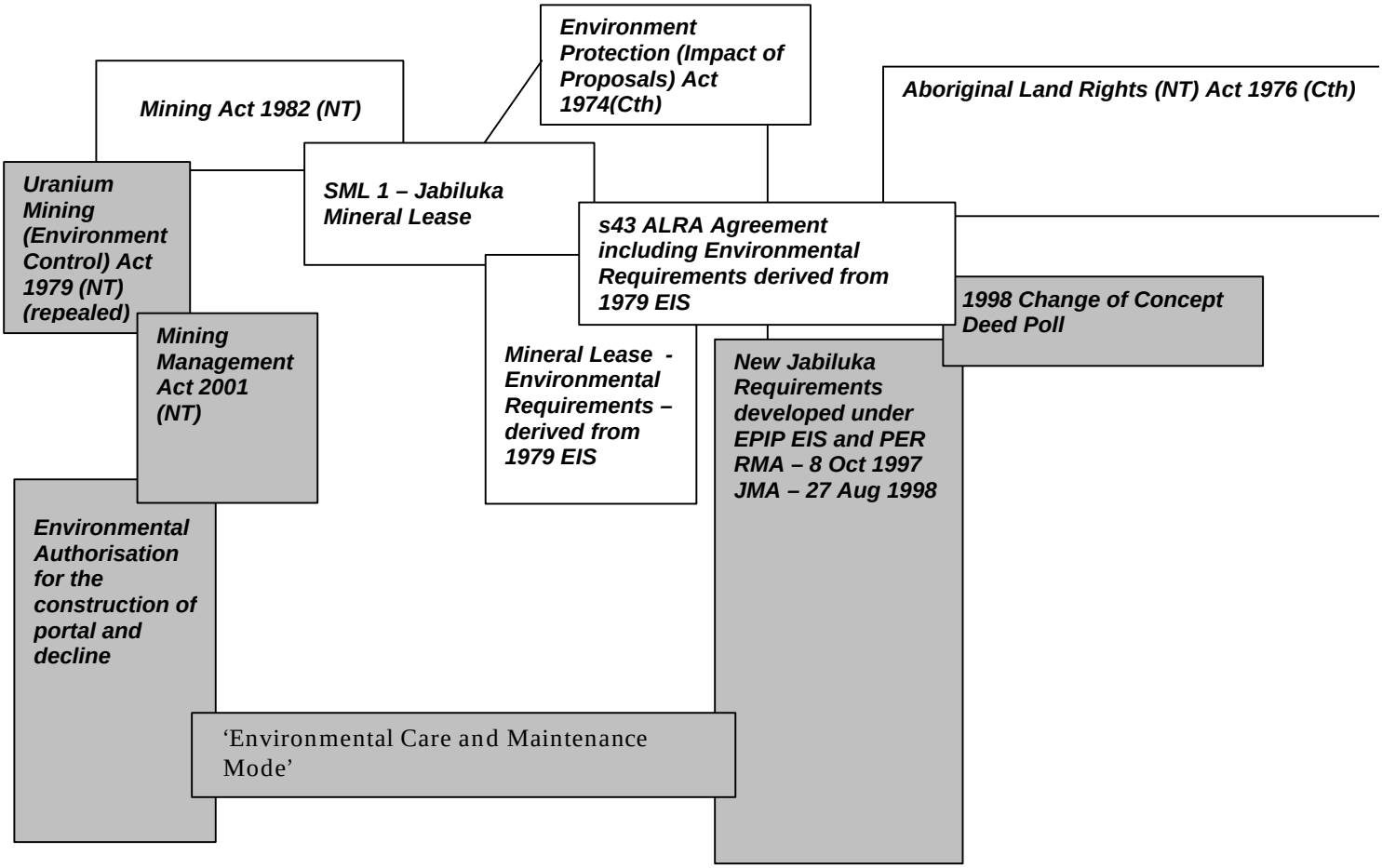
However, the 'Change of Concept' provisions did not allow the Environmental Requirements in the 1982 Agreement to be updated without the consent of the Traditional Owners. For contractual reasons, this has also prevented the Environmental Requirements in the Mineral Lease being updated to reflect the new proposal.

In 1998, ERA accepted that the Traditional Owners would not consent to the company's preferred option of milling Jabiluka ore at Ranger. As a result, ERA was directed by the Commonwealth to prepare a Public Environment Report under the *Environment Protection (Impact of Proposals) Act 1974* (Cth) for mining and milling at Jabiluka (the 'JMA'). On 27 August, 1998 the Commonwealth Minister for Resources and Energy approved the proposal as described in the PER, subject to additional 'Jabiluka Requirements'.

In June 1998, the Northern Territory Minister for Mines and Energy, after consulting with the Commonwealth Minister, issued an Authorisation under the *Uranium Mining (Environmental Control) Act 1979* NT for the construction of a portal and decline and associated facilities on the Jabiluka Mineral Lease. The Authorisation was issued on the basis that the construction activities were common to both the (approved) RMA and (at that stage proposed) JMA.

In September 1999, having completed construction activities ostensibly 'common' to both the RMA and JMA, ERA suspended construction of the Jabiluka Project. Since this time, the Jabiluka Project has been in a so-called

'environmental care and maintenance' mode. The current NT authorisation does not accommodate the prolonged (at least 10 years) period of care and maintenance proposed by ERA and Rio Tinto. Best practice demands the issuing of a new authority to accommodate this drawn-out delay.



2B(c): Commonwealth and Northern Territory arrangements for monitoring and reporting of the environmental aspects of the Jabiluka Project

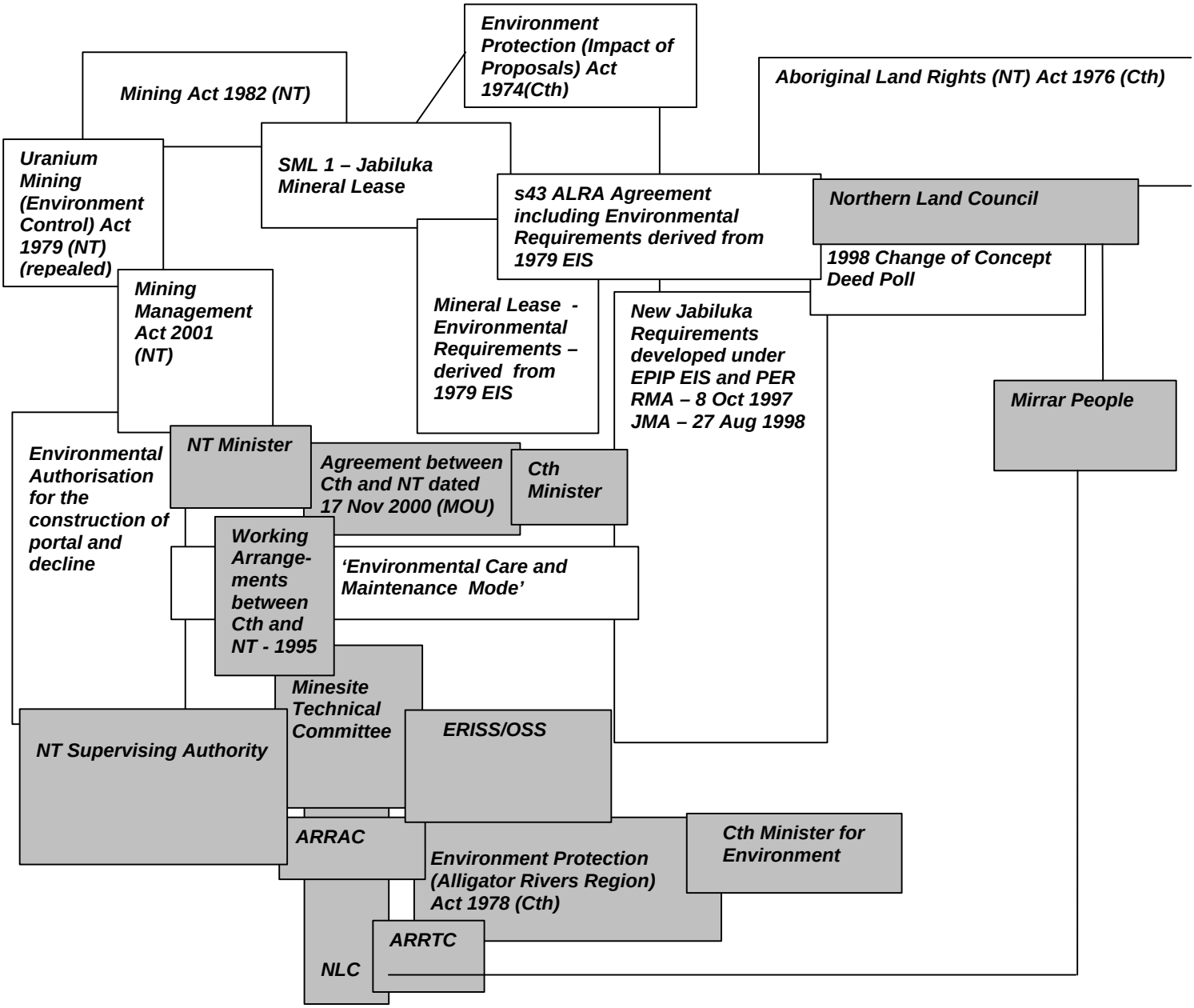
The *Agreement between the Commonwealth of Australia and the Northern Territory of Australia in relation to principles to be applied in the regulation of Uranium Mining in the Northern Territory of Australia* (dated 17 November 2000), as described above in relation to the Ranger Mine, purports to cover the Jabiluka Project. The Agreement makes particular reference to incorporation and adoption of the 'Jabiluka Requirements' developed by the Commonwealth during the 1997 Jabiluka EIS and the 1998 Jabiluka PER, and includes a statement of intention to amend the 23-year-old Environmental Requirements attached to the Jabiluka Mineral Lease.

It is presumed that the Office of the Supervising Scientist and the Northern Territory Supervising Authority use the ***Revised Working Arrangements for Co-ordinating the Regulation of Environmental Aspects of Uranium Mining in the Alligator Rivers Region*** (September 1995) (as described above in relation to the Ranger Mine) to govern their shared legislative responsibilities in respect of Jabiluka. There is, for example, a Jabiluka Minesite Technical Committee. However there is no specific mention of the Jabiluka Project in the Working Arrangements because they pre-date the new development of Jabiluka by ERA. The *Environment Protection (Alligator Rivers Region) Act 1978* (Cth) applies to the Jabiluka Project.

2B(d): Traditional Owners and the regulatory regime for the Jabiluka Project

The Traditional Owners of the Jabiluka Mineral Lease are the Mirrar People, who manage and control the Gundjehmi Aboriginal Corporation.

As in relation to the Ranger Mine, the Traditional Owners have no direct role in the regulatory system at Jabiluka. The Mirrar receive information emanating from reporting processes via the Northern Land Council. The Mirrar may also attempt to assert rights and interests, via the Northern Land Council, through the 1982 s.43 *ALRA* Agreement.


Environment Protection (Impact of Proposals) Act 1974(Cth)
Mining Act 1982 (NT)
Aboriginal Land Rights (NT) Act 1976 (Cth)
Uranium Mining (Environment Control) Act 1979 (NT) (repealed)
SML 1 – Jabiluka Mineral Lease
s43 ALRA Agreement including Environmental Requirements derived from 1979 EIS
Northern Land Council
1998 Change of Concept Deed Poll
Mining Management Act 2001 (NT)
Mineral Lease - Environmental Requirements – derived from 1979 EIS
New Jabiluka Requirements developed under EPIP EIS and PER RMA – 8 Oct 1997 JMA – 27 Aug 1998
Mirrar People
Environmental Authorisation for the construction of portal and decline
NT Minister
Agreement between Cth and NT dated 17 Nov 2000 (MOU)
Cth Minister
Working Arrange-ments between Cth and NT - 1995
'Environmental Care and Maintenance Mode'
Minesite Technical Committee
NT Supervising Authority
ERISS/OSS
ARRAC
Cth Minister for Environment
Environment Protection (Alligator Rivers Region) Act 1978 (Cth)
ARRTC
NLC

SECTION 3: PROBLEMS WITH CURRENT REGULATORY ARRANGEMENTS AT JABILUKA AND RANGER

In 1980, Nugget Coombs wrote:

> …both the Parliament [through the *Land Rights Act*] and the Ranger Inquiry intended that subject only to the National Interest clause, Aboriginal wishes in matters affecting the land should be paramount. An external observer cannot escape the impression that, increasingly day-by-day, that principle is honoured more in the breach than the observance. Where Aboriginal wishes conflict with the interests of mining companies, white property owners, or the convenience of bureaucrats the original intention appears to be whittled away till the principle has become little more than an advertising slogan bearing little relation to the quality of the product...[25]

In 1984, a Commonwealth Social Impact Study into uranium mining in the Alligator Rivers Region found:

> The local Aboriginal people always appear at a distance…They are problems, not participants. And they are not to be assigned an active role. The administrative arrangements are left to outsiders: specialists. The local people may participate as workers, but not as decision-makers, or as the makers or imposers of sanctions. They are not to have a determining voice. Their voices may be heard, but not heeded: they are nowhere decisive. How this could be reconciled with granting of land ownership, and the fact of Aboriginal responsibilities to land, is not explained.[26]

In 1996, in response to the Jabiluka EIS, Environment Australia conducted an *Environmental Assessment Report* in which it stated:

> There would appear to be evidence of marginalisation of the Traditional Owners and the broader Aboriginal community as a result of past decisions concerning development and management of the region...[27]

From the perspective of the Mirrar, the problems identified above remain unabated and in fact have become deeply entrenched over the past two decades. Simply put, the regulatory arrangements for operations at Ranger and Jabiluka are inadequate and inappropriate because they prevent the Traditional Owners effectively managing those parts of Mirrar land subject to uranium mining interests.

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[25] The Impact of Uranium Mining on the Social Environment of Aborigines in the Alligator Rivers Region, 1980, (In Harris, *Social and Environmental Choice – The Impact of Uranium Mining in the Northern Territory*), CRES Monograph 3, CRES, ANU, p.131.

[26] *Aborigines and Uranium – Consolidated Report to the Minister for Aboriginal Affairs on the Social Impact of Uranium Mining on the Aborigines of the Northern Territory*, Australian Government Publishing Service, Canberra 1984 p.84-85.

[27] Environment Australia, Environmental Assessment Report : Proposal to Extract, Process and Export Uranium From Jabiluka Orebody No. 2 – The Jabiluka Proposal. Environmental Assessment Branch, Environment Australia, August 1997, p109.

3(a): THE EFFECTIVE MANAGEMENT, BY THE MIRRAR PEOPLE, OF ABORIGINAL LAND SUBJECT TO URANIUM MINING

As owners of Mirrar Country, the Mirrar People have a responsibility to actively participate in the land's management and protection. This principle goes to the core of Aboriginal land rights.

In order to effectively manage and protect their land, the Mirrar contend that agreements under the *Aboriginal Land Rights (Northern Territory) Act 1976* (Cth), in conjunction with relevant Commonwealth and Northern Territory legislation, *should* provide the Mirrar with the legally enforceable right to:

i) access independent and appropriate information about the way that mining operations on Mirrar land, and arrangements for regulating those operations, directly and indirectly impact upon the physical environment and living culture of the Mirrar;
ii) seek compliance and/or remedies where operators of mining projects on Mirrar land do not comply with the regulatory arrangements;
iii) instigate processes for reforming the regulatory arrangements as they apply to Mirrar land;
iv) disallow changes to the regulatory arrangements which detrimentally affect the exercise of Traditional Owner rights or protection of the environment on Mirrar land.

Unfortunately, at present, the Mirrar are unable to effectively exercise any of these land management functions. Many of the barriers to the exercise of meaningful land management arise from the current regulatory arrangements imposed by government. Other barriers relate to the way existing mining agreements were drafted more than 20 years ago.

3(b): FLAWS WITH THE CURRENT REGULATORY ARRANGEMENTS

3(b)(i) <u>Inconsistency</u>

The arrangements governing the Ranger Uranium Mine and the Jabiluka Project, both located on Mirrar country and both owned by Energy Resources of Australia Ltd, are significantly different. This creates confusion in the Aboriginal (and non-Aboriginal) community and places additional stress on those Traditional Owners seeking to understand why and how decisions are made about mining on their country.

For example, at Ranger, in broad terms, the Commonwealth authorises mining through s.41 of the *Atomic Energy Act* (Cth). The Environmental Requirements attached to this Authority are, to a significant degree, subject to

the Ranger s.44 *Land Rights Act* (Cth) Agreement[28]. Relevant Northern Territory legislation requires the incorporation of these Environmental Requirements in NT authorisations[29].

However, at Jabiluka, where Authority to mine derives not from the *Atomic Energy Act* (Cth), but from the *Mining Act* (NT), there is not even the limited legislative vehicle for the exercise of traditional owner rights as outlined in respect of Ranger. There is no provision in the *Mining Management Act 2001* (NT) for the incorporation of the Jabiluka Environmental Requirements. In addition, while the (repealed) *Uranium Mining (Environmental Control) Act 1979* (NT) compelled the NT Minister to consider *Land Rights Act* agreements (including the 1982 Jabiluka Agreement) in exercising his powers[30], no such specific provision exists in the *Mining Management Act 2001* (NT).

3(b)(ii) Lack of accountability

The transfer of responsibility for regulation and monitoring of Commonwealth-owned uranium resources to the Northern Territory has, in a large part, been carried out through non-legislative agreements between Commonwealth and Territory Ministers. These agreements are not subject to direct parliamentary scrutiny and do not provide mechanisms for persons with legal standing, such as the Mirrar, to seek compliance with the terms of these agreements.

Of the agreements referred to above, the primary documents are the *Agreement between the Commonwealth of Australia and the Northern Territory of Australia in relation to principles to be applied in the regulation of Uranium Mining in the Northern Territory of Australia* (dated 17 November 2000) ["the MOU"] and the *Revised Working Arrangements for Co-ordinating the Regulation of Environmental Aspects of Uranium Mining in the Alligator Rivers Region* (September 1995) ["the Working Arrangements"]. Three key aspects of the MOU have not been implemented. Two of these (Clauses 14 and 15) relate to Environmental Requirements at Jabiluka. The third (Clause 16) relates to revision of the Working Arrangements.

However, because these agreements are essentially 'private' agreements between the Commonwealth Minister and the Northern Territory Minister, the failure of governments to abide by them carries no sanction and there is no mechanism to enforce compliance with their terms. There does not even appear to be any requirement for them to be made public.

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[28] Via the Ranger Extension and Complementary Agreements. There are, however, significant barriers to Traditional Owners exercising land management powers through *Land Rights Act* agreements, see below.

[29] Section 34(4) Mining Management Act 2001 (NT).

[30] Section 18.

3(b)(iii) Outdated Provisions

In his 1977 report of the Inquiry into the Ranger Uranium Mine, Justice Fox stated:

> We strongly recommend against the use [of the *Atomic Energy Act*] for the grant of an Authority to Ranger to mine uranium.

The main thrust of Justice Fox's argument for this recommendation was that the *Atomic Energy Act 1953* (Cth) was never designed for regulating uranium mining, having been introduced as a security measure to enable Australian uranium to be diverted for strategic military use. However, Justice Fox's recommendation was not adopted and Part III of the Act, which deals with Ranger, was 'tacked on' to allow Ranger to proceed prior to self-government in the Northern Territory.

Unfortunately, both the Ranger Mine and the Jabiluka Project continue to rely on authorities or approvals derived from outdated, repealed or 'grandfathered' legislation. While Governments have improved and reformed legislation, mining operations at both sites have been burdened with historical regulatory frameworks.

For example, operations at Ranger rely on a statutory fiction that those named in the s.41 authority issued under the *Atomic Energy Act 1953* (Cth) are carrying out operations on behalf of the Commonwealth. In addition, while the holders of an authority under the *Atomic Energy Act 1953* (Cth) may be convicted of an offence under the Act for failing to comply with the authority[31], the penalty is merely $2,000 in the case of a natural person and $10,000 in the case of a body corporate[32].

To compound the problem, even instruments developed to deal with inadequate legislative direction for appropriate regulation, such as the Working Arrangements agreed to in September 1995, are now outdated. The Working Arrangements make no specific provision for the Jabiluka Project and have not been updated to reflect the repeal of the *Uranium Mining (Environmental Control) Act 1979* (NT). The Working Arrangements also make reference to the creation of further important regulatory instruments, such as 'Agreed Commonwealth Requirements for Environmental Monitoring by the Northern Territory Regulatory Authorities of Uranium Mining in the Alligator Rivers Region', which have never been developed.

The primary role of the Ranger Minesite Technical Committee in the administration of measures to ensure compliance with the Environmental Requirements is, while arguably implicit, not specifically codified in the Working Arrangements. The ambiguous relationship at Jabiluka between

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[31] Section 41A(7).

[32] Section 41D.

authorisations by the NT Minister and deliberations at the Jabiluka MTC is detailed below.

The Working Arrangements also make reference to outdated twice-yearly Environmental Performance Reviews by the OSS and NT Supervising Authority. This regime was replaced in early 2001 by a system comprising an annual Environmental Audit, a mid-term review and routine monthly inspections.

The Environmental Requirements annexed to the Jabiluka Mineral Lease (pursuant to s.64 the *Mining Act 1982* (NT)) and the 1982 Jabiluka Agreement (pursuant to s.43 of the pre-1987 version of the *Aboriginal Land Rights (Northern Territory) Act 1976* (Cth)) were formulated from an EIS process carried out in 1979. They do not represent current or best practices (see below). In addition, their continued effect is contrary to Clause 15 of the MOU between the Commonwealth and the Northern Territory.[33]

3(b)(iv): Impotence of Land Rights Act agreements

The Mirrar People believe that Traditional Owners should have the opportunity to directly participate in the regulatory arrangements governing uranium mining on their country. The only practical way for this to occur is via agreements for mining under the *Land Rights Act* (Cth).

While the Ranger and Jabiluka *Land Rights Act* Agreements provide for Aboriginal participation committees, these entities are chronically dysfunctional. As early as 1984 the Ranger Aboriginal Liaison Committee was identified by a Commonwealth social impact study as having 'now subsided into near, if not actual inactivity, even oblivion'[34]. The 'Bininj Working Committee' established in the 1982 Jabiluka Agreement has suffered a similar fate. Almost unbelievably, neither Commonwealth nor Northern Territory authorities have ever seriously addressed this major flaw in the operation of the regulatory system.

The same 1984 study found:

> that Aboriginal people are not centrally involved in the legal and administrative machinery which has been imposed on the Region, and have not become effective members of the special committees established to deal with social and other problems as they arise. There are no real indicators either that Aboriginal people are developing the skills to be able to participate

[33] Which states the NT Minister will amend the environmental requirements attached as a condition to the Jabiluka Mineral Lease to "more closely reflect the environmental requirements to which the Ranger Authority is subject".

[34] *Aborigines and Uranium – Consolidated Report to the Minister for Aboriginal Affairs on the Social Impact of Uranium Mining on the Aborigines of the Northern Territory*, Australian Government Publishing Service, Canberra 1984, p.120.

> in a more meaningful fashion; consequently it is not surprising that there is little Aboriginal interest in committee or administrative work.[35]

Once again, this problem has never been adequately addressed and has simply compounded over the years.

The Mirrar believe that *Land Rights Act* (Cth) agreements should provide mechanisms for Traditional Owners to propose and seek implementation of improvements to regulatory arrangements, prevent changes detrimental to Traditional Owner interests, and instigate action for breaches of regulatory arrangements. The Mirrar are currently proposing changes to the Ranger Agreement to create such mechanisms, but have met resistance to these proposals from both the Commonwealth and ERA.

However, even if meaningful land management mechanisms were included in the *Land Rights Act* agreements for Ranger and Jabiluka, existing regulatory instruments would not adequately support such agreements.

For example, the *Atomic Energy Act 1953* (Cth) provides only limited potential for the Ranger *Land Rights Act* agreement to affect the enforcement of Environmental Requirements. The Mirrar believe there should be a significant extension of the relationship between the authorising legislation and the provisions of the *Land Rights Act* agreement. (See Section 5 of this submission).

Moreover, for such a system to be effective, this relationship should be reflected in Northern Territory legislation. Northern Territory legislation does not at present contain explicit provisions that Authorisations and mineral leases should be consistent with agreements under the *Land Rights Act*.

At Jabiluka the rights of Traditional Owners are severely diminished because there is no Commonwealth legislation authorising mining and no requirement in Northern Territory legislation that authorities and mineral leases be consistent with Commonwealth environmental approvals. As a result, the 'Jabiluka Requirements' established by the Commonwealth Minister during the 1997 EIS and 1998 PER processes are not annexed to the 1982 Agreement nor the Jabiluka Mineral Lease. Nor are they incorporated in (recently passed) NT legislation, contrary to Clause 14 of the MOU between the Commonwealth and the Northern Territory. They are instead 'implemented' via two letters sent by the Commonwealth Minister to the NT Minister in 1997 and 1998.

Identical 'Environmental Requirements' were annexed to the 1982 Jabiluka Agreement and the 1982 Jabiluka Mineral Lease in order to provide Traditional Owners, through the NLC, with some limited power to enforce

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[35] *Aborigines and Uranium – Consolidated Report to the Minister for Aboriginal Affairs on the Social Impact of Uranium Mining on the Aborigines of the Northern Territory*, Australian Government Publishing Service, Canberra 1984, p.130.

environmental monitoring and reporting through the contractual provisions of the 1982 Agreement. However, now that operations at Jabiluka are governed by the 'Jabiluka Requirements' (although the original Jabiluka Environment Requirements remain legally in force), the Traditional Owners have effectively lost their (albeit indirect) contractual power over environmental management at Jabiluka. It is noteworthy that key provisions of the 'Jabiluka Requirements' remain unmet and that there is no mechanism for Traditional Owners to seek enforcement.

Finally, the diminution of the *Land Rights Act* agreements appears to have become institutionalised. For example, the Working Arrangements purport to provide the mechanism for 'main interested parties', such as the Northern Land Council, to receive information 'via effective consultative and reporting procedures'. To this end, the Northern Territory Supervising Authority is to have regard to the views of the NLC, mainly through the functions of the Minesite Technical Committees. There is no mention of the contractual rights of the Traditional Owners, as represented by the NLC, pursuant to the s.44 Ranger Agreement and the s.43 Jabiluka Agreement.

3(b)(v): <u>Lack of monitoring and reporting on social and cultural impacts</u>

The Primary Environment Objectives of the Commonwealth Environmental Requirements for Ranger (as incorporated in the Northern Territory Ranger General Authorisation) contain a provision that:

> 1.1 The company must ensure that operations at Ranger are undertaken in such a way as to be consistent with the following primary environmental objectives:
>
> (a) maintain the attributes for which Kakadu National Park was inscribed on the World Heritage list;
> (c) protect the health of Aboriginals and other members of the regional community;

The 'attributes for which Kakadu National Park was inscribed on the World Heritage List' include both natural and cultural values. The cultural values encompass the living tradition of the Aboriginal landowners, including the Mirrar People. This has been reiterated by the World Heritage Committee, and accepted by the Australian Government, in recent consideration of whether uranium mining has endangered the World Heritage values of Kakadu National Park.

In addition, the 'health of Aboriginals and other members of the regional community' [as set out in 1.1(c)] should be given an ordinary reading and encompass both the mental and physical health of Aboriginal landowners. The threat of environmental danger often leads to mental anxiety and other

social distress amongst Traditional Owners. This was noted by Environment Australia in its response to the Jabiluka EIS in which it stated:

> ...mining and its cumulative impacts have the potential to contribute to existing sources of stress, potentially leading to increased alcohol usage…[36]

Therefore, it seems clear that the Environmental Requirements and the Ranger General Authorisation require the company to ensure that operations at Ranger do not adversely impact upon the culture, social fabric or mental health of the Aboriginal community.

Accordingly, the Gundjehmi Aboriginal Corporation contends that just as environmental monitoring is carried out on an ongoing basis, so should social impact monitoring be a continuous process.

However, there is no functioning process in place to monitor the ongoing social impact of the Ranger or Jabiluka operations. The last such exercise was carried out in 1997 by the Kakadu Region Social Impact Study, which was a 'once off' or 'snapshot' analysis of the social impact of uranium mining in the region.

As the NLC noted in response to the 1996 Jabiluka EIS:

> Aboriginal people in the region have faced profound social, environmental, and economic changes since the Ranger Uranium Environmental Inquiry examined the basis of their land claims and their opposition to uranium mining. There has been constant monitoring of biophysical environmental change in the region. In contrast monitoring of the social and cultural impacts of uranium mining… has been far from systematic and rarely aimed at securing equitable and sustainable benefits for Aboriginal groups.

The Environmental Requirements and the Ranger General Authorisation require the production of a Environmental Management Report by ERA. Clause 18.2 of the Environmental Requirements provides that the report must deal specifically with 'social impact monitoring'. However, as Appendix 1 demonstrates, this section of the report has been inadequate to the point of negligence.

Unfortunately, as described above, there is no legislative or contractual mechanism for the Mirrar to seek ERA's compliance with the Environmental Requirements or the Ranger General Authorisation despite the company's inadequate monitoring and reporting of social impacts.

At Jabiluka the situation is even worse. There is no Commonwealth Environmental Requirement for social impact monitoring in place and no

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[36] Environment Australia, "Environmental Assessment Report: Proposal to Extract, Process and Export Uranium From Jabiluka Orebody No. 2 – The Jabiluka Proposal". Environmental Assessment Branch, August 1997, p.117.

provision for social impact monitoring in the Northern Territory's Authorisation for construction activities on the Jabiluka Mineral Lease.

In addition, none of the regulatory agencies or committees (the Office of the Supervising Scientist, ERISS, ARRAC, ARRTC, NT DBIRD) have sufficient mandate, resources or personnel to either carry out or assess social impact monitoring processes.

The Gundjehmi Aboriginal Corporation contends that social impact monitoring and reporting should be independently conducted in close consultation with Traditional Owners and other Aboriginals affected by mining operations. To this end, comprehensive social impact monitoring processes, supported by enforcement provisions, should be set out in both the Ranger and Jabiluka *Land Rights Act* agreements and the statutory regulatory instruments.

SECTION 4A: ENVIRONMENTAL MANAGEMENT OF URANIUM MINING AND MILLING WASTES

The management of uranium mining and milling wastes impose additional and fundamentally different constraints to traditional mining (eg. copper, gold or mineral sands) due to the radioactive nature of the ore. Thus, as well as chemical and physical risks to the environment, the release of radionuclides and radiation increases the risks associated with uranium mining and milling relative to a copper mine, for example.

A fundamental concern of the Mirrar is that uranium mining, both during operation and after rehabilitation, could lead to increased concentrations and loads of radionuclides released in the environment compared to pre-mining conditions, as well as possibly higher radiation rates due to the operations undertaken. Many of these concerns are shared by environmentally concerned citizens across Australia and internationally. According to the Environmental Requirements for Ranger, after operations have been completed it is expected that the "the rehabilitated [Ranger Project] area could be incorporated into the Kakadu National Park" (ER2.1) – that is, meet the environmental and cultural standards of being a World Heritage area.

4A(a) Radioactive Decay and Biological Exposure

Uranium (U) atoms are unstable and radioactively decay several times into slightly lighter elements, giving off ionising radiation in the process. There are four principal types - gamma (γ), beta (β), alpha (α) and neutron (n) radiation. Biological damage can arise from the high energy released during radioactive decay, which is capable of breaking or "ionising" chemical bonds and inducing an electrical charge, and the nature of each type of decay. Gamma radiation, high frequency electromagnetic waves, is the least biologically damaging; beta particles, electrons, are more damaging, while alpha particles (charged helium atoms), are the most biologically damaging (see Pochin, 1985; Dalton, 1991). The penetration power, or distance that different radiation types can travel through matter, shown in Figure 1.

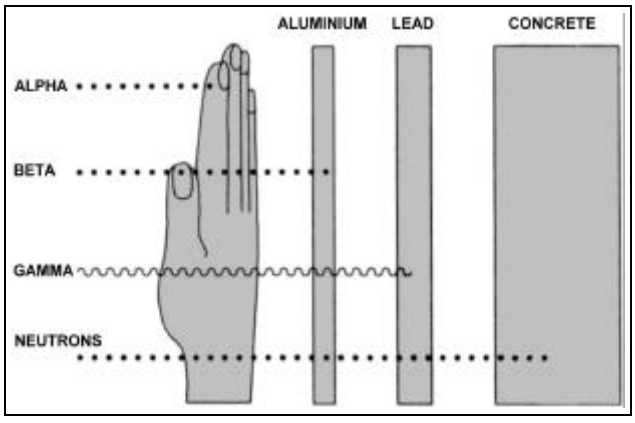


Figure 1 - Penetration power of various types of radiation

Uranium in nature consists of two principal isotopes of different mass – ^{238}U and ^{235}U, the latter being easily used in fission reactions for nuclear weapons or nuclear reactors. The decay of each type of uranium isotope leads to a unique decay sequence, moving through alpha or beta decay to form a new isotope (i.e. element), until a stable isotope such as lead is reached (eg. ^{206}Pb).

Table 1 – Radioactive decay sequence for uranium (^{235}U and ^{238}U)

^{238}U	α	4.51 billion y	^{235}U	α, γ	710 million y
^{234}Th	β	24.1 d	^{231}Th	β	25.5 d
^{234}Pa	β, γ	1.17 m	^{231}Pa	α, γ	32,500 y
^{234}U	α, γ	247,000 y	^{227}Ac	β	21.6 y
^{230}Th	α, γ	75,000 y	^{227}Th	α, γ	18.5 d
^{226}Ra	α, γ	1,600 y	^{223}Ra	α, γ	11.4 d
^{222}Rn	α	3.82 d	^{219}Rn	α, γ	4.01 s
^{218}Po	α	3.05 m	^{215}Po	α	0.0018 s
^{214}Pb	β, γ	26.8 m	^{211}Pb	β, γ	36.1 m
^{214}Bi	β, γ	19.7 m	^{211}Bi	α, γ	129.0 s
^{214}Po	α, γ	0.000164 s	^{207}Tl	β	286.6 s
^{210}Pb	β, γ	22.3 y	^{207}Pb	-	stable
^{210}Bi	β	5.01 d			
^{210}Po	α	138 d			
^{206}Pb	-	stable			

Notes : α - alpha, β - beta, γ - gamma decay (all isotopes emit gamma, only those with a significant gamma decay energy >0.1 MeV have been highlighted); y - years, d - days, m - minutes, s - seconds; μ - micro (10^{-6}). # About 64% of ^{212}Bi decays by β and 36% by α.

The various isotopes in the decay chains often have very different chemical and physical properties. For example, radon (^{222}Rn or ^{219}Rn) is a noble gas (colourless, odourless and tasteless), while uranium and radium are moderately and sparingly soluble respectively compared to thorium which is relatively insoluble.

For uranium mining, the principal radiation exposure pathways are from external gamma radiation, internal exposure due to inhalation of radioactive radon gas, radon progeny and dust (aerosol) particles or internal exposure due to ingestion of contaminated materials (Fry, 1975; Pochin, 1985; Yih *et al.*, 1995). The biological effect of being exposed to radiation will vary with :

- the type of radiation (α, β, γ or n),
- exposure pathway (external, inhalation or ingestion),
- the chemical behaviour of the radionuclide inside the human body,
- the radiation sensitivity of the type of tissue exposed (eg. lung, bone marrow).

As a general rule, radionuclides and radiation rates in the environment are low, with some small areas perhaps elevated due to local geological features. It is important to note that despite the higher radioactivity of uranium deposits, most only show a very localised elevated radiation signature at the surface, while some, such as Jabiluka, Beverley and Honeymoon, do not show any signature at all (Mudd, 2002a).

4A(b) Types of Wastes

The mining and milling of uranium deposits leads to the following main types of wastes (among others such as industrial wastes, chemicals, putrescible wastes, etc.) :

- High Grade Ore (various grades, generally >0.1% up to 10% U_3O_8; Ranger ~0.3% U_3O_8; Jabiluka ~0.5% U_3O_8)
  - significant potential for impacts on water quality due to uranium and other metals (often associated with uranium mineralisation);
  - source of sediment;
  - strong source of radon gas and progeny;
- Low Grade Ore (generally 0.02-0.1% U_3O_8)
  - significant potential for impacts on water quality due to uranium and other metals (often associated with uranium mineralisation);
  - source of sediment;
  - significant source of radon gas and progeny;
- Inert or 'Non-mineralised' waste rock (generally <0.02% U_3O_8)
  - some potential for impacts on water quality, depending on weathering and metals and uranium;
  - source of sediment;
  - reasonable source of radon gas and progeny;
- Tailings – finely ground ore remaining after milling (shown in Figure 2)
  - very high potential for impacts on water quality due to uranium and other metals (often associated with uranium mineralisation) and the numerous industrial chemicals used in milling and uranium extraction;
  - significant source of seepage to and potential for contamination of groundwater;
  - strong source of radon gas and progeny;
- Contaminated minesite water
  - various ponds which are intended to retain the contaminated runoff from ore stockpiles, low grade ore stockpiles and/or store water for use by the mine and mill;
  - major source of potential risks and impacts to surrounding surface water ecosystems;
  - significant source of seepage to and potential for contamination of groundwater;
  - minor source of radon gas and progeny.

For large and complex sites such as Ranger, construction of commenced some 23.5 years ago, the quantities of these various types of wastes are significant. Water management at Ranger, which commenced commercial milling 21 years ago, has been a constant and demanding challenge, as well as tailings and low grade ore management. For sites such as Jabiluka, the principal challenge to date has been water management for the inappropriate (RMA [37]) design as constructed.

[37] See section 4.3.1 for the analysis of the Ranger Mill Alternative (RMA) versus Jabiluka Mill Alternative (JMA).

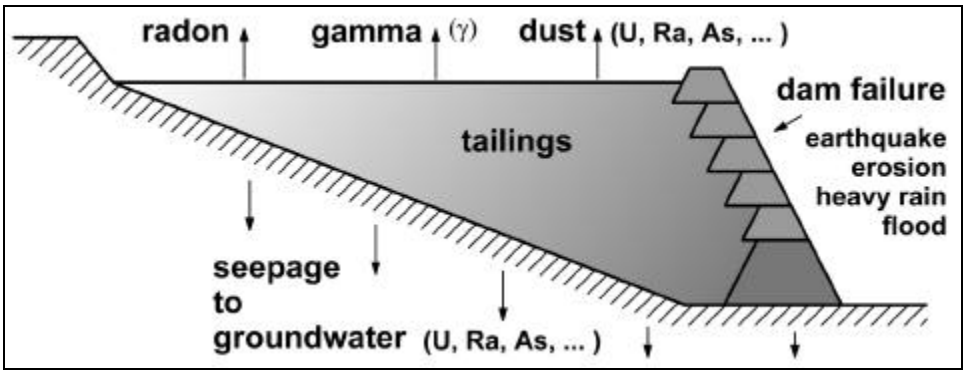


Figure 2 – Radiation and environmental risks associated with uranium tailings

Waste management problems lead to increasing pressures on ecosystems on each mine site, with increasing concern for the environment and worry that it is merely a matter of time before significant impacts start to manifest.

The Mirrar are concerned about the impacts of uranium mining and milling on their country, and wish to see the Senate Inquiry address the environmental performance, monitoring and reporting of the Ranger and Jabiluka projects to ensure that the short and long-term impacts are minimised to the greatest extent possible.

The Mirrar are concerned that the dominant focus of the company, Energy Resources of Australia Ltd, and government officials places too much emphasis on the downstream protection of Kakadu National Park at the expense of minimising cumulative impacts on the project or lease areas.

Due to the confluence of issues at Ranger and Jabiluka, the principle of complete transparency and public reporting on all environmental matters should be adopted by ERA, the OSS and DBIRD. All of the information held by OSS and DBIRD should be publicly accessible as a matter of public and stakeholder interest.

SECTION 4B: ENVIRONMENTAL MONITORING AND REPORTING OF THE RANGER PROJECT

4B(a) Current Status – Waste Inventories, Ore Reserves and Expected Life

The Ranger uranium project was imposed on the Mirrar people against their express wishes, as noted by the Ranger Uranium Environmental Inquiry (Fox *et al.*, 1977) :

> "The evidence before us shows that the Traditional Owners of the Ranger site and the Northern Land Council … **are opposed to the mining of uranium on that site.** … Some Aboriginals had at an earlier stage approved, or at least not disapproved, the proposed development, but it seems likely that they were not then as fully informed about it as they later became. Traditional consultations had not taken place, and there was a general conviction that opposition was futile." (pp 9)

The following section will analyse the environmental performance, monitoring and reporting regime of the Ranger project, focused on highlighting Mirrar concerns for protecting their rightful interests in the country of the Ranger Project Area. The original opposition of the Mirrar to Ranger is important and it should in no way be interpreted that the following analysis and discussion of Ranger in any way implies support or acceptance of the project.

The Mirrar believe that environmental monitoring and reporting should be extensive, rigorous and of a high quality to be able to demonstrate that the damage or impacts are the absolute minimum that can be achieved. The Mirrar do not want environmental monitoring and reporting to be used as a mechanism by anyone to downplay concerns over environmental performance. A detailed site map and aerial photo of the Ranger project is given in Figure 3.

By December 2001, the Ranger Project had the following inventory of wastes (this list is not exhaustive, mining and milling data is detailed more completely in Appendix 2; also see ERA-AR, 2001) :

- High Grade Ore Stockpiles : 7.9 million tonnes (Mt) at 0.20% U_3O_8
- Low Grade Ore Stockpiles : about 35.032 Mt (approx. 0.06% U_3O_8)
- Non-Mineralised Waste Rock : about 65.4 Mt [#] (<0.02% U_3O_8)
  [[#] ERA and OSS data does not clearly distinguish or correlate, see Appendix 2; apparently includes some 'very low grade ore'.]
- Tailings (total) : 23.306 Mt (residual ~0.033% U_3O_8)
- Contaminated water (as of September 2001; NTSA, 2001b) :
  - Tailings Dam 2,800,000,000 litres
  - Pit #1 / #3 5,750,000,000 / 260,000,000 litres
  - Retention Pond 1 (RP1) 260,000,000 litres
  - Retention Pond 2 (RP2) 850,000,000 litres
  - Retention Pond 3 (RP3) 52,000,000 litres
- Contaminated wetlands (water treatment) :
  - Retention Pond 1 (RP1) 159.9 ha
  - 'RP1' [38] Wetland Filter 27.8 ha
  - Djalkmarra Creek / Billabong 57.7 ha

[38] Since it treats RP2 water the wetland filter is called the 'RP2 Wetland Filter' in this submission, see later section.

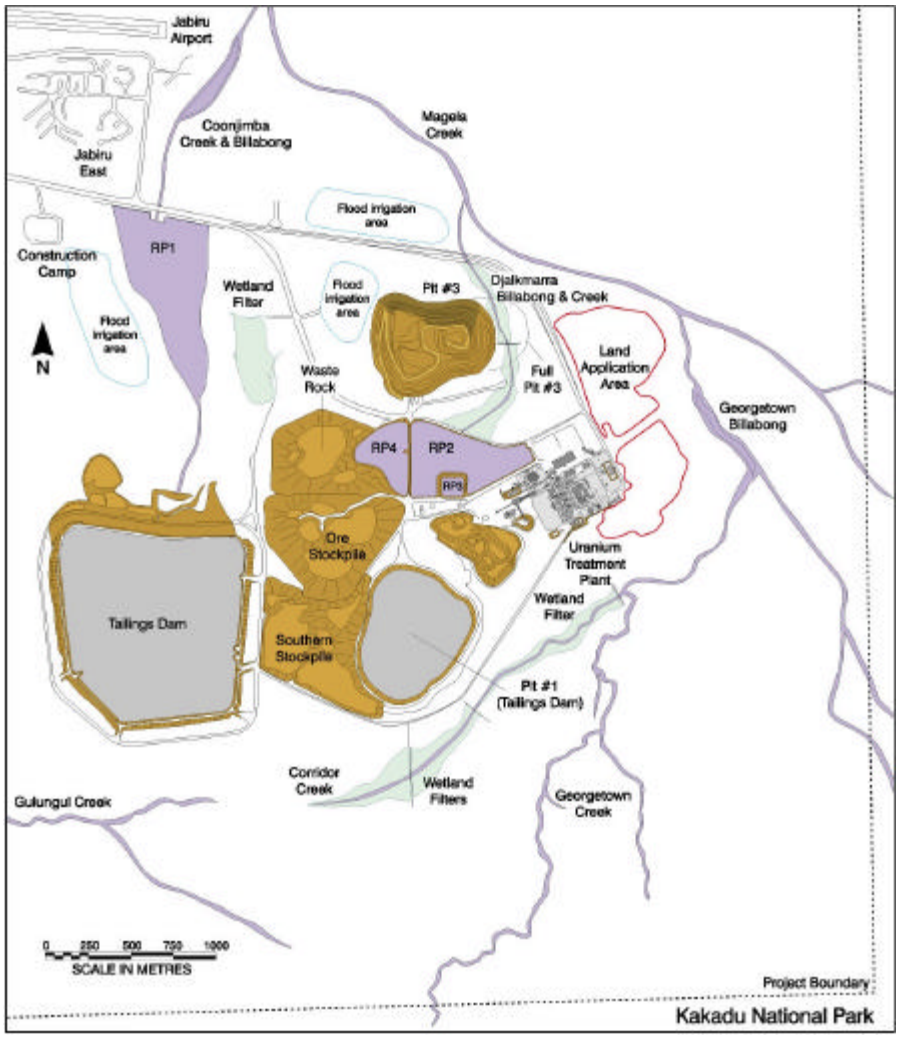


Figure 3 – Site plan of the Ranger uranium mine and mill and associated facilities [39] and aerial photo [40] (7 July 2001) [Note : RP4 is now decommissioned.]

[39] Courtesy Anti-Nuclear Alliance of Western Australia, Perth, WA, based on maps in ERA-RAER (various).
[40] Courtesy Northern Land Council.

- Contaminated soils (irrigation) :
  - Magela Land Application Area 55 hectares (ha)
  - 'RP1' Wetland Filter Irrigation 46 ha
  - Djalkmarra Irrigation Area 38 ha
- Average chemical / reagent usage in the Ranger mill (Appendix 2) :

Pyrolusite (MnO_2)	4,807 t (5.2 kg / t ore)
Sulfuric Acid (H_2SO_4)	42,272 t (43 kg / t ore)
Lime (CaO)	16,554 t (17 kg / t ore)

Ammonia (NH_3)	1,303 t (0.52 kg / kg U_3O_8)
Kerosene	840,000 L (0.3 L / kg U_3O_8)
Amine	33,500 L (0.01 L / kg U_3O_8)

The list does not include the open cuts, mill area, Corridor and Georgetown Creeks, among other areas. The ongoing concerns on contamination for most of these areas will be addressed in later sections. It can be expected that, although some areas are not specifically addressed, many of the concerns are common and would be applicable at these areas.

Unfortunately, the amount of data being reported publicly, both by the OSS and ERA, is gradually reducing. The OSS has not published annual ore, low grade ore, waste rock and important mill data (see above) since OSS-AR (1997). Quarterly stock market reports by ERA now exclude uranium grade in mill data; this data is now only available on an annual basis (eg. ERA-AR, various). Mine data is only reported in ERA-RAER (2000, 2001) and ERA-AR (various).

As mine and mill data, especially minesite water volumes, is important for determining the extent of contamination of the various parts of the Ranger site (as outlined above), the OSS and ERA should be more comprehensively reporting such data in their respective annual reports.

The expected life remaining for the Ranger project is uncertain. The expected operational life of Pit #3 has constantly been changed or extended since mining began in mid-1996. The fluid nature of mine plans for Ranger #3 are largely due to the nature of mining economics, which depends on ore grades (as mined and predicted), the ratio of low grade ore and waste rock to ore, processing characteristics, detailed exploration drilling and quantification of the orebody before mining (and comparisons during operation), markets, and so on. Government regulators / advisors (DBIRD / OSS) need to be vigilant in assessing the significance of such changes with respect to environmental performance.

The mining of Pit #3 was initially planned to be completed by 2007 but by mid 1998 the date had already been reduced to 2004 (pp 8, ERA-AR, 1998). In mid 1999 the end date for mining was 2006 (pp 8, ERA-AR, 1999). By mid 2000, detailed drilling and geologic analysis had been undertaken to significantly increase the reserves at Pit #3 and mining was expected to finish by 2007 (pp 5, ERA-AR, 2000). The position by early 2002, however, was that mining of Pit #3 "… is expected to continue until at least 2009" (pp 5, ERA-AR, 2001). A geologic cross-section of the Ranger #3 orebody is shown in Figure 4.

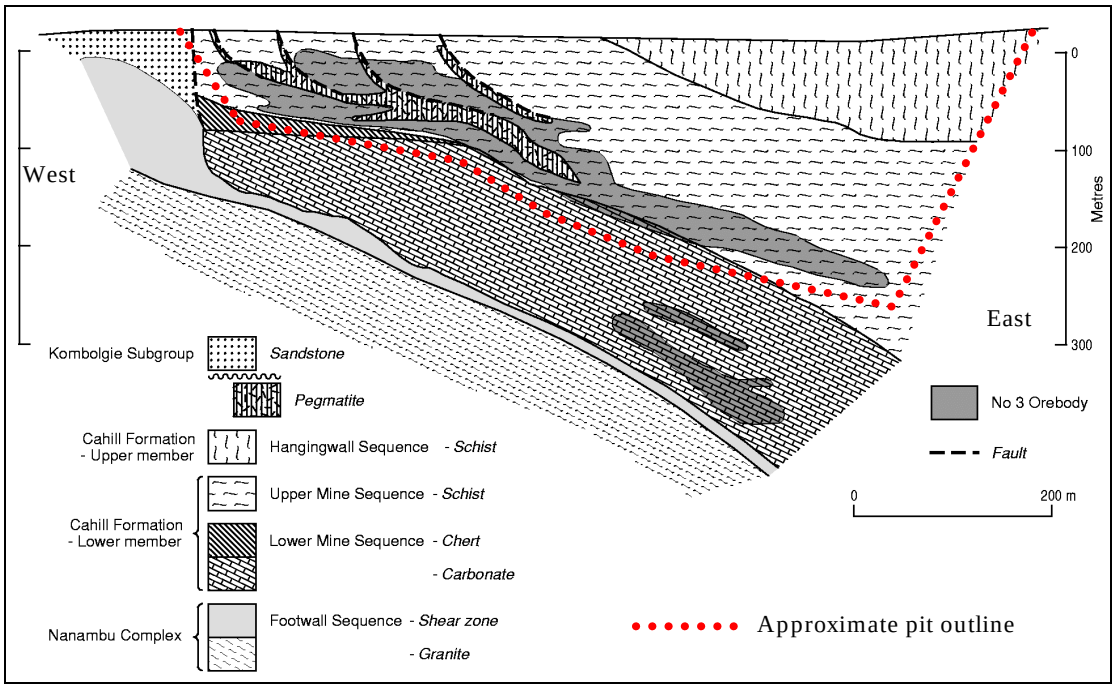


Figure 4 – Geologic cross-section of the Ranger #3 orebody (McKay & Miezitis, 2001)
[Note : open cut outline added and is approximate only.]

The mining life of Pit #3 is critical since it will be the tailings repository after the filling of Pit #1 with tailings. Depending on timing, Pit #1 may be full of tailings by perhaps 2006 or 2007 (see later section), with Pit #3 not available until about 2010 (based on current mine plans). This would place enormous strains on tailings storage capacity as well as water management and could significantly complicate the timing of rehabilitation after the milling of stockpiles is completed.

There are a number of other critical issues with regards to Pit #3 :

- the continual extension and enlargement of the open cut to enable the extraction of higher amounts of ore than first predicted;
- the significantly higher quantities of low grade ore being mined than first predicted;
- the location of Pit #3 adjacent to Magela Creek and possible groundwater connections – especially important for tailings management;
- the potential for underground mining beyond 2009 (also very important for tailings management) – based on the ore extensions greater than 300 m in depth and below the current planned floor of Pit #3; this ore apparently continues to the east though at increasing depth;
- the increased leachability [41] of uranium from Pit #3 ores and material.

[41] It is understood that senior government regulators/advisors and the company are increasingly concerned about the rapid leaching rates of uranium from Ranger #3 material. See also uranium concentration in RP2 (Figure 17).

The potential for an underground mine is of great significance, as it has implications for tailings management, groundwater protection, and the continued operation of the Ranger mill. The possibility of underground mining has been acknowledged since the earliest days of the Ranger proposal but there has been no public statement by ERA, nor one demanded by OSS or DBIRD, on whether underground mining will proceed. It appeared to be excluded from discussions with the Northern Land Council. For example, ERA's Ranger #3 mine plan to the NLC (ERA, 1997) does not raise or even suggest the possibility of underground mining. Other underground mining references include Fox *et al.* (1977) (pp 76), Nicholls (1979) (pp 11), Haylen (1981) (pp 20), Anonymous (1991) (pp 9).

In ERA-AR (2001), the "inferred resource" category of Ranger #3 is stated to be 6.4 Mt at 0.19% U_3O_8 (compared to 12.4 Mt at 0.19% U_3O_8 the previous year). Given previous estimates in ERA-AR (1991) which specified underground ore resources of between 4 to 7.6 Mt (~0.24% U_3O_8), it is likely that ERA are presently considering its economic options, especially regarding the continued Mirrar opposition to Jabiluka.

It is unclear whether existing approvals allow for underground mining.

The continued extension of mining at Ranger #3 – either by open cut or underground (or both) - is critical to future planning for tailings, water management and rehabilitation and thus the needs for future environmental research, monitoring and reporting at Ranger. Assuming that only the remaining ore within the (currently) planned open cut is extracted, this would give the mill about 29.8 Mt of ore to continue processing until about 2016 (based on data in ERA-AR, 2001).

The problems of lower ore grades [42], increased quantities of low grade ore and increased leaching potential of Ranger #3 material all point to the contamination strains and demands on the Ranger site being significantly amplified over the next 15 years prior to rehabilitation.

It is assumed, based on historical publications and reports, that the other anomalies within the Ranger Project Area (such as Ranger's 4, 5 and 8; see McKay & Miezitis, 2001) will not be explored nor developed by ERA. The Mirrar remained opposed to further mining other than Ranger #3.

Another issue which is not acknowledged publicly is that of the potential for processing the low grade ore. This could be done either through heap leaching or some form of physical or chemical beneficiation to produce a reasonable grade ore concentrate. The only uranium mine in Australia to undertake heap leaching is Nabarlek in Arnhem Land, essentially as an experiment on 157,000 t of low grade ore; radiometric sorting was used to produce a higher grade feed to the mill at Mary Kathleen while Radium Hill used combined physical/chemical gravity treatment to produce a high grade concentrate for milling at Port Pirie (data in Mudd, 2002a, 2002b). Thus there are precedents for Ranger.

[42] For example, predicted ore grades were about 0.31% U_3O_8 compared to the stockpile at 0.20% U_3O_8.

The use of heap leaching was originally stated as a possibility in the Ranger Draft Environmental Impact Statement (EIS) (pp 46, RUM, 1974) and was still listed in ERA research projects until recently (eg. pp 176, McNally & Unger, 1993; pp 5-6, ERA, 1995). It is understood that further beneficiation research is being completed by ERA with a view to enabling a commercial decision in the near future.

Given ERA's current financial difficulties [43] and the continuing poor state of the uranium market, there are legitimate grounds for concern. The Commonwealth and Northern Territory Governments, through the OSS, DBIRD and the NLC, must ensure that as ERA continues to cut costs [44], the environmental budget is strongly protected and indeed boosted as a result of this Senate Inquiry.

It is critical that greater emphasis be placed on rigorous environmental monitoring, research and reporting which can identify trends promptly and accurately. Major knowledge gaps must be addressed to allow for thorough rehabilitation planning and implementation to meet the needs and expectations of the Mirrar and broader community.

Recommendations

The annual quantities of materials utilised at Ranger needs to be more thoroughly reported by ERA and OSS in their respective annual reports, specifically including the following :

- the quantities of ore, low grade ore and non-mineralised rock mined from Pit #3 including uranium grade (and other minerals of concern such as sulfide or copper).
- the annual use of industrial chemicals and reagents used in the processing mill at Ranger (acid, ammonia, lime, etc.).
- the short and long-term plans for mining need to be publicly stated each year, focusing on full transparency of issues such as the timing of tailings management, ores mined versus predicted quantities, heap leaching (and / or beneficiation) and the potential for underground mining.
- the OSS and DBIRD continue to ensure significant commitments from ERA to fund environmental monitoring and ensure that a rigorous environmental monitoring and reporting program is always in place.

[43] Recent half-yearly profit report (24 July 2002) stated no dividends would be paid to shareholders since net profits of $3.3 million were 35% lower than the previous corresponding period.

[44] At present, Rio Tinto Ltd have directed ERA to cut costs by some 22% by the end of 2003 (ERA Annual General Meeting, 15 April 2002).

4B(b) Existing Environmental Monitoring and Reporting Regime

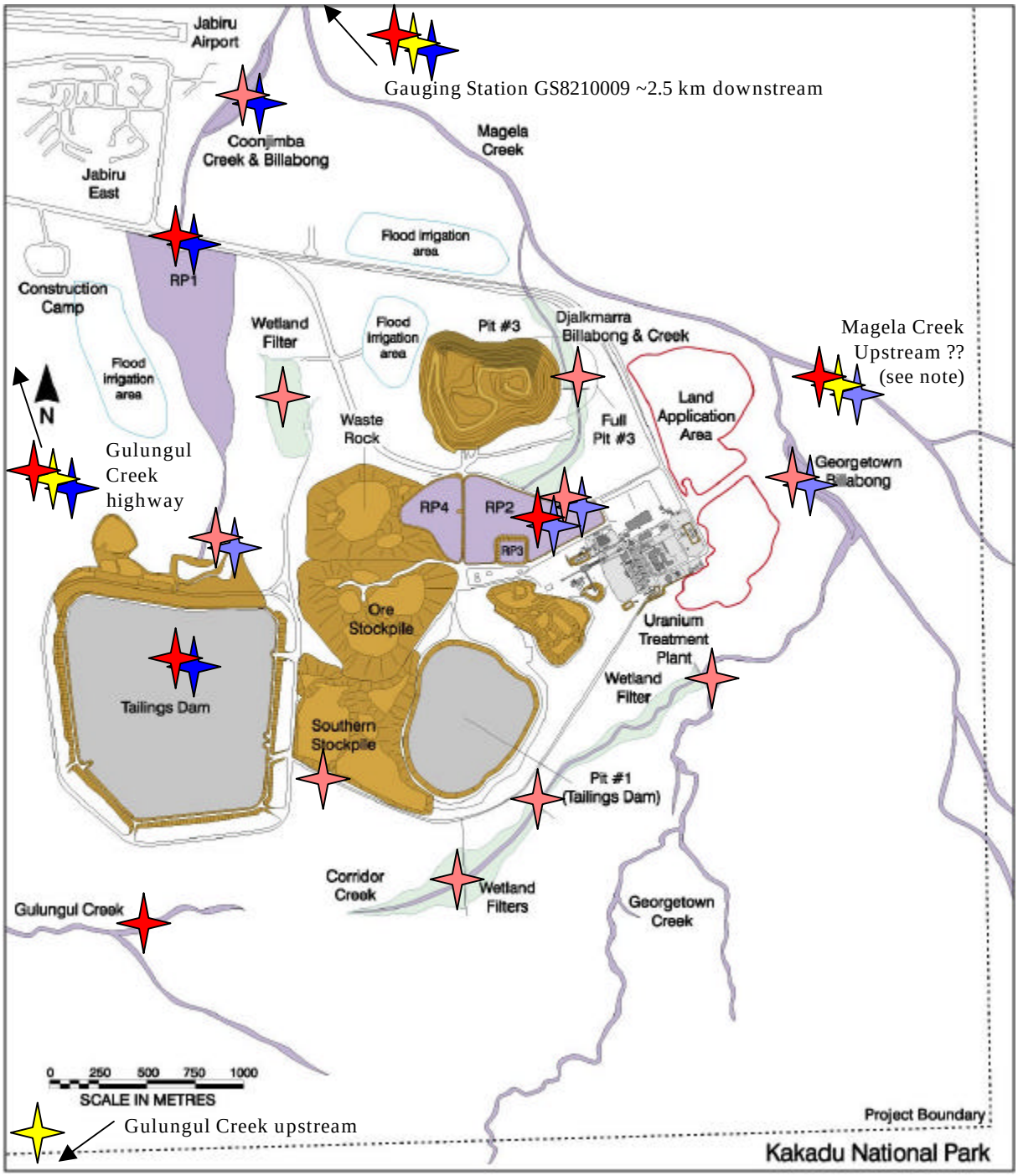
As outlined previously, the two principal mechanisms governing environmental monitoring and reporting by ERA are the Commonwealth Environmental Requirements (attached to the Section 41 Authority under the *Atomic Energy Act 1953*) and the Northern Territory Ranger General Authorisation 82/3 (issued by the NT Minister for Resources under relevant NT legislation). The relevant extracts of Authorisation 82/3 are included in Appendix 3. The existing DBIRD check monitoring program is given in Appendix 9.

There are three monitoring programs for Ranger : (i) ERA – the primary monitoring program, largely administered through self-regulation (in accordance with Authorisation 82/3 and the limited peer review processes such as the Ranger MTC); (ii) DBIRD – check monitoring for quality assurance purposes (to ensure accuracy of ERA data); (iii) OSS – an independent but smaller check monitoring program.

The locations of the various surface water, groundwater and soil monitoring sites is given in Figures 5 to 7, based on the Authorisation 82/3 and ERA-RAER (various). The general layout of DBIRD monitoring is shown in Figure 8. The OSS only recently began formal monitoring of the Ranger site over the 2001-02 wet season (OSS, 2002a), which was a response to the 'manganese (process water) leak' of mid-2000 (OSS, 2000a). The OSS program is not comprehensive, restricted to one upstream and one downstream site on Gulungul Creek and the same for Magela Creek, marked on Figure 5. The OSS program essentially augments the existing ERA monitoring program as well as the DBIRD check monitoring.

4B(c) Environmental Spills, Leaks and Breaches

Of great concern to the Mirrar is the repeated history of leaks, spills, accidents and poor performance at Ranger – which are customarily downplayed by ERA, OSS and DBIRD as merely "incidents", "technical divergences", "occurrences" or "unplanned events". It is rare that ERA is held to public account for these ongoing problems and to date the company has never been convicted of breaching the Environmental Requirements – despite clearly documented breaches and statements by the OSS in the past (eg. OSS, 2000a). A detailed list of such 'occurrences' was prepared as Appendix 2.9 to the report of the Senate Select Committee on Uranium Mining and Milling (SSCUMM, 1997). The Mirrar wish to highlight that 'incidents' continue to occur, including some of significant scale in 2000 (process water leak of some 2 million litres or ML) and 2002 (incorrect dumping of some 84,500 t of low grade ore). A select 'incidents' list has been collated and presented in Appendix 4.



ERA / OSS / DBIRD Surface water / billabong monitoring location.

ERA / DBIRD Seepage collector system monitoring location

Figure 5 – Surface water monitoring of the Ranger Project

Notes :

– No Magela Creek upstream location often indicated by ERA and OSS (eg. RAER, 1997-2001; Klessa, 2000, 2001a, 2001b; OSS-AR, 2001). Location based on OSS-AR (2000) and recent OSS website on "Environmental Monitoring" (uploaded 31 July 2002 : www.ea.gov.au/ssd/monitoring/).

– Gulungul Creek highway/upstream and Magela Creek '009' just off map to the north-west/south-west and north, respectively.

Figure 6 – Groundwater monitoring (ERA) of the Ranger Project (ERA-RAER, 2001)

Note : There are many more groundwater bores around the Ranger site (311 in total), though most are not part of statutory monitoring (i.e. Authorisation 82/3) but may be used by ERA or DBIRD for internal monitoring (see also Figure 8). There is no OSS check monitoring of groundwater.

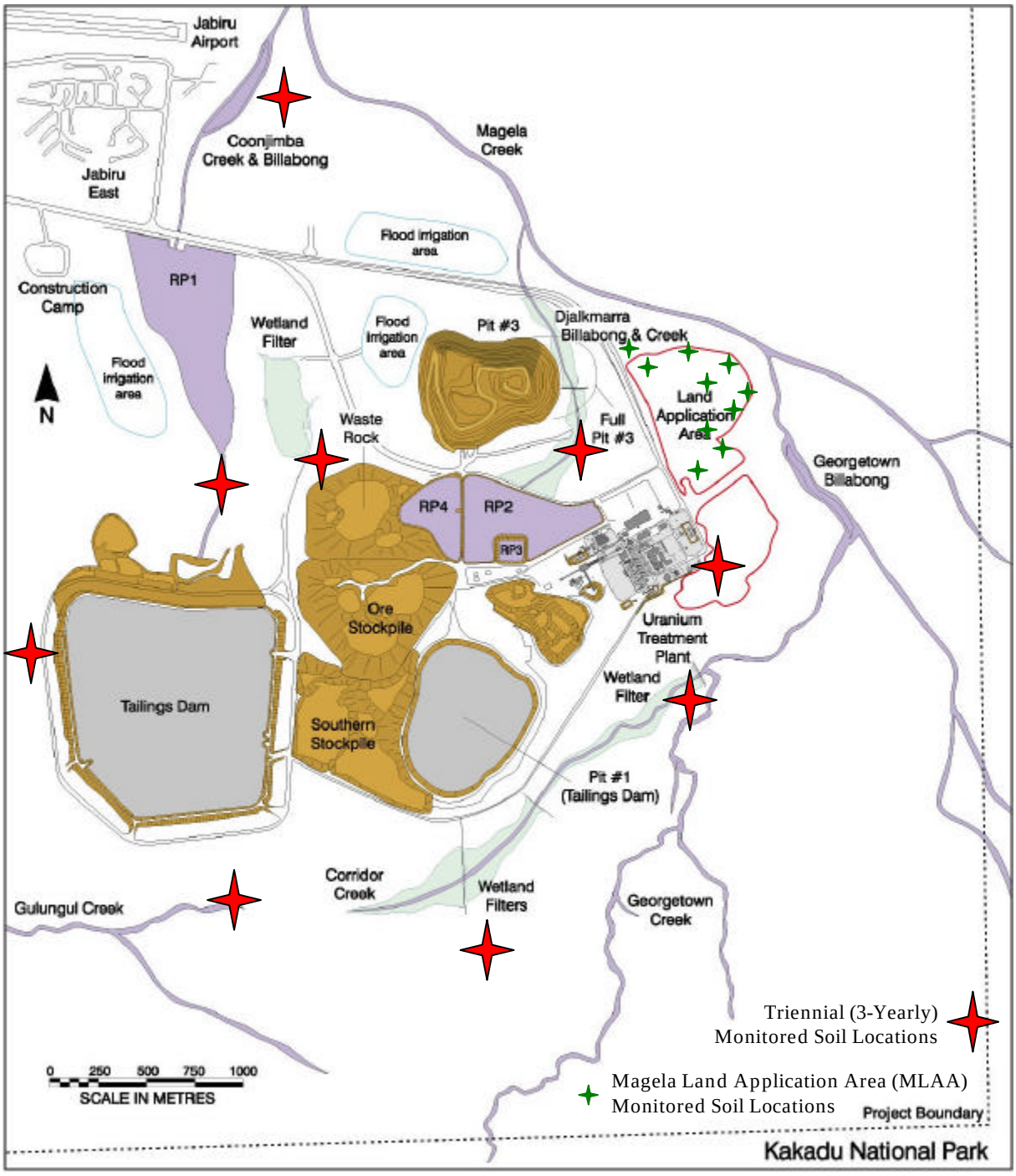


Figure 7 – ERA soil monitoring locations at the Ranger site
(drawn from ERA-RAER, various)

Note : No check monitoring of soils is presently undertaken by DBIRD nor OSS. In the 1980s, extensive soil sampling and monitoring was undertaken by (then) DME, but none by the OSS.

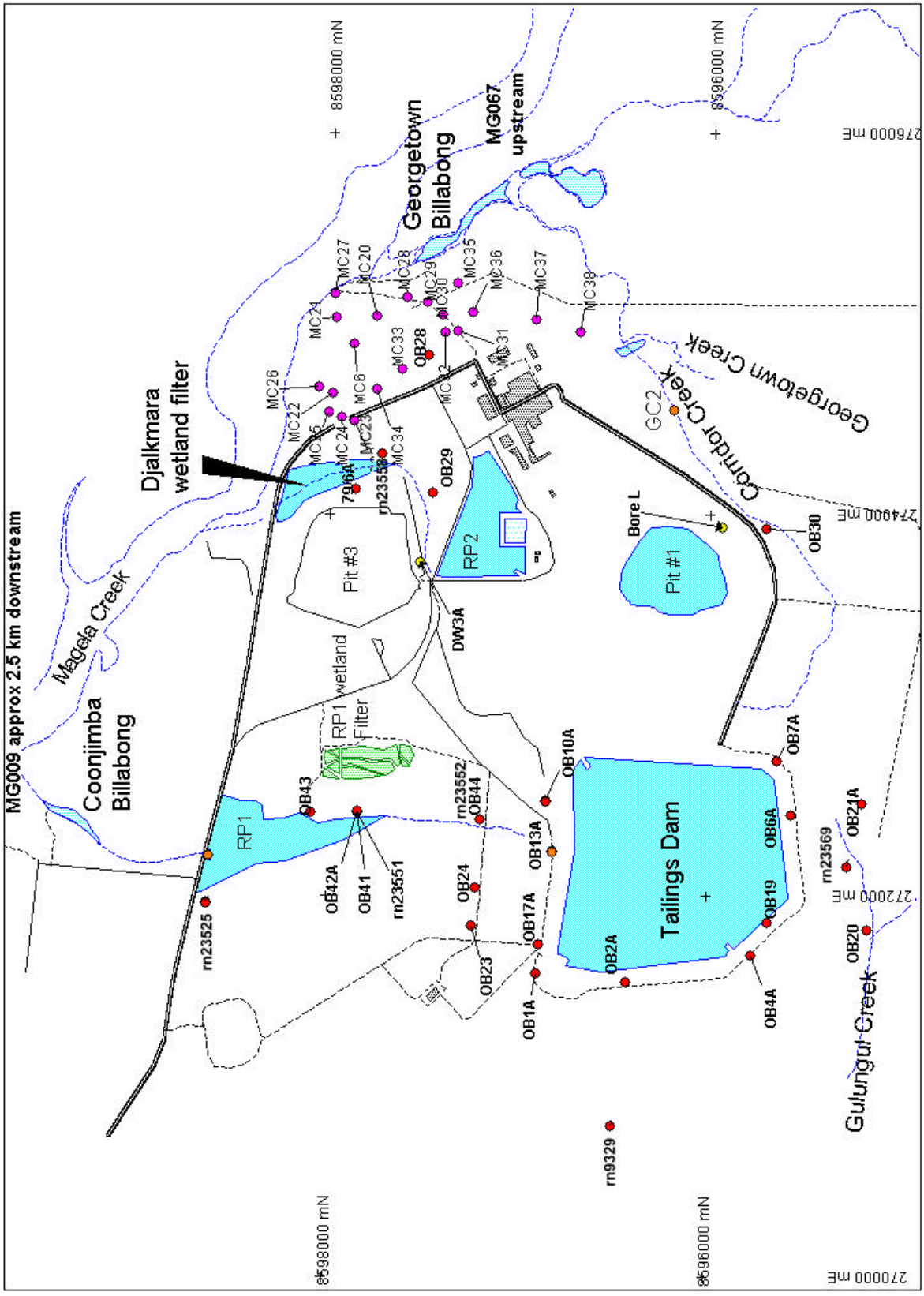


Figure 8 – General layout of DBIRD surface and groundwater monitoring locations (NTSA, various) (Electronic copy courtesy DBIRD)

Note : According to DBIRD and Water Resources (NT), there are 311 registered groundwater bores in the region this map depicts. (McGill – DBIRD, email, 5 August 2002).

A recent example of downplaying 'incidents' is the OSS 2000-01 Annual Report (OSS-AR, 2001). It states that there were "no reportable incidents during the year" (pp 18). In its 6-monthly report of December 2000 to the Alligator Rivers Region Advisory Committee (ARRAC), however, the OSS described the following significant incident (pp 1-2, OSS, 2000b) :

- Sept. 9, 2000 – About 20,000 litres of tailings leaked following the failure of a pressure gauge tapping point adjacent to one of the tailings pumps in the mill area. The failure resulted in tailings spraying over the bunds surrounding the pipe and associated infrastructure into an area which drains to RP2.

According to Environmental Requirement 16.1 ('Reporting Incidents'), ERA must immediately report to stakeholders (OSS, DBIRD, NLC) :

> "… any mine-related event which :
>
> (a) results in significant risk to ecosystem health; or.
> (b) which has the potential to cause harm to people living or working in the area; or
> (c) which is of or could cause concern to Aboriginals or the broader public."

A tailings spill such as that on 9 September 2000 is clearly of risk to mill workers, and would be of legitimate concern to the Mirrar and the general public.

4B(d) Tailings ('Process Residue') Management

The interim and long-term storage of tailings has always been one of the most contentious issues associated with the Ranger Project. From August 1981 to August 1996, tailings were deposited in a large (~1.2 km^2 or 120 ha) storage dam to the west of Pit #1 and the processing mill (see Figure 3). At present, tailings are deposited into the former Pit #1. The acidic tailings from the mill were neutralised to pH 7, although in more recent times the pH is only adjusted to pH 5 (with current plans to shift lower to pH 4 [45] to cut costs). A graph of recent water levels and volumes in the above ground dam is presented in Figure 9. The dominant issues have and continue to be radon flux, water management, physical stability, seepage to and contamination of groundwater and long-term management and rehabilitation.

The Commissioners made two critical recommendations concerning tailings (pp 327, Fox *et al.*, 1977) :

7.1 That the Ranger project be permitted to commence only if there is a firm, legally binding undertaking by Ranger to replace in one or other of the pits the tailings and any stockpiles of low grade ore remaining after milling ceases.

7.2 That the supervising authority not have the ability to relax the requirement that the tailings and unused ores be returned to the pits.

[45] Ranger Minesite Technical Committee meeting minutes, 10 July and 12 June 2002.

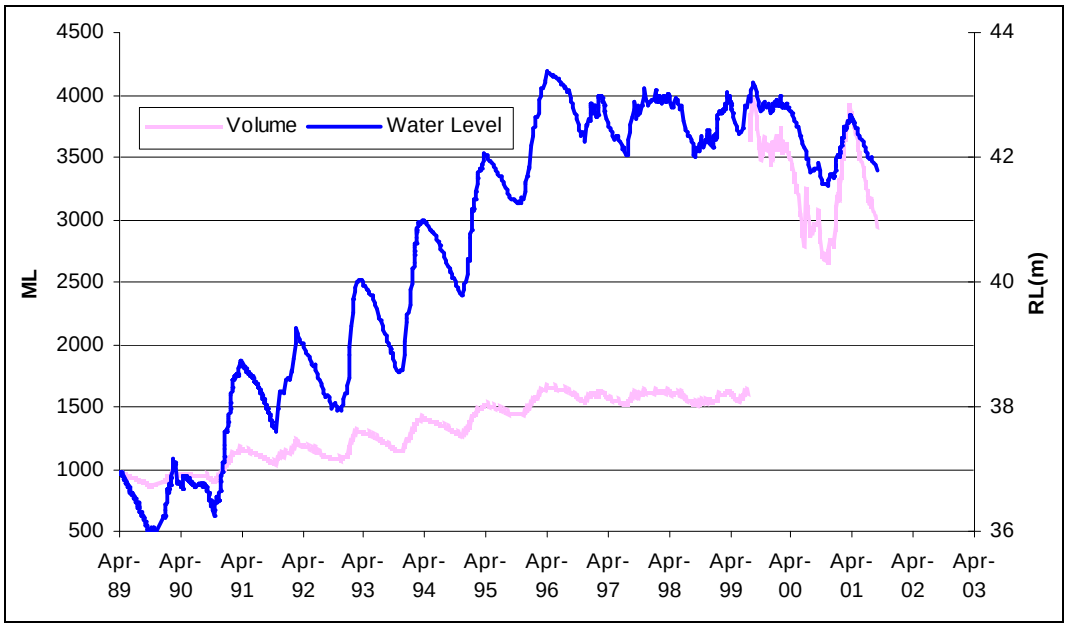


Figure 9 – Tailings dam water levels and volumes (ERA-RAER, 2001)

It is important to highlight that the Ranger Inquiry recognised low grade ore as an equivalent long-term environmental risk as tailings and should also be backfilled into mined out pits. This has never been implemented by the Commonwealth or the Northern Territory – with no legally binding requirement to address this issue.

When the Ranger Project was approved on 9 January 1979 (the original Section 41 Authority), the attached Environmental Requirements included the following two provisions, allowing a subtle but critical change from Fox *et al.* (1977) :

29a *Subject to paragraph (b) of this clause, all tailings shall be dealt with by being deposited in or transferred to the mine pits in a manner approved by the Supervising Authority not later than 5 years after the cessation of mining (whether under this Authority or otherwise in accordance with law) on the Ranger Project Area.*

29b *If after 10 years from the date of issue of the Authority but before the cessation of mining on the Ranger Project Area, the Supervising Scientist reports that he is satisfied that, by dealing with the tailings in the manner outlined in the report, the environment will be less well protected than by depositing or transferring the tailings to the mine pits and, following receipt of such report, the Minister for Science and the Environment, the Council and the Joint Venturers agree that the tailings should be dealt with in the manner outlined in the report, all tailings shall be dealt with in the manner the report.*

The position was therefore clear : ERA must (eventually) deposit all tailings back into the mined out Pits #1 and #3 (the 'below-grade' option), although they were allowed ten years to research and try and justify a case for rehabilitating the above ground dam 'as is' (in situ), despite the strong and clear recommendations against this from the Ranger Inquiry. It is important to note that position of the Mirrar has always been for tailings deposition back into and complete backfilling of the pits (eg. pp 149, Fox *et al.*, 1977).

Although ER-29b allowed ERA to put a case to the OSS for in situ rehabilitation of the above ground tailings dam from 1989 onwards, the process became long and drawn out. It was not until December 1997 that ERA made a (quiet) commitment [46] to abide by ER-29a and accept the emplacement of all tailings in Pits #1 and #3. Despite the obvious environmental and cultural significance of this decision, OSS-AR (1998) fails to even note ERA's commitment to final below-grade tailings management.

The present Environmental Requirements (January 2000 Section 41 Authority) state :

11.2 *By the end of operations all tailings must be placed in the mined out pits.*

11.3 *Final disposal of tailings must be undertaken, to the satisfaction of the Minister with the advice of the Supervising Scientist on the basis of best available modelling, in such a way as to ensure that :*

a) *the tailings are physically isolated from the environment for at least 10,000 years;*
b) *any contaminants arising from the tailings will not result in any detrimental environmental impacts for at least 10,000 years; and*
c) *radiation doses to members of the public will comply with relevant Australian law and be less than limits recommended by the most recently published and relevant Australian standards, codes of practice, and guidelines effective at the time of the final tailings disposal.*

The above ground dam is inspected annually by an appropriately qualified and independent consultant, according to established industry/government standards for large water and tailings storage dams. The report, the Annual Tailings Dam Surveillance Report (Annex C.7, Authorisation 82/3), is completed by September every year but is confidential. The results of the annual surveys are summarised in NTSA (various) though only very briefly in OSS-AR (various).

The approvals process for tailings deposition into Pit #1 led to ERA not being required to line the pit with an impermeable barrier, such as clay to minimise groundwater contamination. It was argued that fractures and permeable units such as carbonate rocks would not be dominant in controlling groundwater flow since the tailings would be of relatively lower permeability and therefore only minimal seepage may reach groundwater. It is understood that the upper height limit of tailings currently allowed for Pit #1 is (reduced level [47]) RL 0 m or about 20-35 m below ground surface – though this is not incorporated into Authorisation 82/3 nor the current Environmental Requirements.

The maximum height of RL 0 m complies with the spirit of the Ranger Inquiry recommendations. Unfortunately, the main public reports of recent times which acknowledge the current RL 0 m limit is Kinhill (1996) and ERA-RAER (2000 [48]) – it is not noted or discussed in OSS-AR (various) or NTSA (various). In contrast, Kinhill (1997) uses RL 19 m with no use of RL 0 m (pp 5-27 to 5-42). It is noted, however, that ERA is investigating strategies which could allow them to obtain approval for depositing tailings above RL 0 m, though this is not being undertaken with great public acknowledgement (or debate) by ERA, OSS or DBIRD.

[46] See ERA-AR (1998) and Milnes (1998).
[47] For example, relative to mean sea level.
[48] Although it is not noted in operations sections but in the research section up the back.

Another requirement for tailings in Pit #1 is that the density exceed 1.2 t/m^3, averaged over 20 m intervals (no requirement existed for the above ground dam).

The 20-35 m is where shallow aquifer sands, gravels and porous soils exist which often have direct connections to surface water systems, such as billabongs. Groundwater discharge to billabongs is especially important in the dry season. There are legitimate concerns about the long-term impacts on groundwater (>10,000 years) from tailings stored above RL 0 m.

4B(e) Surface Water Management

A General approach

The management of surface water and contaminated minesite waters has been one of the most visible and contentious issues associated with Ranger from its earliest days. Under the recently repealed *Uranium Mining (Environmental Control) Act 1979* (NT), the management of site waters was through the declaration of a 'Restricted Release zone' (RRZ). The RRZ concept was used to define the active area of Ranger operations and all water contained within the RRZ. The discharge of RRZ water could only be authorised if certain flow conditions were met within the Magela Creek (eg. flow greater than 20,000 litres per second or L/s) and detailed environmental monitoring (as per Annex A.5 of Authorisation 82/3).

With the implementation of the new Environmental Requirements from January 2000, a new water management system has been implemented which allows decisions based on actual water quality rather its origin. The three main types of water are considered to be (eg. pp 14-15, OSS-AR, 2000) :

- **Process Water** - water used in milling and stored in the above ground tailings dam and Pit #1. This water is never to be released.
- **Actively Managed Water** – runoff and seepage from ore and low grade ore stockpiles, includes Retention Ponds 2 and 3 (RP2, RP3), water managed on the basis of its quality (salinity, metal concentrations, radionuclide activities, etc). Generally refers to waters previously part of the RRZ. Must be passed through treatment systems such as wetlands or irrigation (land application) prior to discharge.
- **Passively Managed Water** – Passively managed water refers to areas of the Ranger site which are not part of daily operations and are largely undisturbed, such as Retention Pond 1 (RP1), and can be released without restriction subject to controls on sediments into Coonjimba and Djalkmarra Billabongs, respectively.

A site plan of water management areas is shown in Figure 10.

The water quality is monitored across the site and upstream and downstream in Magela Creek by ERA, OSS and DBIRD, as discussed previously.

B Water quality triggers

A new system for water quality compliance was introduced in late 2001 at Ranger, based on the recently released National Water Quality Management Strategy (ANZECC & ARMCANZ, 2000). Previously a series of 'Maximum Allowable Additions' (MAAs) were specified based on increases in concentration downstream relative to upstream as well load limits for many contaminants. The new water quality compliance system includes three levels or 'triggers' for select contaminants which could indicate a mine signature, given in Table 2.

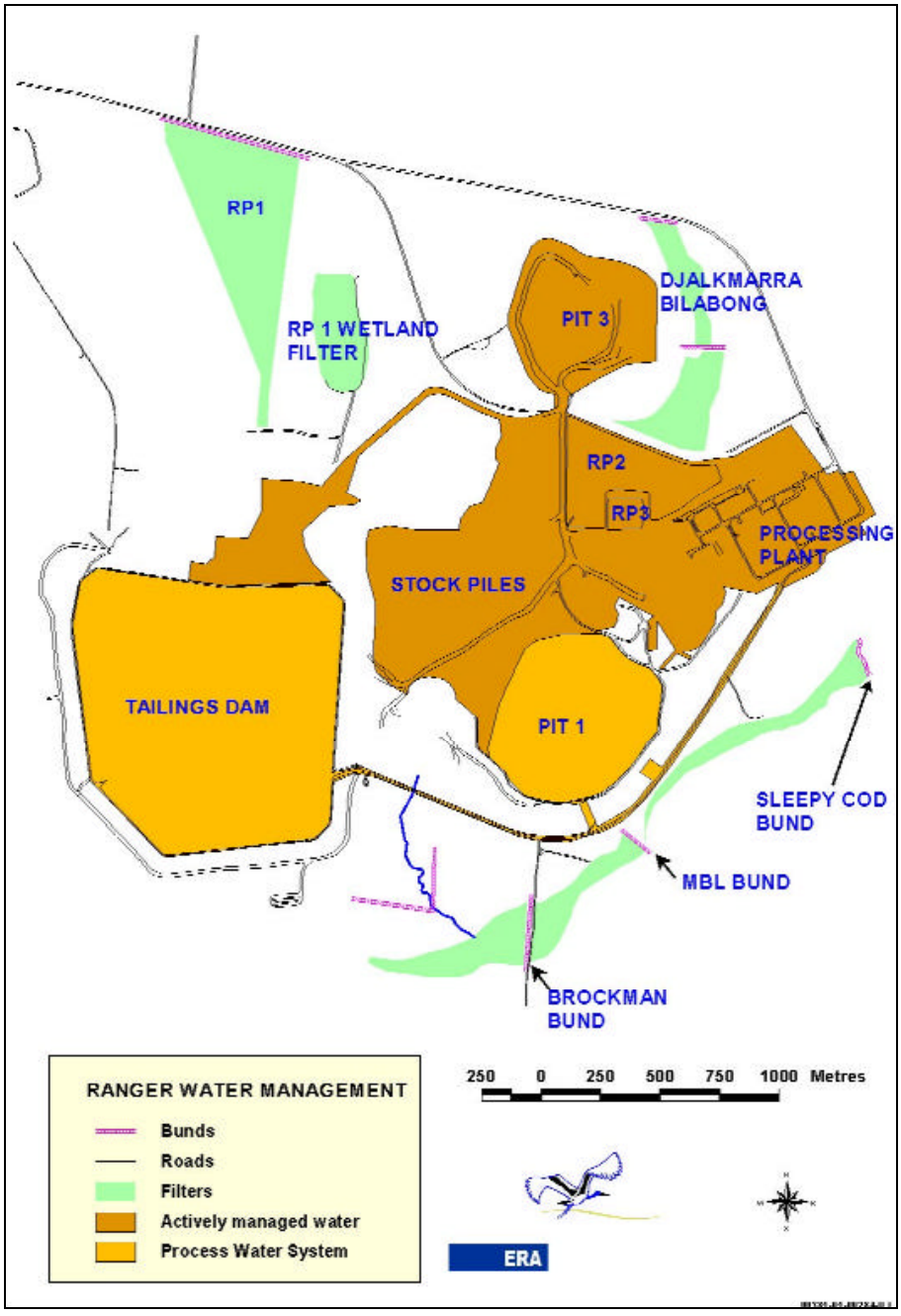


Figure 10 – Principal surface water management features (ERA-RAER, 2001)

In general, the trigger values are based on statistical variation from average background concentrations and/or ecological toxicity for various contaminants or solutes, as derived by the work of the OSS (eg. Klessa, 2000, 2001a, 2001b; Van Dam, 2000).

The terms for each trigger level are defined as (OSS, 2001) :

- Focus – one standard deviation from the mean or average concentration;
  - requires a '*watching brief*' or closer attention paid to whether variation is natural or possibly mine-related, further sampling may be necessary;
- Action – two standard deviations from the mean or average concentration;
  - requires '*investigation and corrective action*' to ascertain the cause of the elevated values;
- Limit – three standard deviations from the mean or average concentration or an alternate concentration based on ecological toxicity;
  - potentially due to operations at Jabiluka and a *'breach'* of environmental authorisations, clear corrective action required. Supervising Scientist to advise Minister on whether the Environmental Requirements have been breached.

The trigger values for pH, Mg and SO_4 are considered guidelines only whereas U, ^{226}Ra and Mn are statutory.

Table 2 – Water quality triggers for Magela Creek at GS8210009
(Klessa, 2001a, 2001b; OSS, 2001)

	Units	MAAs [1]	Focus	Action	Limit	NWMQS
Electrical Conductivity (EC)	µS/cm		21	30	43	20–250 [2]
pH	-	no data	5.8–6.50	5.1–6.8	5.2–7.2	6.0–8.0 [3]
Turbidity	NTU	15	10	24	56	no data
Calcium (Ca)	mg/L	1.3	not set	not set	not set	
Magnesium (Mg)	mg/L	10	use EC	use EC	use EC	no data
Nitrate/Nitrite (as N)	mg/L	0.6 (4.4)	not set	not set	not set	0.075 [3]
Phosphate (as PO_4)	mg/L	0.01 (2.8)	use EC	use EC	use EC	no data
Sulfate (SO_4)	mg/L	19	use EC	use EC	use EC	no data
Copper (Cu)	µg/L	0.6 (90)	not set	not set	not set	
Lead (Pb)	µg/L	0.7 (8)	not set	not set	not set	
Manganese (Mn)	µg/L	24 (6)	10	18	32	
Uranium (U)	µg/L	3.8 (3.2)	0.20	1.40	5.8	0.5 [4]
Zinc (Zn)	µg/L	5 (200)	not set	not set	not set	
Radium (^{226}Ra)	mBq/L	(13)	>10	>10 over 90 days	>10 over 1 year	no data

[1] Maximum Allowable Additions (MAAs) based on Authorisation 82/3 – Loads in brackets are t/year except uranium (^{238}U & ^{234}U) and radium in GBq/year (10^9 Bq/year) (the 88 GBq/year is approximately 3.5 t of uranium, assuming radioactive equilibrium between ^{238}U & ^{234}U);
[2] Recommended values for 'slightly disturbed' NT tropical upland and lowland rivers;
[3] Recommended values for 'slightly disturbed' NT tropical wetlands, freshwater lakes and reservoirs, and lowland rivers;
[4] Considered a 'low reliability' toxicity-based guideline.

4B(f) Groundwater Management

The groundwater of the Ranger facility is generally not used, except for collection of seepage, pit dewatering or the supply of potable water from select extraction bores (eg. the Brockman or Magela West borefields). The main focus is monitoring groundwater pressures and quality. A critique of groundwater issues is presented in a later section on tailings management.

4B(g) Stockpile and Waste Rock Management

The principal (and single) criterion used for decisions about rock excavated from Pit #3 (and formerly Pit #1) was from the original 1979 Environmental Requirements. It stated that uranium 'material' would be defined as rock containing (dry weight) greater than 0.02% uranium. Thus any rock excavated >0.02% U_3O_8 had to be incorporated into the Restricted Release Zone. The new Environmental Requirements include no reference to this definition and there is only a single reference incorporated in Authorisation 82/3 (clause 3.3.3.3). Inert or non-mineralised waste rock was considered to be benign and could be used across the Ranger site without restriction. An aerial view of stockpiles is in Figure 11.

Figure 11 – Locations of various grade stockpiles (ERA-RAER, 2001)

The 0.02% definition of uranium material leads to three main categories of rock :

- **Economic Ore** – grade dependent on processing economics, market conditions, etc., generally >0.1% U_3O_8.
- **Low Grade Ore (LGO)** – uneconomic to mill but needs to be managed to prevent leaching and environmental impacts (0.02% < LGO < 0.1% U_3O_8).
- **Non-Mineralised or Waste Rock** – considered minimal environmental risk, often used for construction works (eg. dam embankments, foundations, etc.).

It is generally considered that the various rock units are considered low in sulfide (eg. pp 109-110, Fox *et al.*, 1977), as well as being high in alkaline minerals (such as carbonates). Hence there is no requirement to address the potential for acid mine drainage in Authorisation 82/3 (compared to Jabiluka where such a potential exists and requirements are incorporated into approvals). A 1988 internal research report entitled "Acid Leaching From Ore Stockpiles and Waste Dumps in the Ranger Project Area, East Jabiru" [49] appears to investigate the issue but is not public. According to concerns presented to Mirrar representatives the issue is of legitimate concern, especially the sulfur behaviour in the above ground tailings dam.

4B(h) Critique of Tailings Management

The management of uranium mill tailings requires containment of the wastes and contaminants for greater than 10,000 years – an issue which fundamentally challenges modern science (eg. Wasson *et al.*, 1998).

Despite the perhaps overly optimistic and positive view taken by ERA staff in presenting their analyses of rehabilitating the above ground tailings dam in situ in the late 1980s to mid 1990s, the summaries of Wasson (1992), Waggitt (1994), Waggitt & Riley (1994) and Riley & Rippon (1997) provide substantive weight to the arguments originally used by the Ranger commissioners to justify below-grade management of tailings. There are many important points to note from these papers (see URG, 1998; Mudd, 1999).

Despite the obvious significance of these issues to the ecological and cultural heritage values of the adjacent World Heritage-listed Kakadu National Park, not withstanding that the Ranger Project Area is (eventually) to be incorporated in Kakadu, Riley & Rippon (1997) over-confidently state that (pp 196) :

> "Previous studies suggest that the risk of failure of the proposed rehabilitation structure at Ranger Uranium Mine over a 1,000 year period is high but that the direct environmental bio-chemical hazard of released tailings is low."

[49] Milnes & Fazey (1988); see Appendix 5

The basis and principles used by Fox *et al.* (1977), therefore, were verified by the range of research carried out on the potential rehabilitation of the above ground dam containing tailings, despite over-confident assertions of low environmental risk by Ranger's staff and consultants. That it took some 20 years for this process to re-inforce the Ranger Inquiry is an indictment of the OSS and DBIRD.

Given this historical context, the Mirrar remain concerned about ongoing tailings issues and the ability of the OSS and DBIRD to independently [50] scrutinise and hold ERA to public account over decisions that need to be made in coming years as the Ranger site moves towards rehabilitation.

There are many examples where the OSS, DBIRD and ERA have failed to adequately and completely address tailings issues in public reports :

- poor reporting of maximum tailings levels allowed for Pit #1 (eg. RL 0 m ?) and current initiatives to relax this requirement;
    - a critical issue as this has implications for the timing of Pit #1 filling and the need for Pit #3;
- poor reporting of physical properties of tailings (density, permeability, consolidation, particle size);
    - according to information given to representatives of Gundjehmi Aboriginal Corporation, the technique used to measure tailings density in Pit #1 is questionable due to the fact that it largely ignores the thick zone of several metres of fine unconsolidated silts. Thus whether ERA are truly meeting the 1.2 t / m^3 density requirement is debatable;
    - despite claims of low tailings permeability, no data is known to be reported publicly;
- groundwater issues, especially high permeability zones such as carbonates and fracture zones, fault zones (addressed in detail below);
- microbiology of tailings (especially due to the change in deposition from sub-aqueous to sub-aerial) – closely related to sulfur / carbon behaviour in the tailings;
    - the method for tailings discharge changed from sub-aqueous (below water) to sub-aerial (above water or using beaches) in 1987 and corresponded to a major change in the geochemistry of the tailings. There are a number of internal ERA research and consultancy reports listed in Appendix 5 – all of which are believed to be confidential among probably many other reports. The formation of sulfide (due to microbial activity converting the high sulfate in the tailings) is clearly identified as a major environmental risk, and was probably given considerable weight by ERA in finally accepting final below-grade tailings storage;
- no time-frame established for returning tailings to pits (addressed below);
- incorrectly naming the dam an ‘evaporation pond’ despite 13 Mt of tailings still stored;
- radon flux remains poorly measured (or reported), especially from water-covered tailings.

A Groundwater contamination/protection issues

A major concern of the Mirrar is the protection of groundwater. The Ranger and Jabiluka sites can generally be simplified as consisting of shallow aquifers (‘Type A and B’ regimes) and deeper fractured rock aquifers (‘Type C’), as shown in Figure 12.

[50] Noting that many of the papers on the proposed in situ rehabilitation of the above ground tailings dam were co-authored by ERA, OSS and / or DBIRD staff.

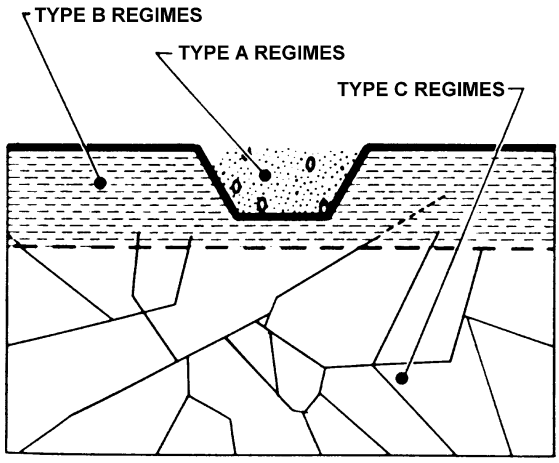


Figure 12 – Simplified groundwater systems at Ranger (Ahmad & Green, 1986)
(also applicable to Jabiluka with the addition of sandstone at the surface)

The seepage from the above ground tailings dam and now Pit #1 has not been adequately addressed in public reports by ERA, DBIRD or the OSS. The principal concerns relate to :

- contamination of shallow aquifers connected to surface waters, including billabongs;
- contamination of deep aquifers connected to shallow aquifers;
- difficulties in accurately quantifying and predicting groundwater behaviour.

As Figure 12 highlights, fault and fracture zones can represent an opportunity for rapid groundwater flow, as recognised by the Ranger Inquiry (eg. pp 98-103, Fox *et al.*, 1977). The Mirrar contend that the significance of this contamination pathway has been consistently downplayed in public by the OSS, DBIRD and ERA. For example, no known public report or paper shows the existing plume of seepage from the above ground tailings dam. The importance of fracture and fault zones on permeability and therefore the potential for groundwater contamination.

In documents obtained by Gundjehmi Aboriginal Corporation, a confidential internal DBIRD (then DME) report from January 1992 (Woods, 1992) discusses their check water monitoring program at Ranger. It presents a figure of the plume from the above ground dam, which shows major contamination along the major fault zones, as acknowledged by the Ranger Inquiry. Of further concern is an internal OSS report (Klessa, 2001c [51]) which incorporates a 1973 figure of the interpreted fault lines in the area of the above ground tailings dam. The two figures are shown in Figure 13. A more detailed analysis and cross-section showing permeability of both the above ground dam and Pit #1 was developed by Haylen (1981), both shown in Figure 14.

[51] This report is publicly available.

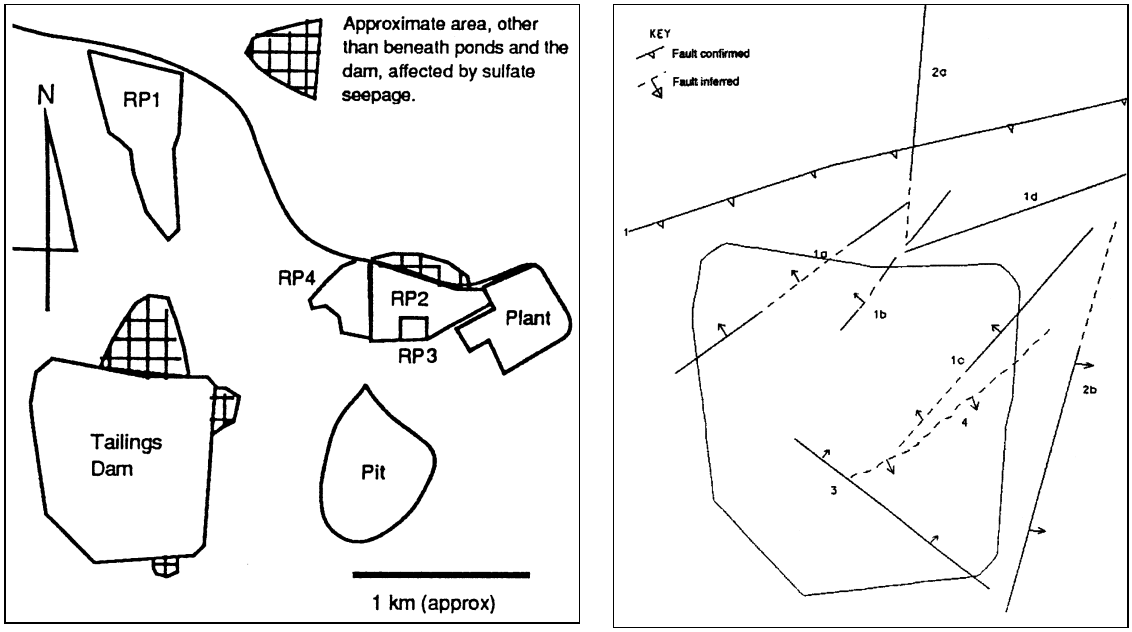


Figure 13 – Left : Seepage plume (based on elevated sulfate) from the above ground dam (edited for presentation only; Woods, 1992); Right : Known and inferred fault lines beneath the above ground dam (from "Coffey & Hollingsworth, 1973"; used in Klessa, 2001c)

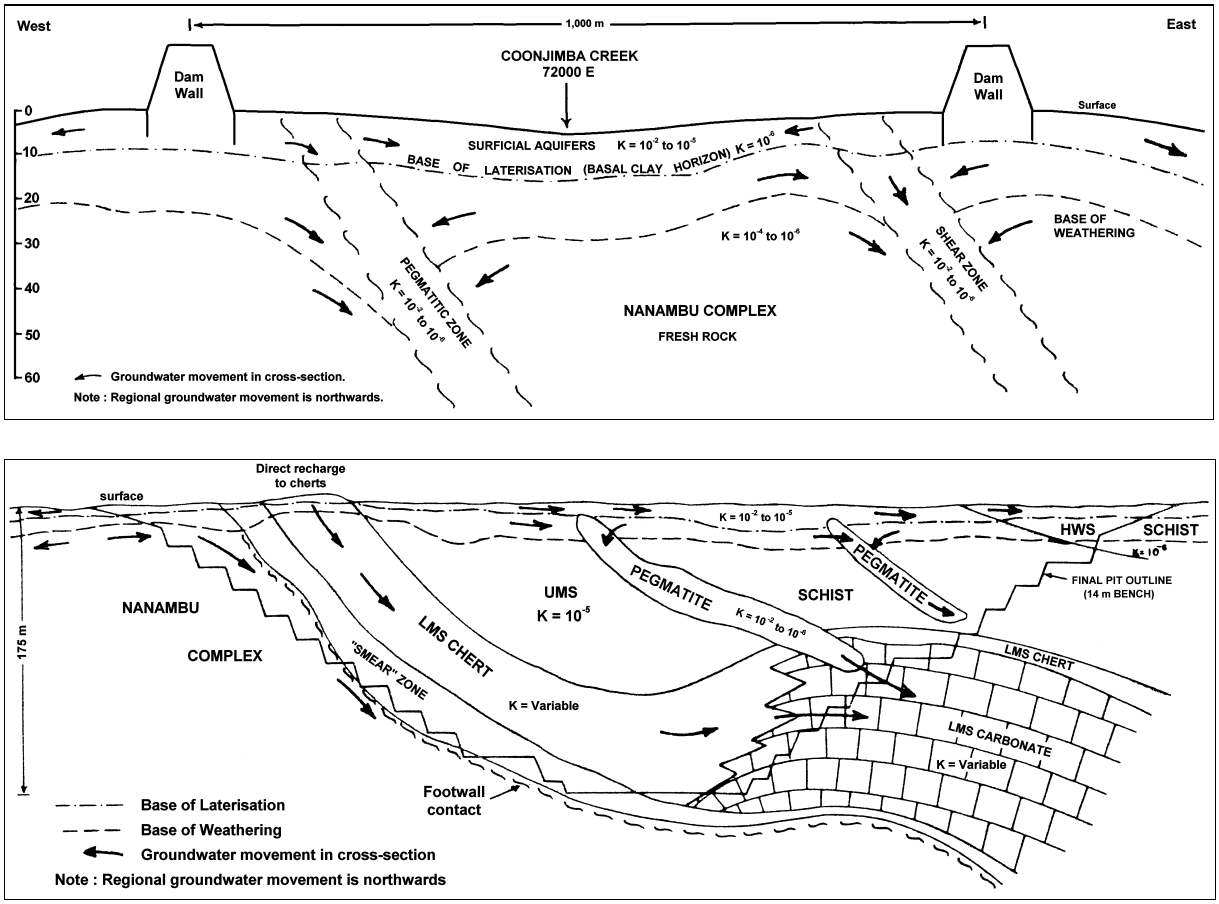


Figure 14 – Permeability of faults, fracture zones and rock units beneath the above ground dam and Pit #1 (Haylen, 1981)

There are a number of internal reports by ERA (compiled within Appendix 5) which address the rate of contaminant migration through faults zones, work often done by the Australian Nuclear Science & Technology Organisation (ANSTO) or the Commonwealth Scientific & Industrial Research Organisation (CSIRO). In a conference poster in Germany in September 1998 (Woods & Foley, 1998), ERA acknowledged the plume migration and the importance of the faults in controlling the pathways for contamination. In recent years ERA have been undertaking research on the use of geophysical surveying methods to locate and identify seepage plumes.

Other research by the OSS mainly centres on groundwater chemistry and the mechanisms of radionuclide migration (eg. U, ^{226}Ra) and major solute migration (eg. Mg, SO_4) (eg. Martin & Akber, 1996; Kalf & Dudgeon, 1999; Klessa, 2001c). Based on the bibliography of OSS publications [52], it would appear that detailed hydrogeology studies, especially the quantification of groundwater flowpaths, do not receive priority in the research efforts of the OSS.

It is clear that the OSS, DBIRD and ERA are well aware of the issues raised above although the lack of dedicated expertise in hydrogeology within the OSS is of concern. The lack of scientific rigour by DBIRD and ERA in reporting on the above issues also raises significant concerns about their attention on groundwater protection.

The Mirrar agree with Mudd (2002a) that the short and long-term impacts on groundwater resources and quality are not give due prominence in environmental monitoring and reporting (the relevant examples include Nabarlek, Rum Jungle and Ranger). There needs to be a greater emphasis on quantifying groundwater behaviour and publicly reporting the results, especially given the needs to predict groundwater behaviour for some 10,000 years into the future to ensure waste containment after rehabilitation. Some of the issues which need to be addressed publicly include :

- quantification of fracture zone properties through common geologic and hydrogeologic techniques;
- greater emphasis on identifying potentially permeable rock units, especially carbonate features as identified by Haylen (1981);
- more rigorous monitoring and reporting of different components of groundwater, both vertically and horizontally;
- investigation of methods needed to ensure low permeability of tailings liners, especially where the pit walls are in more permeable strata (especially above RL 0 m).

[52] Available through the OSS website at www.ea.gov.au/ssd/publications/bibliography.html

B Time frame for transferring remaining above ground tailings

There is still about 13,624,000 t (or ~13.6 Mt) of tailings in interim storage in the above ground tailings dam. A small scale dredging experiment shifted approximately 1 million m^3 (1 Mm^3) over 1997-98, focused on creating an even surface to try and enhance evaporation rates from the facility. Although the above ground dam is now often referred to as an 'evaporation pond' by the OSS, ERA and DBIRD, this is patently misleading since it still contains 13.6 Mt of tailings in temporary storage : the primary purpose remains interim tailings storage.

As noted earlier, ERA publicly committed to below-grade deposition of all tailings in the long-term and the new ERs specify this explicitly with no escape clause for further research.

A major failure of the new ERs and government oversight of this issue is that no time frame is placed on the emplacement of tailings back into Pit #1 (or Pit #3).

The Mirrar remain strongly concerned that :

- the tailings in Pit #1 may reach RL 0 before Pit #3 is finished being mined (eg. 2006-7);
- the tailings in the above ground dam may remain in such temporary storage until after 2010 (assuming Pit #3 becomes available by this time) – increasing the potential for groundwater contamination (especially the catchments of RP1 and Gulungul Creek);
- if tailings are not transferred from the above ground dam to Pit #1 as soon as possible, the tailings when shifted will likely take several years to consolidate thereby delaying required rehabilitation works by years;
- in the future, if the Ranger Mill Alternative for Jabiluka ever proceeds, ERA may choose to extract the full size of the Jabiluka orebody of some 53 Mt [53], leaving no room for the 13.6 Mt still remaining in temporary storage (according to Kinhill, 1996, 1997, predicted storage capacity of Pit #3 is of the order of 43 Mt).

Future scenarios currently being considered by ERA, DBIRD and OSS include increasing the height and capacity of the above ground dam, more rapid mining of Pit #3, earlier cessation of mining at Pit #3, an additional above ground dam, increased height of tailings in Pit #1, or even a special purpose pit. Some are clearly more serious than others.

The Mirrar wish to see that the 13.6 Mt of tailings still in interim storage be removed and emplaced in Pit #1 as soon as possible, and no later than the end of 2007. This will improve the prospects for prompt and more efficient rehabilitation and minimise long-term risks in tailings management (eg. volume / density, consolidation, groundwater contamination, etc.).

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[53] The full size and extent of the Jabiluka 2 orebody is largely a matter of economics. The original Pancontinental Mining Ltd proposal was to extract 53.3 Mt of ore averaging 0.39% U_3O_8 (Pancontinental, 1979). The ERA proposal (Kinhill, 1996) was to mine 19.5 Mt at 0.46% U_3O_8. Recent revisions of the ore resource by ERA state a new target of 13.8 Mt at 0.51% U_3O_8. Parts of the Jabiluka 2 orebody are still open for further exploration.

Future plans for tailings management, a critical aspect of environmental monitoring and reporting, must be developed and publicly announced at the earliest possible opportunity.

Recommendations

The management of radioactive uranium mill tailings is a major challenge and needs to be undertaken with full transparency. To enhance both short and long-term management of tailings, the following should be adopted :

- the incorporation of a deadline for removing the tailings from the above ground dam into Authorisation 82/3 and the Environmental Requirements (i.e. by the end of 2007).
- detailed analysis and reporting of the existing contamination of groundwater by seepage from tailings storage facilities (above ground dam and Pit #1), especially with regards to the use of contaminant plume maps.
- the OSS need to undertake specialist research on groundwater flowpaths, such as fracture zones and faults zones, to allow more detailed quantification of contaminant migration rates. This will allow more realistic design and implementation of tailings storage within Pit #3 as well as long-term groundwater monitoring needs after rehabilitation (around 2016 ?).
- the incorporation of the current RL 0 m limit for Pit #1 into Authorisation 82/3 and the Environmental Requirements and should also be legally binding with no escape or modification clause. A similarly appropriate limit should also be introduced for tailings Pit #3 (when this proceeds).
- all detailed studies and reports that already exist within ERA, DBIRD and OSS should be made publicly available.
- detailed field studies should be undertaken by the OSS to quantify radon flux, microbiological behaviour and the physical properties of tailings (especially permeability).
- more rigorous horizontal and vertical monitoring and reporting of all groundwater units around tailings facilities (dam and Pit #1).
- a more suitable technique be developed and applied to measure tailings density in Pit #1, incorporating known mill data (such as t ore milled and t reagents used).
- correct terminology be ensured by ERA, DBIRD and OSS at all times (eg. do not refer to the above ground dam as an ‘evaporation pond’).

4B(i) Critique of Surface Water Management

The management, monitoring and reporting of water issues at Ranger is relatively comprehensive but lacks clarity and independence in a number of key areas. The treatment of contaminated minesite waters is discussed in the next section.

A General monitoring and water management

The Mirrar are concerned that failures in water monitoring continue to occur. Some examples include :

- ***Repeated Contamination of RP1*** – due to dumping of low grade ore in the RP1 catchment, uranium has leached and contaminated RP1 now every wet season since 1998-99;
- ***More Monitoring Locations*** – a more rigorous monitoring program is clearly required. A more appropriate upstream location is needed, as the current point, near Georgetown Billabong, is too close to potential impacts from the mine (such as groundwater solutes from land application). Also, more detailed monitoring of Gulungul Creek is required, especially around the southern and western margins of the tailings dam, upstream and downstream within the Ranger Project Area (monitoring of Gulungul Creek Highway should continue).
- ***More Frequent Sampling*** – in order to distinguish the 'first flush' effects of early wet season rains, more frequent water sampling is clearly required. This should include electronic and automatic samplers to collect samples over storm events or various stages of creek flows. Many water storages should also be sampled more than quarterly or monthly and instead fortnightly during the wet season (eg. RP2, above ground tailings dam, Pits #1 and #3, seepage collection systems).
- ***More Detailed Hydrology*** – the collection of detailed hydrology and stream flow data should be more comprehensive than at present. There is no flow curve or other hydrology data for Magela Creek or other creeks presented graphically by DBIRD, OSS or ERA. Generally, only dates of first and final flow are reported, with perhaps total flow volumes as available or water discharges from Ranger.
- ***More Comprehensive Analysis*** – at present, the main determinant of what contaminants are analysed in water samples is Authorisation 82/3. Accordingly, some contaminants are not covered in sufficient detail to ensure releases from Ranger are quantified and the minimum or lowest that can be achieved. Some examples include radium (^{226}Ra), nitrate (NO_3).
- ***Failure to Direct Contaminated Runoff to RP2*** – such as the failure of drains on a laterite ore stockpile to direct water to RP2 during early 2002 (see OSS, 2002b);

B Retention Pond 1

The initial design of the Ranger uranium project included a dam across (then) Coonjimba Creek and Billabong to receive runoff from the catchment north of the tailings dam. The catchment of this pond, called Retention Pond 1 (RP1), was therefore supposed to be relatively clean and allow the suspended sediments in runoff to settle out before being discharged into the Coonjimba and Magela Creeks. As the water quality was relatively good, there were no controls engineered or designed into the dam wall and after the early wet season rains RP1 water would discharge freely over the spillway for about 4-5 months.

During 1998, ERA sought and received approvals to dump low grade uranium ore (~0.02-0.1% U_3O_8) on the northern wall of the tailings dam. This was primarily to allay concerns over the physical stability of the embankment in this area, as the foundations were known to be weaker and seepage a critical issue to monitor and manage. Some drainage works were put in place to ensure that contaminated runoff would flow through to Retention Pond 2 (RP2), which was designed and engineered to receive such waters.

During the 1998/99 wet season, the first following the placement of this uranium ore within the RP1 catchment, the uranium concentrations increased 100-fold from a normal background value of <1 µg/L to some 70 µg/L [54] within weeks. As this coincided with low flow rates in the Magela Creek, there was real concern that this could cause an unacceptable increase in uranium concentrations at the gauging station 'GS009'. In an attempt to reduce the flow rate ERA placed sandbags over the RP1 spillway. Towards the end of the wet season, uranium concentrations had reduced somewhat to about 10 ppb – still above the pre-1998 levels. Although the obvious source was the dumped ore, this was denied by ERA and investigations were begun by the OSS and ERA to isolate the exact 'source'.

It is understood that the total load of uranium discharged by this incident alone from Ranger was of the order of some 500 kg – the MAA for uranium at this time was 3,500 kg – natural loads are about 25 kg. The RP1-derived uranium is therefore a significant increase in uranium load for the Coonjimba and Magela Creek systems.
New drainage works were put in place during the 1999 dry season, as well as making the 'sandbag' control feature more permanent through the use of fencing. The 1999/2000 wet season saw the uranium concentrations in RP1 discharge once again reach highly elevated levels of about 40 µg/L. During 2000 ERA finally admitted that the source of the elevated uranium was indeed the ore on the tailings dam wall and the failure of drainage controls which overflowed during wet season storms.

Although more drainage control works were done in 2000 and apparently again in 2001, the uranium concentrations have continued to stay elevated in RP1, staying around 10-15 µg/L in the dry season. The levels in the 2000/01 wet season reached about 25 µg/L.

[54] Based on two analyses of 68 and 72 µg/L – ERA, DBIRD and OSS generally quote the analysis as 68 µg/L.

In early 2002 the Mirrar were informed by the NLC that the uranium concentrations had again reached some 70 µg/L – indicating a major failure of the drainage control works and fresh leaching of contamination from the dumped ore into RP1. It is curious that ERA states it was not aware of RP1's elevated uranium concentrations until the 'focus' level for uranium was reached at monitoring point GS009 and it started investigations to trace the source. ERA is required to test the quality of RP1 discharge on a weekly basis and therefore should have known earlier. ERA's response again was to merely sandbag the RP1 spillway. The uranium (and sulfate) concentrations up to mid-2001 are shown in Figure 15.

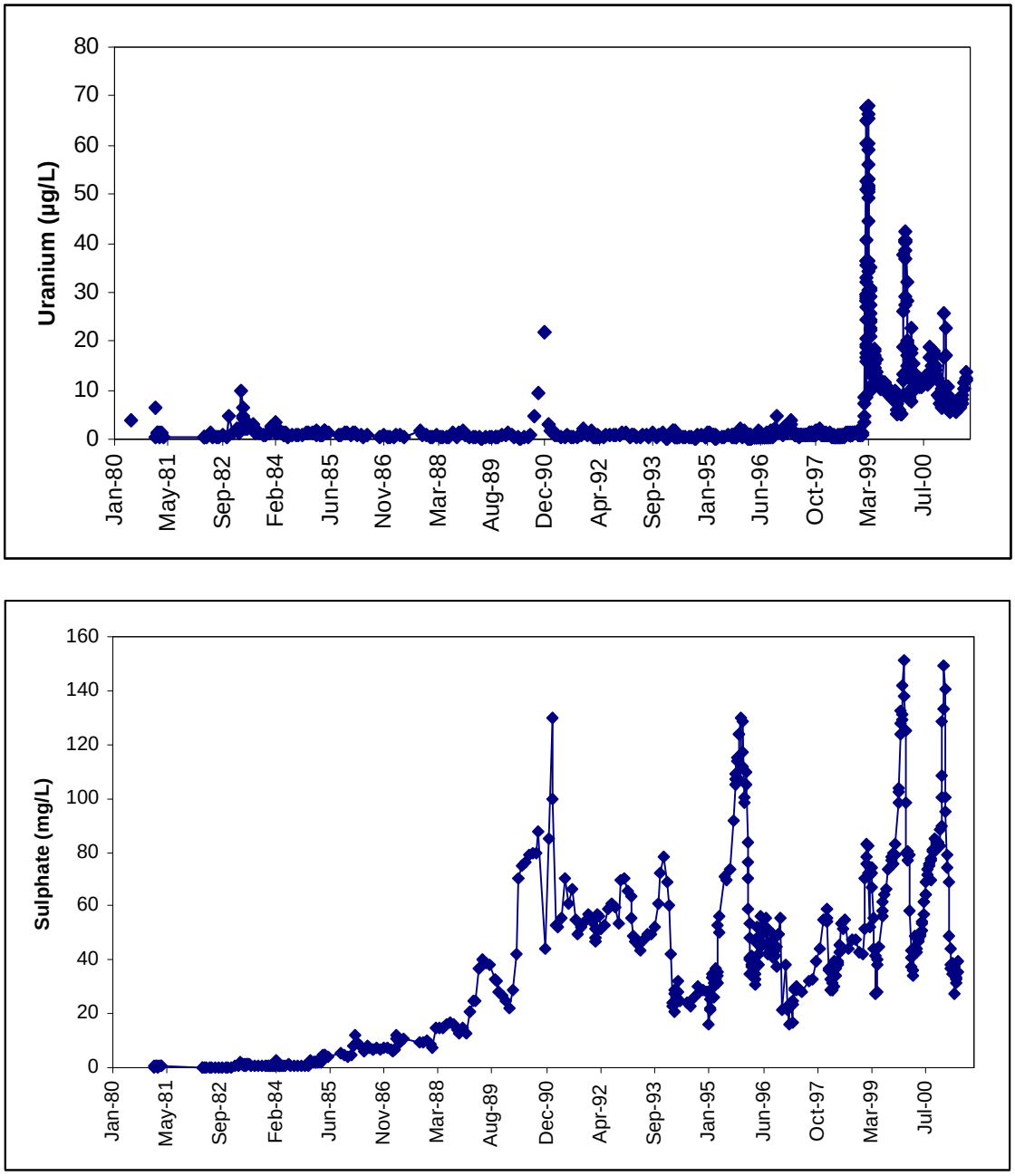


Figure 15 – Uranium and sulfate in discharge from RP1 (ERA-RAER, 2001)

There has been considerable field investigation of RP1 (eg. le Gras & Klessa, 2001; le Gras & Boyden, 2001; pp 15-16, OSS-AR, 2000, pp 47-48, OSS-AR, 2001) yet still the problem has occurred over four successive wet seasons. The Mirrar are extremely disappointed that such continuing cycles of pollution – with recognised threats to Magela Creek – are allowed to continue without sufficient enforcement of environmental objectives by the OSS, DBIRD or ERA. The ERs and Authorisation 82/3 both state that impacts on the Ranger Project should be 'As Low As Reasonably Achievable' (ALARA) (eg. clauses 1.2(e) and 3.2.5, respectively). The elevated uranium concentrations are severely impacting on Mirrar confidence in environmental management at Ranger and raising serious doubts about many other aspects of ERA's operations.

In response to these concerns, ERA have recently begun efforts to completely re-engineer the RP1 catchment to try and minimise and prevent such continuing cycles of pollution occurring again in the future – returning RP1 to the relatively clean catchment it was prior to 1998 (although there will undoubtedly be some residual contamination flushing through the pond for some years).

This process must be done with the full knowledge and approval of stakeholders and regulators, as ERA can clearly not be trusted to undertake this project on its own. The Mirrar also believe that additional monitoring points are required downstream of RP1 in the Coonjimba Billabong and along the flow-path where RP1 discharge would mix with waters in the Magela Creek.

A set of water quality triggers should be in place for RP1 to ensure that de-contamination objectives are met and maintained in the future. More rigorous monitoring of radium is also required.

C Retention Pond 2

The water quality of RP2 has always been low, with some extremely high surges in uranium concentrations in recent years (as noted by a former senior chemist from Ranger who went public with serious allegations about environmental mismanagement). For example, the uranium concentration in RP2 reached greater than 7,000 µg/L in late 1998 – among the highest concentration ever recorded by this time. Recent annual reports by ERA (ERA-RAER, 2000, 2001) fail to include any water quality graphs for RP2 (limited tables are presented), despite being one of the main storage ponds of contaminated water on the Ranger site. DBIRD include both graphs and tables in their 6-monthly surveillance reports (NTSA, various), with the most recent graph of uranium and electrical conductivity shown in Figure 16.

A major concern regarding RP2 is that, with the new water management system, ERA believe that there is no restriction on the use of RP2 water for fighting fires (see pp 16-17, OSS-AR, 2001). A more alarming use of contaminated water cannot be considered. The Mirrar strongly oppose the use of contaminated water such as RP2 being used in fire fighting activities.

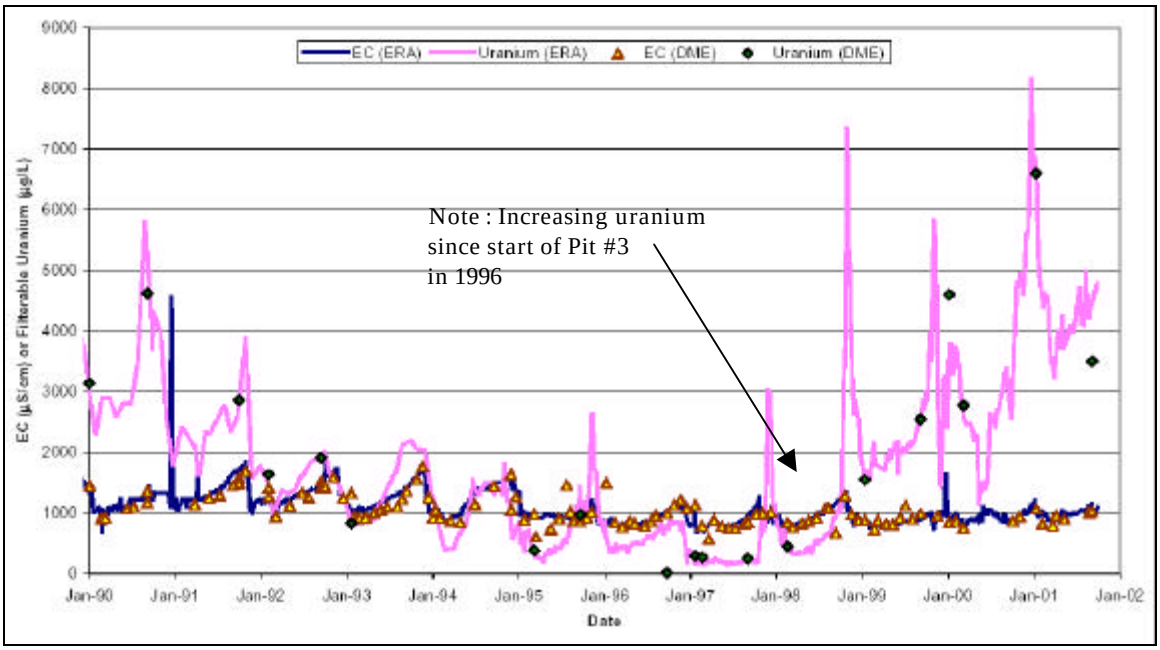


Figure 16 – Uranium concentration and electrical conductivity in RP2 1990-2001 (NTSA, 2001b)

C Gulungul Creek Highway

The protection of the water quality of the Gulungul Creek system was a major issue during the Ranger Inquiry (Fox *et al.*, 1977) yet it is only partially monitored by ERA and DBIRD. The OSS formal monitoring program, which began in the 2001-02 wet season, includes upstream and downstream points in Gulungul Creek.

As noted in Figure 5, the downstream monitoring point is known as "Gulungul Creek Highway" (GCH), which is where Gulungul Creek passes the Arnhem Highway. This point is also located outside the Ranger Project Area within Kakadu National Park and is a popular swimming spot for bininj (Aboriginal people). Based on Authorisation 82/3, ERA are not required to monitor any other point along Gulungul Creek except GCH on a monthly basis.

According to recent allegations of a whistleblower (a senior ex-chemist from Ranger [55]), ERA do monitor the perimeter of the tailings dam which leads to Gulungul Creek (eg. 'Tailings Dam South Road Culvert' or TDSRC). When a significantly elevated concentration of 7 µg/L was discovered at GCH in January 1997, he sought permission from management to trace the source through Gulungul Creek but was denied on the basis that this was not necessary to meet statutory monitoring requirements (ie. Authorisation 82/3). It is understood his report and documents are being submitted to this Senate Inquiry and worthy of significant attention. It is understood that, in the investigation of his allegations by the OSS, the value of 7 µg/L has been verified but was altered some six months later to 0.1 µg/L. A recent graph of uranium at GCH is shown in Figure 17.

[55] G Kyle, 5 April 2002, Copy of report and documents forwarded to Gundjehmi Aboriginal Corporation.

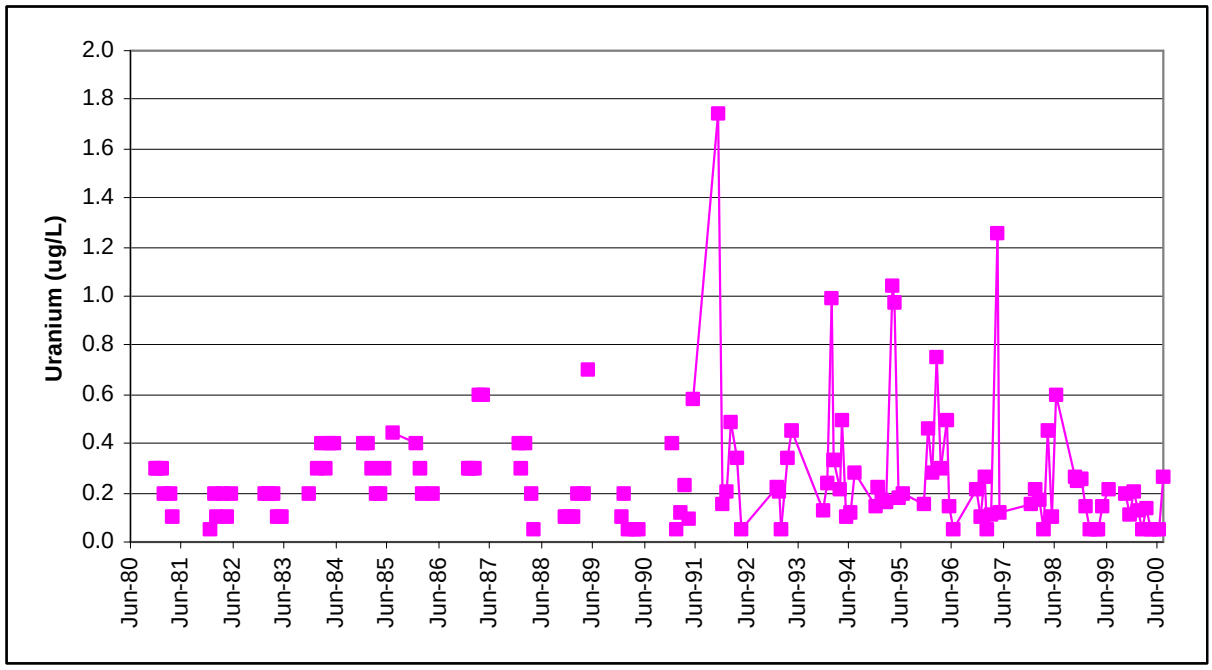


Figure 17 – Uranium concentrations at Gulungul Creek Highway (GCH)
(ERA-RAER, 2000)

It should be noted that the value of 7 µg/L is not within the data graphed in Figure 17, nor are the other high values of 2, 7 and 11 µg/L noted by the former ERA chemist in the water quality database for GCH. The data for TDSRC is not reported in ERA-RAER (various) despite its obvious environmental significance.

Of greatest concern to the Mirrar is that ERA refused permission for a scientist to investigate a potentially regular and significant leak from the Ranger site and then altered the water quality database. Significantly, at the time of the 7 µg/L being obtained, the relevant water quality criteria for Ranger was 3.8 µg/L downstream in Magela Creek. Although it is arguable whether ERA have breached any statutory requirements, the impacts were noted within Kakadu National Park and ERA refused to investigate and improve their environmental monitoring along Gulungul Creek. This is of deep, legitimate concern and the Mirrar contend that ERA has breached the Environmental Requirements by not reporting an incident which could be of concern to Aboriginal people or the broader public.

It should be noted that the confluence of Gulungul and Magela Creeks is about 3 km downstream of point '009' [56] and impacts on the Magela floodplain from Gulungul are therefore not detectable in the current regime. More detailed statutory monitoring is required along Gulungul Creek, with a greater emphasis on complete water chemistry monitoring (including radium) and the use of trigger levels to ensure that leaks or increased loads are not entering Gulungul Creek and therefore Kakadu National Park.

[56] Based on OSS monitoring location map : www.ea.gov.au/ssd/monitoring/

C Magela Creek ('GS8210009')

The water quality of the Magela Creek is monitored downstream at a gauging station labelled GS8210009 or '009'. It is only since the early 1990s that regular upstream monitoring has been adopted (eg. GS8210028 and GS8210067), though it is not included in Authorisation 82/3. According to the Water Quality clauses of the January 2000 Environmental Requirements :

3.3 Background variables for key variables in water quality, including values for conductivity, pH and uranium, are determined by the Supervising Scientist from time to time and communicated to the company and other major stakeholders. Should the values for these variables measured at Gauging Station GS8210009, or other key locations, show trends away from, or be abruptly divergent from, those background values, and if, in the opinion of the Minister, with the advice of the Supervising Scientist, the results may be attributable to mining operations, then the company must undertake such investigations and remedial actions as required by the Supervising Authority after consultation with the Supervising Scientist and other major stakeholders.

However, clause 13.1 of the ERs states :

13.1 During operations the company must carry out a comprehensive monitoring program, as required by the Supervising Authority or the Minister with the advice of the Supervising Scientist, which :

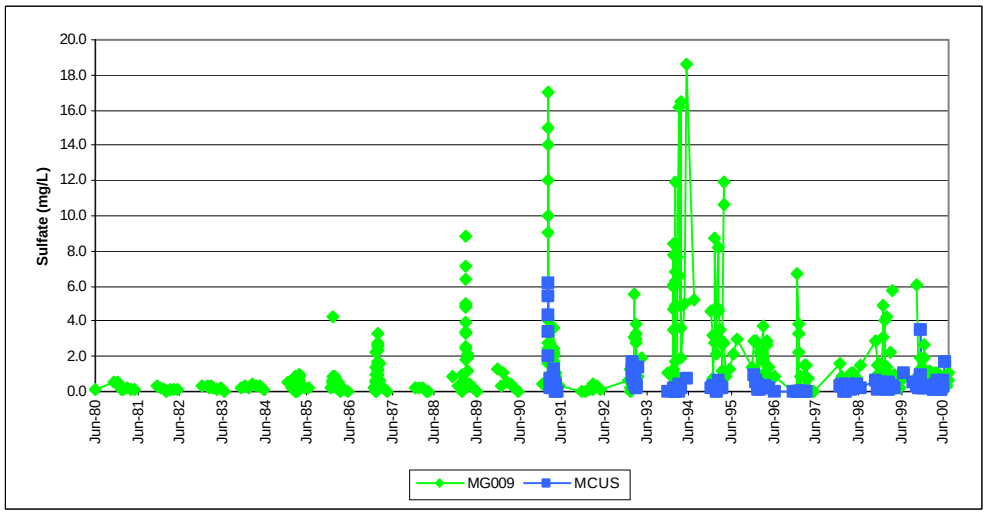
(a) includes monitoring stations on Magela Creek upstream and downstream of the mine at Gauging Stations GS8210028 and GS8210009 and such other sites as may be approved or required by the Supervising Authority; and

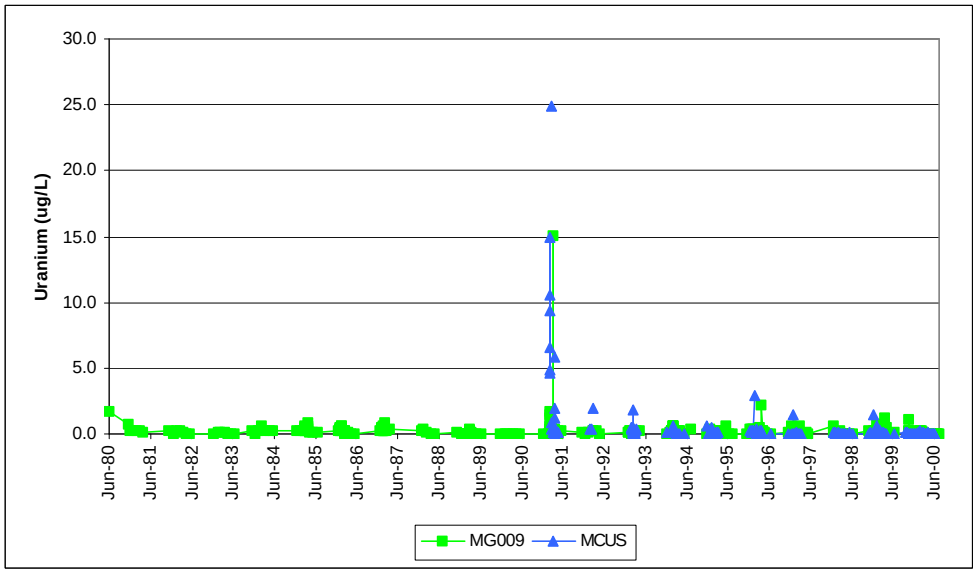
(b) is sufficient to allow interpretative analysis of impacts from operations.

Despite ERs 3.3 and 13.1 (a), it is confusing as to which upstream sites should be used for statutory purposes. For example, the ERs state '028' while both DBIRD and ERA use '067' (eg. NTSA, 2001b). There appears to be no public report (eg. ERA-RAER, various; NTSA, various; OSS-AR, various) which presents a clear map of the locations of these monitoring points. Klessa (2000) states that both 028 and 067 data could be considered to be the same for the purpose of analysis of impact (although this assumption could not be statistically verified with existing data sets).

This highlights the arbitrary nature of implementing the monitoring program, and who decides what it should include, with no clearly documented rationale for upstream locations versus downstream monitoring and its interpretative analysis. The only point for the determination of impact from Ranger remains '009', although there is confusion between who uses which upstream site. The trigger levels make no reference to a difference from upstream water quality (except for radium).

The uranium concentration in the Magela Creek is typically less than 0.1 ppb, with occasional samples returning up to 0.5 ppb. It is noteworthy that in the first wet season after the introduction of this new system, the 'focus' level for uranium was reached at 009. The recent uranium and sulfate (SO_4) concentrations at 009 are presented in Figure 18.





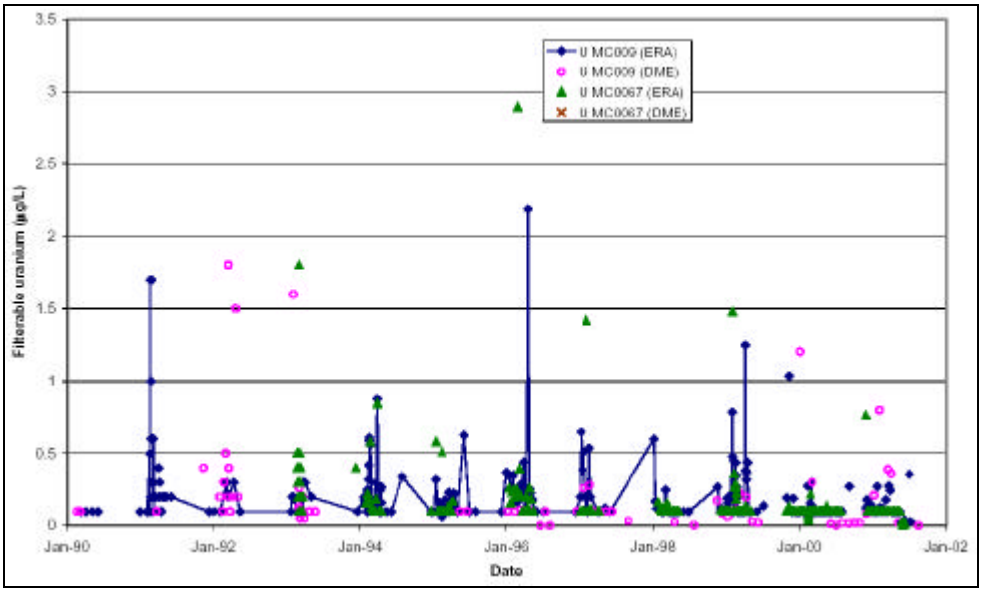


Figure 18 – Water quality of Magela Creek at '009'
(ERA-RAER, 2000, 2001; NTSA, 2001b)

The Mirrar remain opposed to the limit of 5.8 ppb for uranium as it represents an unacceptable degree of pollution above the naturally occurring concentrations in Magela Creek. The lack of maintaining strict load limits – which were previously quite generous to Ranger – is also a major failure as significant loads can still flow through and impact on Magela Creek without necessarily reaching the 'limit' values. Under the previous guidelines, ERA was allowed to dump up to 3,500 kg of uranium in Magela Creek every year with water releases from Ranger – the natural load of uranium is generally about 25 kg.

It is important to note that elevated SO_4 and magnesium (Mg) concentrations in Magela Creek at 009 are attributed to Ranger, though whether this is defined as an 'impact' is contentious - very little is known about long-term chronic changes.

Recommendations

The monitoring and management of contaminated minesite waters at Ranger needs to be significantly improved. The Mirrar believe this can best be achieved through use of the following :

- the re-incorporation of load limits into water quality criteria which are no more than twice the average natural loads in a system (preferably lower).
- the trigger system for water quality be expanded to include other important contaminants from Ranger such as NO_3, PO_4, Cu, Pb, Zn and others.
- the limit for uranium at gauging station 8210009 in Magela Creek should be lowered from 5.8 µg/L to 0.5 µg/L.
- a greater number of monitoring sites be established, especially along critical drainage features such as Gulungul, Corridor and Georgetown Creeks and Coonjimba and Djalkmarra Billabongs. More data will allow ongoing analysis and checks on sources of contaminants, loads, dilution, reactions and uptake by the ecosystem, and therefore possible impacts.
- a separate system of trigger levels be developed and applied for important discharge sites such as Corridor Creek, RP1 and Gulungul Creek.
- greater emphasis be placed on collecting hydrology data (stream flow rates and total volumes) for joint interpretation with water quality data.
- ERA adopt event-based monitoring to ensure compliance of all necessary water management system components.
- water samples be more thoroughly analysed for various indicator and important contaminants, such as Mn, ^{226}Ra and major solutes (Mg, SO_4).
- a more suitable upstream site for Magela Creek should be developed and standardised in Authorisation 82/3 and the Environmental Requirements.
- OSS need to undertake a wider and more detailed surface water monitoring program around the Ranger site, especially the creeks and billabongs.
- greater use of upstream data should be made in analysing water quality, especially with reference to flow (hydrology) data.

Recommendations (continued)

- the OSS and DBIRD continue to ensure significant commitments from ERA to fund environmental monitoring of minesite and adjacent surface waters and ensure that a rigorous environmental monitoring and reporting program is always in place.

4B(j) Critique of Contaminated Water Treatment

A Land application and irrigation of contaminated waters

Of further interest is that when the Mirrar were first informed by a representative from the Northern Land Council (NLC) of the focus level being reached at GS009 for uranium, it was suggested that this might be related to the Magela Land Application Area (MLAA). The MLAA receives contaminated Retention Pond 2 (RP2) water through irrigation or 'land application'. This practice was first adopted in the mid 1980s and has been heavily used by Ranger since this time, covering a total of about 55 ha (see Figure 5). The situation at the current time is unclear, although the NLC representative made it known that, in his opinion, the focus level being reached at GS009 was related to the MLAA.

The Mirrar remain concerned that the MLAA may have reached the end of its useful life (or soil load limits) and is no longer able to retain contaminants such as uranium or radium. There is a wealth of evidence that shows that conservative contaminants such as Mg and SO_4 are not retained by the MLAA soils, and they form efflorescent salts during the dry season and flush through into the Magela Creek during the wet season. The salts have even been observed on the banks of the Magela Creek in the dry season, related to groundwater discharge from the MLAA. The increasing Mg and SO_4 concentrations at GS009 clearly include a major contribution from the salts derived from the MLAA.

According to Authorisation 82/3, only 12 sites are monitored on a yearly basis in the MLAA, with samples taken from four depths (0-5, 40-50, 90-100 and 140-150 cm). The MLAA must be investigated as a continuing pollution source for the Magela, focusing on the extent and rate of Mg and SO_4 migration and whether there is any residual capacity in MLAA soils to continue retaining uranium and radium. This would ascertain if the MLAA is indeed contributing to the 'focus' level being reached for uranium at 009.

An important issue for the Mirrar is that the salt loadings and extended irrigation of the MLAA led to tree deaths over some 13 ha. The problem was first discovered by ERA during March 1995 and their investigation is reported by Callahan (1995). There is no report or public acknowledgement of this issue in OSS-AR (1995) [57].

[57] OSS-AR (1994) forewarns that "studies on the long-term impact on vegetation from salt and/or water logging effects were inconclusive" (pp 35-36). Some internal reports by OSS also study stress symptoms on individual trees (eg. Ashwath & Chandrasekaran, 1993, OSS Internal Report 132).

At the time, the 13 ha represented one-third of the 35 ha MLAA (which was subsequently expanded to include an additional 20 ha around the south-east area of the mill). Thus the reporting of environmental performance of the MLAA is therefore selective at best and needs to be more thoroughly addressed. The Mirrar remain concerned at the ever increasing area of sites such as land application and therefore the area of impact on the Ranger Project Area.

B Wetland filters

The use of wetland filters at Ranger has always been contentious and it took many years of research before ERA were finally given approval to treat contaminated RP2 waters. It would appear that wetland filters perform similar to land application in that salts such as Mg and SO_4 and only minimally reduced while U is captured within the plants and sediments of the wetland.

The wetland filter was constructed from an old borrow pit and first trialled over 6 weeks in 1994, with a full-scale trial over 5 months in 1995. The outlet water is discharged onto a land application area some 46 ha on the western side of RP1. Since the treated water is eventually flows to RP1, the wetland filter is called the 'RP1 Constructed Wetland Filter'. This name is misleading, however, since it treats RP2 water and should in reality be called the 'RP2 Constructed Wetland Filter' (used hereafter). A further 2 wetlands have recently been constructed on the south of Pit #1 and next to the RP2 filter, though it is not known whether they have regulatory approval to being operation as yet. The existing dam walls on the Corridor Creek system are also now referred to as 'wetlands', despite the fact they were never meant to be used in this fashion.

The concerns of the Mirrar on the use of wetlands include :

- the short-term nature of wetlands – what is the ultimate capacity to retain uranium and other contaminants and the ultimate fate of the various contaminants?;
- the need to consider them radioactive wastes after the completion of mining and milling on the Ranger site and excavate them as part of rehabilitation works;
- the long-term cumulative impacts on plants and animals within the wetlands until rehabilitation – especially the potential for bioaccumulation.

Both ERA and OSS have undertaken research on the internal dynamics and performance of the RP2 Constructed Wetland Filter (eg. Klessa *et al.*, 1998a, 1998b, among others). There still appears to be no answers to dot points 1 and 3 above.

It is understood that, along with concern by senior company staff and government regulators and advisors over the increased quantities and leaching rates of Ranger #3 material, the current wetlands are thought by some to be already saturated with contaminants and therefore of minimal useful capacity to treat water. This especially applies to the 'wetlands' along Corridor Creek.

Another incident of concern to the Mirrar is the 1998 episode where the RP2 Constructed Wetland Filter was allowed to dry out. Although it is presented by ERA as an experiment to see the degree of oxidation and contaminant release (eg. pp 133-139, ERA-RAER, 1999), it is understood that the simple fact was that Ranger mill personnel demanded the water against the strong advice and protests of environmental staff (who understood dot point 2 and never wanted the wetland to dry out).

Unlike the MLAA, there is no requirement for soil (sediment) or water quality monitoring in Authorisation 82/3 or the ERs. Although ERA do undertake and report environmental monitoring data for the use of wetland filters, it should be included in the Authorisation as the monitoring of land application sites is incorporated. More thorough public reporting of internal research reports by OSS and ERA [58] should also be undertaken.

Recommendations

The treatment of contaminated minesite waters and monitoring of the areas used for this at Ranger needs to be significantly improved. The Mirrar believe this can best be achieved through use of the following :

- the incorporation of maximum cumulative load limits into specific areas for disposal, specific to the use of irrigation (land application) or wetlands.
- release of all reports and data on known environmental problems at treatment areas (wetlands, irrigation).
- detailed studies on the long-term future of existing sites to continue to be able to perform effectively, including all contaminants (Mg, SO_4, Mn, U, ^{226}Ra, etc.).
- incorporation of more rigorous sampling (more sites and frequency) of wetland and irrigation areas in Authorisation 82/3 and the Environmental Requirements.
- need to reduce reliance of OSS and DBIRD on company data and assertions in managing these contaminated areas.
- OSS and DBIRD should undertake check monitoring and analysis of wetlands and irrigation sites.
- the Corridor Creek wetlands need to be investigated as to whether they have any capacity to continue to perform as wetland filters in the future.

[58] It is acknowledged that ERA have presented some of their wetlands research at scientific conferences.

4B(k) Critique of Stockpile and Waste Rock Management

On the afternoon of 27 February 2002, the Mirrar were informed by the NLC of the incorrect dumping of low grade ore at the Ranger site. Despite incomplete details, environmental monitoring data had indicated a surge in uranium concentration in waters entering Corridor Creek to some 2,000 μg/L. This creek flows into Georgetown Billabong and then to the Magela Creek and Kakadu. Detailed investigations were initiated by the OSS and ERA into the source of incorrect dumping and the levels of uranium contaminating surface waters. The OSS and ERA investigation reports highlight serious deficiencies with current and future environmental performance at Ranger.

This incident is not without precedent – in November 1988 it was discovered that radiometric ore discriminators had been malfunctioning for up to 6 months leading to the incorrect dumping of up to 500,000 t of low grade ore (see Appendix 4).

As noted previously, the current mining within Pit #3 is producing much higher quantities of low grade uranium ore (0.02-0.12% U_3O_8) than was predicted in mine planning estimates. This low grade material requires separate stockpiling and storage, since any runoff would be highly contaminated with uranium. The resultant need for additional material storage space at Ranger is proving a significant management issue.

On 14 January 2002, truck drivers from the mine began dumping the ore on an area (#2 low grade ore stockpile, 0.02-0.08% U_8O_8) that had been compacted and 'sealed' to allow uncontaminated runoff (i.e. rainfall) to be diverted away from RP2. As this area was not supposed to receive this type of ore, the runoff was draining freely through existing networks that lead to Corridor Creek and Georgetown Billabong. The dumping of ore continued until 26 February when the Environment Department within Ranger discovered the source (after prompting from Darwin). The total amount of ore dumped at the site is about 80,900 tonnes (t) of 0.02-0.08% U_8O_8 ore and 3,600 t of 0.08-0.12% U_8O_8 ore, or 84,5000 t in total. Excess runoff was also being generated at the laterite ore stockpile (>0.12% U_8O_8) and instead of reporting to RP2 as required it was mixing with the runoff from the #2 stockpile.

The incident highlights some major concerns of the Mirrar about operations at Ranger, namely :

- the incident is a clear breach of Ranger's statutory Environmental Requirements (eg. 1.2e, 3.2, 7.1) but was not described as such by OSS (2002b);
- uranium concentrations were as high as 8,140 ppb in some locations, with most samples in the stockpile area showing between 500 and 1,000 ppb;
- the elevated uranium concentration in runoff water from the stockpile area was not identified by minesite personnel but the Darwin office (via email) of ERA's 100%-controlled EWL Sciences on 23 February;
- runoff from the high grade ore #4 stockpile (containing 0.12-0.18% U_8O_8) also breached proper drainage, and instead of flowing to RP2 joined the runoff from the incorrectly dumped low grade ore in flowing through to Corridor and Georgetown Creeks;

- ERA state they do not have the resources to finish the full implementation of the recommendations of the OSS (2000) report on the manganese leak;
- the high turbidity of the runoff was noticed by accident, which triggered sampling of the area in question and the 'discovery' of elevated uranium concentrations;
- the mine and environment departments at Ranger are not communicating effectively, despite this being a major shortcoming identified during the investigation of the 2000 manganese leak. This serious deficiency was also highlighted by the NLC by email in November 2001 to ERA's environment department;
- it took some 44 days for the problem to be identified – despite the increased oversight and site visits by regulators (which is now monthly) and previous commitments by ERA to improve environmental and other management at Ranger;
- the location of the leached uranium which entered Corridor Creek's headwaters is still uncertain – greater investigation needs to be undertaken to quantify the environmental location and impact of the uranium, and other potential contaminants. For example, has there been any discharge to groundwater ? Uptake by plants? Radium activities in runoff waters and in plants ?

The OSS and ERA state that the incorrect interpretation of the elevated uranium concentrations was justification for why ERA had not breached any environmental regulations. That 'incompetence' can be used to excuse such significant scale problems at a mine site surrounded by a World Heritage area is of deep concern and regret to the Mirrar.

However, the Mirrar have been informed that the actual situation within ERA is even worse than this : there was no interpretation of the data from the stockpile area by ERA staff. This is not just incompetence but borders on professional negligence.

During Senate Estimates on 30 May 2002 (ECITA, 2002), the performance of the new joint DBIRD-OSS Routine Periodic Inspection (RPI) program was questioned. The 17 January 2002 RPI – 3 days after the incorrect dumping began – inspected the #2 stockpile but only the base to assess seepage issues since the December 2001 RPI had inspected surface features. During the January RPI the OSS asked about the top of the stockpile but were assured by ERA's Environment Department that it was inactive. This emphasizes that the OSS is too reliant on ERA assertions in monitoring and reporting and that DBIRD is failing to fulfill its public mandate.

In accordance with Authorisation 82/3, the placement of ore, low grade ore and waste rock has to be in conformity with the *Ranger Mining Manual* (clause 3.3.3). This report is believed to be confidential and is about to be replaced, under the *Mining Management Act 2001* (NT), by a new Mining Management Plan (MMP). Whether the incorrect dumping was in contravention of the Ranger Mining Manual cannot be ascertained since it is not a public document.

Although the problem was supposed to have been corrected through urgent remedial works in late February, in late April 2002 the Mirrar were informed that runoff still continuing from the southern stockpile area had reached some 13,875 µg/L uranium. This calls into serious question the effectiveness of the 'stockpile remedial works' undertaken by ERA and their subsequent inspection by the OSS and DBIRD.

The high uranium concentrations and flow volumes entering the Corridor Creek system from the southern stockpile add weight to concerns about the future effectiveness of the wetlands in this region of the mine.

In response to this latest incident – which was some seven times the concentration leading to the identification of the incorrect stockpiling – the OSS stated in media comment on 24 April 2002 that they had directed ERA to cease discharge of stockpile runoff into the headwaters of Corridor Creek.

It has been repeated to the Mirrar several times since this date that the 13,875 µg/L will not be sourced and investigated at all. This situation is patently inadequate and calls into question the ability of the OSS and DBIRD to effectively implement both the Environmental Requirements and Authorisation 82/3. Both of these statutory mechanisms include clauses stating that impacts on the Ranger Project Area (and not just Kakadu) should be "As Low As Reasonably Achievable" (ALARA). If the source of such major uranium contamination will not be sourced by ERA (nor enforced by the OSS and DBIRD), how can it be claimed that operations conform with ALARA ? The Mirrar are disturbed that the Ranger Project Area is not being protected to the best degree possible and that the short and long-term damage done to their country needs to be demonstrably the minimum achievable.

The Mirrar remain deeply concerned that there is still a raft of inadequacies in the environmental and water management systems at Ranger related to the various stockpiles and their environmental regulation, which is largely done in secret through the Ranger Mining Manual.

Recommendations

The stockpiling of ore, low grade ore and non-mineralised material is proving a significant challenge from Pit #3. To ensure that operations at Ranger do not lead to repeat situations of 2002 and earlier incidents, the following improvements are recommended :

- the 'Ranger Mining Manual' be available publicly, or its successor the Mining Management Plan (MMP) under new NT legislation.
- development and implementation of a more rigorous inspection programs be developed by the OSS and DBIRD which physically checks all stockpiles prior to, during and immediately after each wet season. Such a program should not be reliant on ERA statements or incompetence.
- more thorough reporting of stockpile locations, plans and quantities by ERA, OSS and DBIRD, including water management aspects for each site.
- the discharge of runoff from southern stockpile not be permitted to enter the Corridor Creek system until the wetlands have been ascertained to be suitable for the remaining period of the Ranger operation (eg. 15 years) and increased environmental monitoring has been properly implemented.

4B(l) Critique of Groundwater Management

As discussed previously, there is a range of groundwater monitoring undertaken by ERA and DBIRD. The OSS undertake no statutory check program for groundwater.

The reporting of groundwater is generally minimal. The water quality and height data for statutory bores is often presented in tables with select bores graphed (see ERA-RAER, various; NTSA, various). However, a site plan showing regions of seepage impacted groundwaters is not included in the main public reports just listed. The inclusion of hydrogeologic cross-sections indicating the vertical monitoring locations of the bores is often absent, if included at all.

According to the locations of tailings plumes presented in Figure 13, the impact of preferrential pathways such as fractures and fault zones is critical at Ranger yet these issues are almost entirely ignored in public reports. There is very little permeability data on the public record to address and quantify these aspects further.

A good example where fast preferrential groundwater flowpaths have been important in contamination is the Magela Land Application Area. In the early 1990s it was discovered that epsomite salts were forming at the surface of the MLAA as well as being detected on the banks of Magela Creek during the dry season. The confidential ANSTO [59] research report on the issue [60] identified several linear geologic features which gave rise to rapid groundwater transport of salts to the Magela, much faster than would otherwise have been expected. The only publication containing a figure of these zones is a journal paper by ANSTO staff, shown below in Figure 19. A photo of the salt formation at the soil surface is shown in Figure 20. There is often no discussion of fast groundwater flowpaths at the MLAA in DBIRD or OSS reports, despite this information being commonly understood.

There is a clear and obvious need to improve the reporting of groundwater monitoring data across the Ranger site through the use of plume maps, cross-sections, better reporting of physical properties such as permeability and their relationship to geological features.

[59] Australian Nuclear Science & Technology Organisation, formerly the Australian Atomic Energy Commission.
[60] Lowson & Reid (1994), see list in Appendix 5.

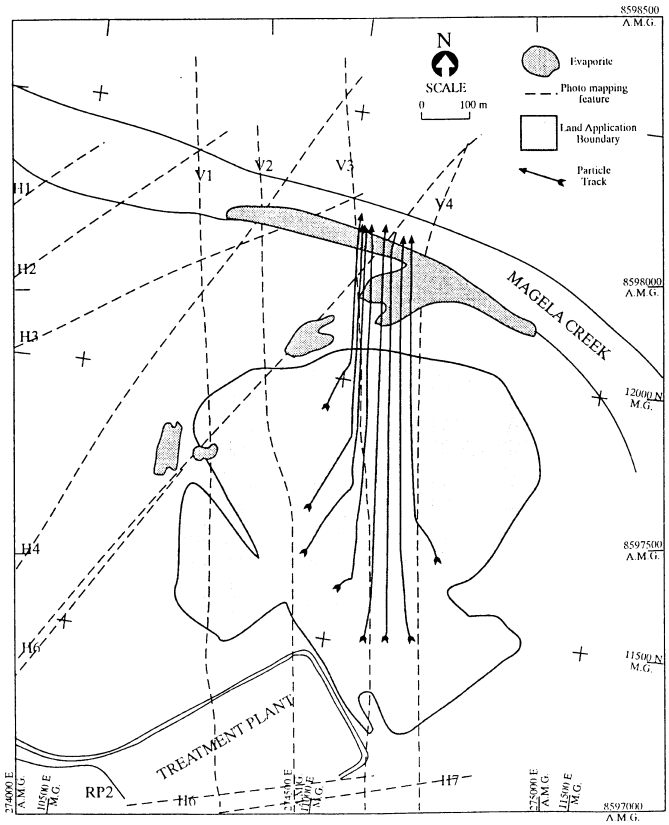


Figure 19 – Rapid groundwater flowpaths at the MLAA for contaminant migration
(Brown *et al.*, 1998)

Figure 20 – Salt ($MgSO_4.2H_2O$) formation at the soils of the MLAA
(Figure 4.7, OSS-AR, 1994)

Recommendations

The management and protection of groundwater could be enhanced through the following improvements :

- development and implementation of check groundwater monitoring program by the OSS.
- greater frequency of groundwater bores in areas of and downgradient from higher permeability zones, including broader analysis of water quality.
- more thorough reporting of groundwater data, both horizontally and vertically, by ERA, OSS and DBIRD, including cross-sections, plume maps and groundwater elevations (i.e. piezometric surfaces).
- more detailed field studies aimed at quantifying groundwater flow paths to enable more accurate short and long-term (>10,000 years) models.

4B(m) Critique of Soil Monitoring

As discussed previously, there is a range of soil monitoring undertaken by ERA, though DBIRD no longer undertake any check soil monitoring. Historically, the former Conservation Commission of the NT undertook extensive soil monitoring and testing across the Alligator Rivers Region. This work lasted from 1979 to the mid 1980s. The OSS undertakes no statutory check program for soils at Ranger, although they do have a considerable amount of data acquired in the course of various research projects.

The 20 ha extension area of the MLAA appears to have no paired soil samples being monitored by ERA (no such detail in the authorisation). Also in conflict is the quote by ERA-RAER (2001) that samples are only collected from 0-5, 40-50 and 90-100 cm (pp 47). The Authorisation 82/3 also states sampling from a depth of 140-150 cm is required (or to depth of refusal of auger).

In accordance with Authorisation 82/3, ERA are required to analyse paired soil samples every three years across the Ranger site, as well as annual soil tests in the Magela Land Application Area.

Given the importance of soils in retaining contaminants, especially uranium and radium in the top surface soils, a more frequent and thorough analysis of soils is needed top identify trends promptly and enable appropriate decisions and action to be adopted.

Recommendations

The management and protection of soils could be enhanced through the following improvements :

- development and implementation of check soil monitoring programs by the OSS and DBIRD.
- more sampling points located in areas of active water treatment, such as wetlands or irrigation.
- more detailed field studies aimed at quantifying long-term contaminant retention characteristics of soils.

SECTION 4C: ENVIRONMENTAL MONITORING AND REPORTING OF THE JABILUKA PROJECT

4C(a) Current Status

The main features of Jabiluka at present include :

- an underground decline for access, mine development and exploration. The main tunnel is approximately 1,150 m long with cross-cuts and drives totalling about 667 m;
- office and workshop facilities, including diesel storage tanks;
- an 'Interim Water Management Pond', intended for one wet season only;
- a 'mineralised' stockpile of **47,000 t uranium ore =0.02% U_3O_8** and potentially acid-forming rock (contains reactive sulfide minerals). The **average uranium grade is 0.123% U_3O_8**, including **10,000 t at 0.27% U_3O_8**. The average sulfide (S) grade is 0.12% S, with a maximum of 0.48% S;
- a **57,000 t** 'non-mineralised' stockpile (i.e. <0.02% U_3O_8 and <0.5% S);
- a 140 m ventilation shaft (for the underground decline);
- contaminated soils and other industrial wastes (oils, chemicals, etc.);
- sediment traps for erosion and drainage control.

Recent aerial photos and a site plan are given in Appendix 6.

The Jabiluka Project has been inactive since September 1999 and is currently on "environmental care and maintenance" with both ERA and parent company Rio Tinto Ltd publicly stating that Jabiluka will not be developed for at least a decade. The principal (and only substantive) activity onsite remains water management, which is sourced from the decline and rainfall on the site in the wet season.

The actual design basis for the current Jabiluka site remains contentious – is it really the 'Ranger Mill Alternative' (RMA) or is it common to both the RMA or 'Jabiluka Mill Alternative' (JMA) ?

Although regulatory approvals were issued on the basis that site construction activities (Stage 1) would be common to either development option, a comparison of the site as constructed with the various designs in the original Jabiluka Draft Environmental Impact Statement (eg. Figure 4.22; Kinhill, 1996) and the JMA Public Environment Report (eg. Figure 2.3; Kinhill, 1998) clearly shows that the existing design is closest to the RMA. Whether the site can be adequately retrofitted to suit the JMA is a simple engineering choice, mainly centred on cost (not technology or ability).

The OSS recently prepared a briefing paper on water management at Jabiluka for the February 2002 meeting of the reconstituted Alligator Rivers Region Technical Committee (ARRTC) (OSS, 2002 jwm). It acknowledges that the current site was indeed only a temporary facility built for one wet season only (i.e. the RMA) :

> "The IWMP was originally designed to contain runoff from **one** 1 in 10,000 year Wet Season as the development of the mine was to proceed immediately including the construction of the 9 ha retention pond the following Dry season. However development of stage two did not commence …" (pp 1, emphasis added)

The constructed retention pond at Jabiluka (the 'Interim Water Management Pond' or IWMP) is about 3.5 hectares (ha). According to Kinhill (1996), the area of the retention pond for the RMA "… will be 9.0 ha" (pp 4-67). In contrast, the final approved version of the JMA (Kinhill, 1998; EA, 1998) did not contain any reference to a retention pond, even a temporary facility for construction purposes.

These combined facts suggest that the IWMP is 'Stage 1' of the RMA – although no staged construction of the pond is discussed in Kinhill (1996, 1997, 1998) or EA (1997, 1998). The above quote from the OSS clearly shows that Stage 2 refers to the full 9.0 ha pond of the RMA.

The Mirrar contend that the Jabiluka site was built to the engineering design and intent of the RMA – against express Mirrar wishes. Given this, the design was never anticipated to remain static for this period of time (eg. since September 1999) and the Mirrar believe that recent reports of water contamination due to current site management confirm their many legitimate concerns about the lack of environmental planning and protection for Jabiluka in the short and long-term.

4C(b) Existing Environmental Monitoring and Reporting Regime

The program for environmental monitoring and reporting is given in Jabiluka Authorisation 98/2. A copy of the relevant text and tables from this authorisation are provided in Appendix 7, including reporting requirements.

As highlighted previously, the "Environmental Requirements" (ERs) for Jabiluka are attached to the 1982 Agreement and incorporated into the terms and conditions of the mineral lease (MLN1). Although the OSS, DBIRD and ERA act as if the Ranger ERs are applicable at Jabiluka, they have no legal enforceability, as demonstrated by events in early 2002 (see below).

A list of environmental incidents at Jabiluka (compiled from ERA-JAER, 1999, 2000, 2001 and recent events) is given in Appendix 8. The list shows repeated sampling and analysis failures (eg. radium), as well as adequate maintenance of critical monitoring equipment such as blast monitors.

4C(c) Water Management

A Overview

The increasing problems of water management at Jabiluka have recently been studied and reported to the Mirrar and Gundjehmi Aboriginal Corporation by Mudd (2001), included as Appendix 6 of this submission. It is stated that :

- Water management at Jabiluka has historically – and currently – been promoted as a 'zero-release' operation, but due to unnecessary project risks taken by current owner ERA – namely premature construction of an inappropriate design (the RMA) – the Jabiluka project is facing a continually escalating water management crisis;
- The use of "Best Practicable Technology" (BPT), as practised by ERA, fails to account for the legitimate concerns of the Mirrar, generally being an exercise in assuring approvals of the lowest cost option;
- The Mirrar have not been adequately informed and consulted about water management issues at Jabiluka, especially prior to approvals;
- Groundwater behaviour around and discharge into the decline is still poorly understood and analysed, despite this being the major contaminant source for water management at Jabiluka;
- Inadequate reporting of critical water management aspects by ERA, OSS and NT authorities, especially :
    - water level and quantity over time of the IWMP;
    - Reverse Osmosis treatment quality and irrigation quantities (and performance of Jabiluka soils from this irrigation);
    - groundwater sources, both quantity and quality, remain poorly reported.
- The OSS and DBIRD need to pro-actively support the legitimate concerns of the Traditional Owners, the Mirrar, and argue for active rehabilitation over 2002 and 2003 to alleviate water management strains;
- Water treatment should be continued on-site at Jabiluka in the short-term to ensure that contamination levels are not further increased in areas outside of the IWMP.

This submission provides an update to water management issues since December 2001. A timeline of historical and more recent water management from June 1998 to November 2001 is given in Appendix 6. The history of water management to date demonstrates that Mirrar concerns about protecting country are not being adequately realised through the existing regulatory regime.

Groundwater issues will be addressed in a following section.

B Current surface water monitoring and reporting regime

The quality of surface water is monitored both within the existing infrastructure and around the immediate area of Ngarradj (hereafter Swift Creek). The sampling points which are part of the ERA statutory monitoring regime (as outlined in Appendix 7) are shown in Figure 21. The water quality of Swift Creek is also monitored by the OSS and DBIRD, although maps of their sampling locations are not available (it is understood locations are similar to ERA's).

The DBIRD check monitoring program commenced in the 1998-99 wet season and is given in NTSA (2001b) and Appendix 9, although it is understood to be under revision at present.

The OSS also undertakes a water quality monitoring program around Jabiluka. Based on the summary of stream water quality presented in le Gras *et al.* (2001 & 2002), a similar sampling frequency is assumed.

As with Ranger, a new system for water quality compliance was introduced in late 2001 at Jabiluka, based on the recently released National Water Quality Management Strategy (ANZECC & ARMCANZ, 2000). The was necessary largely due to the fact that the site no longer operated on a 'Total Containment Zone' basis and was regularly releasing water across the site for disposal.

The water quality compliance system includes three levels or 'triggers' for select contaminants which could indicate a mine signature, given in Table 3. In general, the trigger values are based on statistical variation from average background concentrations and / or ecological toxicity for various contaminants or solutes, as derived by the work of the OSS (eg. Klessa, 2000, 2001a, 2001b; Van Dam, 2000).

The terms for each trigger level are defined as (OSS, 2001) :

- Focus – one standard deviation from the mean or average concentration;
  - requires a '*watching brief*' or closer attention paid to whether variation is natural or possibly mine-related, further sampling may be necessary;
- Action – two standard deviations from the mean or average concentration;
  - requires '*investigation and corrective action*' to ascertain the cause of the elevated values;
- Limit – three standard deviations from the mean or average concentration or an alternate concentration based on ecological toxicity;
  - potentially due to operations at Jabiluka and a '*breach*' of environmental authorisations, clear corrective action required. Supervising Scientist to advise Minister on whether the Environmental Requirements have been breached.

The trigger values for pH, Mg and SO_4 are considered guidelines only, whereas NO_3 and U are statutory.

Figure 21 – Location of ERA surface water monitoring points for Swift Creek.
(Figure courtesy of Northern Land Council. JSC – Jabiluka Swift Creek; TC / TN / TS – Tributary Central / North / South; US – Upstream; B – Billabong)

Table 3 – Water quality triggers for Swift Creek, downstream of Jabiluka (JSC)

	Units	Focus	Action	Limit	NWMQS
Electrical Conductivity (EC)	µS / cm	15	18	21	20 – 250 (1)
pH	-	4.61–5.31	4.27–5.65	3.92–6.00	6.0 – 8.0 (2)
Magnesium (Mg)	mg / L	0.37	0.50	0.76	no data
Nitrate (NO_3)	mg / L	0.30	0.63	1.26	0.075 (2)
Sulfate (SO_4)	mg / L	0.60	0.91	1.50	no data
Uranium (U)	µg / L	0.02	0.03	5.8	0.5 (3)

(1) Recommended values for 'slightly disturbed' NT tropical upland and lowland rivers;
(2) Recommended values for 'slightly disturbed' NT tropical wetlands, freshwater lakes and reservoirs, and lowland rivers;
(3) Considered a 'low reliability' toxicity-based guideline.

C *Surface water quality in Swift Creek*

The water quality of surface water in the Swift Creek is of a very high purity, with extremely low uranium (U) (despite the presence of one of the world's largest uranium deposits below ground; le Gras *et al.*, 2002). The various tributaries to and parts of Swift Creek have been monitored since the 1997-98 wet season (the first before the start of construction in June 1998). The water quality data for the Swift Creek catchment is summarised in Table 4, based on OSS, ERA and DBIRD monitoring data. The water quality is dependent on effects such as first flush and the time of year (wet or dry season), however, concentrations in Table 4 are considered representative.

D *Water quality at Jabiluka*

There are two principal sources of water at Jabiluka – groundwater pumped from the decline and surface runoff, which are mixed together in the IWMP. A minor source of contaminated water is the mineralised stockpile. The IWMP water quality is summarised in Table 3 of Appendix 6 and in Figure 22 below. The quality of other waters onsite at Jabiluka are given in Tables 4 to 6 of Appendix 6. Detailed discussion of water quality issues is given in Appendix 6.

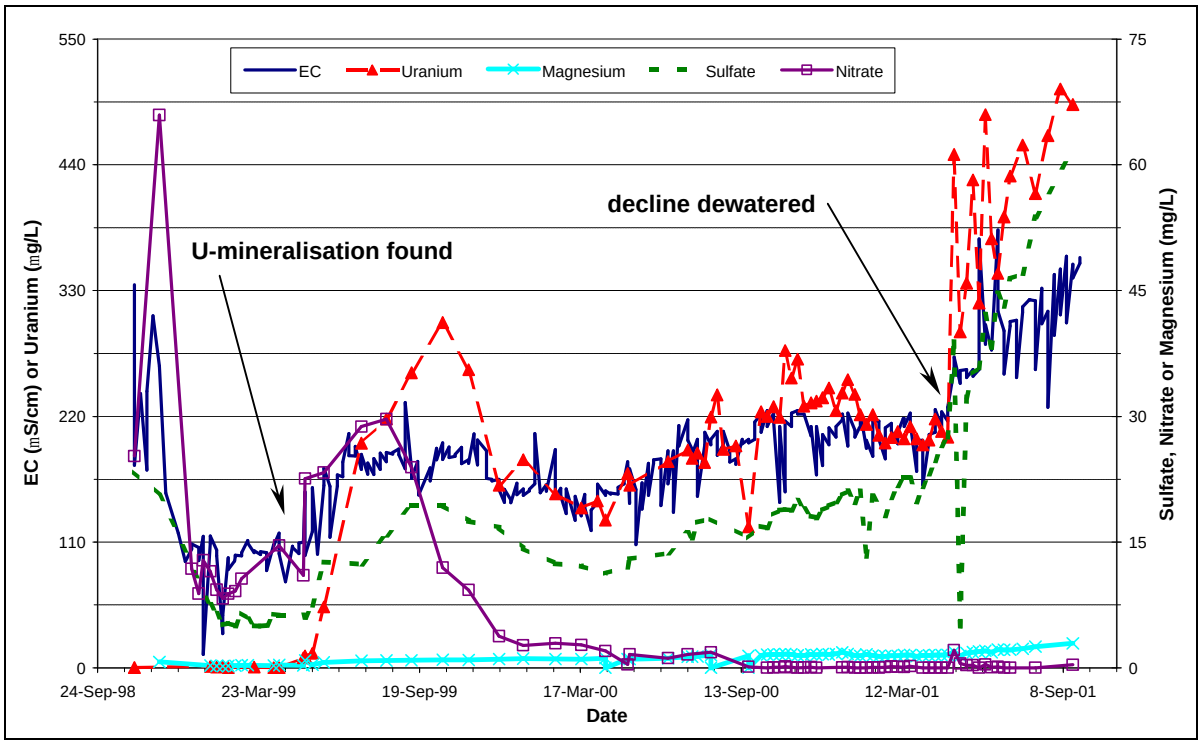


Figure 22 – Water quality in the Interim Water Management Pond (IWMP)

Table 4 – Average water quality of Swift Creek and tributaries (late 1997 to mid 2001)

(EC µS/cm; Turb. NTU; rest mg/L)	pH	EC	Turb.	Na	K	Ca	Mg	NO_3 (1)	SO_4	Cl	PO_4 (2)	TOC
Swift Creek Upstream (JSCUS)	4.82	11.2	1.3			0.16	0.25		0.32	2.3	<0.003	2.7
Swift Creek Upstream West Branch	5.83	11.3	5.9			0.44	0.69		0.16	2.2	<0.009	
Swift Creek Upstream East Branch (3)	4.97	9.9	1.3			0.26	0.20		0.22	2.3	<0.003	
North Tributary Upstream	5.90	8.5	1.0			0.08	0.47		0.10	1.37	<0.005	
North Tributary Downstream (JSCTN)	6.12	19.0	4.3			0.69	0.94		0.27	1.65	<0.002	~0.8
Central Tributary Upstream	6.08	14.7	0.49			0.18	0.98		0.11	2.0	<0.009	0.6
Central Tributary Causeway	6.05	15.6	2.0				0.99		0.08	2.0	<0.006	~0.8
Central Tributary Downstream (JSCTC)	6.08	21.1	3.0			0.36	1.35		0.11	2.1	<0.004	
Swift Creek Downstream (JSC)	5.35	10.9	3.5	1.1	~0.2	0.18	0.36	<0.2	0.24	2.2	<0.004	
Swift Creek (Oenpelli Rd)	5.40	11.2	2.6			0.16	0.36		0.22	2.2	<0.009	

(all µg/L; except ^{226}Ra mBq/L)	Al	Cu	Fe	Mn	Ni	Pb	Zn	U	^{226}Ra (4)
Swift Creek Upstream (JSCUS)		0.17		3.3				0.008	
Swift Creek West Branch		0.16		3.2				0.020	
Swift Creek East Branch #		0.18		2.6				0.007	
North Tributary Upstream	6.8	0.16	39	0.79	0.16	0.06	1.5	0.006	
North Tributary Downstream (JSCTN)	9.8	0.11	24	2.8	0.35	0.05	0.9	0.016	~ <2
Central Tributary Upstream	8.6	0.14	37	1.92	0.42	0.05	1.8	0.011	
Central Tributary Causeway	5.2	0.17	68	3.5	0.28	0.05	4.9	0.008	
Central Tributary Downstream (JSCTC)	5.4	0.09	64	6.2	0.30	0.05	5.3	0.009	~ <2
Swift Creek Downstream (JSC)		0.18		3.6				0.010	~ <2
Swift Creek (Oenpelli Rd)	41.1	0.20	70	3.5	0.15	0.06	3.3	0.011	

(1) Analytical detection limits for nitrate (NO_3) have improved.

(2) Phosphate levels are generally extremely low, indicative only.

Named 'East Tributary' in le Gras *et al.* (2002) (may be South Tributary).

Abbreviations : EC – Electrical Conductivity; Turb. – Turbidity; TOC – Total Organic Carbon.

References : ERA-JAER (1999, 2000, 2001); Jones *et al.* (1998); le Gras *et al.* (2001, 2002); Mudd (2001). [Note : OSS data emailed 1 August 2002.]

The water quality in the IWMP has been affected by the encountering of mineralised ore during decline construction (26 April 1999) and early development (eg. the ore cross cut) as well as the need to store water in the decline during the wet season in early 2001 (the 20 million litres (ML) of uranium contaminated water was pumped out by 19 June 2001). Both these events are clearly distinguishable and marked in Figure 22.

E Water quantity at Jabiluka

The quantity of water held onsite at Jabiluka is derived from seepage pumped from the decline, rainfall and runoff. The IWMP is currently authorised to hold a maximum of 150 ML, to maintain enough capacity to store rainfall from a 1-in-10,000 year storm event. Curiously, the original maximum was some 168 ML, suggesting that the limit has been reassessed and reduced recently. The capacity and quantity of water stored in the IWMP is discussed in some detail in Appendix 6.

For an average wet season (about 1,483 mm at Jabiru airport), rainfall volumes are about 60 ML. The three wet seasons from 1998-99 to 2000-01 were well above average (each around 1,900 ± 50 mm), with the recent 2001-02 wet season being slightly below average (about 1,276 mm).

The second major source of water is seepage into the decline. This is required to be pumped out to maintain the "operational status" of the tunnel and minimise damage. The total is estimated to be about 30 ML per year with a clear increase towards the end of the wet season and a decrease towards the end of the dry season (~0.75-1.5 litres per second). This suggests hydraulic connections between the shallow aquifers and the deeper aquifers in which the decline is constructed.

The well above average rainfall between 1998-99 to 2000-01 and groundwater seepage volumes have necessitated that excess water be disposed of from the (temporary) IWMP in order to maintain the ability to retain a 1-in-10,000 year storm event during the wet season, as per approvals and World Heritage commitments.

From August 2000 to December 2001, 'Reverse Osmosis' (RO) water treatment units were operated at Jabiluka, irrigating treated water onto 3.8 ha of the disturbed site. Due to the failure of the RO units to maintain predicted production (and later quality) targets, in October 2001 small amounts of treated RO water were mixed with contaminated IWMP water and irrigated over an expanded 6.34 ha – most of the disturbed Jabiluka site.

As of the date of this submission, it is understood that direct irrigation of contaminated IWMP water (U at 461 μg/L, May 2002) – with no mixing with RO treated water – is likely to be approved at Jabiluka by the NT Minister for Resources within days and would likely continue until about November 2002.

The Mirrar oppose outright the direct irrigation of contaminated IWMP water.

4C(d) Critique of Water Management

There are numerous issues which have failed to be taken into adequate account in the approvals, design, construction, operation and long-term planning of water management for Jabiluka. This section will raise specific issues of relevance, highlighting that the design of environmental monitoring and / or reporting regimes have failed to meet the legitimate expectations of the Mirrar.

A Long-term water management : need for urgent rehabilitation

As noted, the Jabiluka Project is currently on "environmental care and maintenance" with any decision about its future "push[ed] … into the next decade" [61]. Thus there is an over-arching need to adopt a strategy for the site which achieves the best environmental (and cultural) outcome.

The principal source of contamination of the IWMP is uranium found in the seepage pumped from the decline, where concentrations can range from 200 to 13,626 µg / L. The decline water also constitutes 30 ML a year or about one third of the water entering the IWMP. The estimated annual loads of uranium in decline seepage are about 200 kg (which could lead to uranium concentrations in the IWMP reaching 1,350 µg / L or higher). Thus, the best long-term water management option is clearly to prevent the decline seepage from reaching the IWMP.

The Mirrar contend that the best way to prevent uranium-rich seepage from contaminating the IWMP is to backfill the mineralised ore into the decline and seal it using clay lining, grouting or another technology to ensure low permeability and minimise cross-contamination of groundwater. Thus there would no longer be a need to pump out the decline seepage. It is noted that the current "Emergency Rehabilitation Plan" [62] for Jabiluka adopts this same approach. Another approach which could be used is that of a 'plug' or constructed barrier – a common approach and technique across the mining and construction industries. This may include grouting around the plug to minimise and lower the seepage from the cross-cut and lower decline to within a few percent of its current quantity (the quality should also be improved with lower uranium concentrations).

The Mirrar oppose outright any suggestion of removing the mineralised ore to Ranger and have instructed the Northern Land Council in this regard.

Based on the analysis of water management difficulties in subsequent sections, it is clear that the continued use of irrigation is insufficient and entirely inappropriate. The Mirrar support the use of Reverse Osmosis treatment or another equivalent technology. Other water treatment options currently being considered for "long-term water management" often necessitate a contaminated waste being generated.

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[61] Chairman's Speech to the Annual General Meeting, 15 April 2002, Energy Resources of Australia Ltd.
[62] Updated annually, latest being *Jabiluka Project Plan of Rehabilitation #5*, October 2001.

In considering this, the Governing Committee of Gundjehmi Aboriginal Corporation unanimously passed the following resolution on 23 July 2002 :

> "Traditional Owners resolve to instruct the Northern Land Council that no waste resulting from water treatment be removed from Jabiluka site unless long term care and maintenance involving plugging and back-filling of the decline is actioned."

The clear position of the Mirrar with regard to water management is therefore focused on rehabilitating the Jabiluka site. This involves removing the mineralised ore from the surface and sealing it within the decline. The pond would quickly become less contaminated with a further one or at most two wet seasons and this too could then be rehabilitated.

It would obviously be cheaper for the site to be properly rehabilitated promptly than to constantly struggle to maintain and operate a site which is clearly not going to be considered by ERA and Rio Tinto any further until after 2010. According to the current "Plan of Rehabilitation #5" for Jabiluka, the cost of rehabilitation, as outlined in principle above through backfilling of the decline and removal of the pond, is estimated at only $2.3 million. This money is already available since it is guaranteed through bond / surety arrangements. Given the number of personnel involved at Jabiluka, environmental monitoring requirements and maintenance costs, it should clearly be more economical for ERA to rehabilitate the entire site now.

The Mirrar believe that, in the welcome event of Jabiluka's rehabilitation, a minimum of environmental monitoring would need to be continued at the site to address existing issues and demonstrate that rehabilitation measures are adequate to ensure Kakadu's World Heritage values are protected.

The Mirrar contend that whatever program of action is taken for Jabiluka – rehabilitation or the status quo – environmental monitoring and reporting needs to be rigorous and thorough so that damage done to Mirrar country is the absolute minimum that can be achieved ('ALARA').

B Water quality monitoring – Swift Creek

In general, the water quality data obtained for the Swift Creek catchment is much more extensive and of higher scientific quality than that which was obtained before development of the Ranger uranium mine and mill. However, the Mirrar wish to raise the following concerns :

- ***Statutory Water Quality 'Impact Point'*** – the point of assessment for the impact of the Jabiluka Project on Swift Creek is approximately 1 kilometre (km) to the east of the site. It is not located within the Jabiluka Mineral Lease but within Kakadu National Park. Regardless of the fact that this is due to the engineering design of the site, if the water quality limit is breached at this point, the pollution has already occurred within the World Heritage area.
- ***Water Quality*** – the comprehensive analysis of water quality samples (salts, nutrients, metals including U) is only performed "monthly commencing with first flush" (Authorisation 98/2). For reliable determination of the impact of Jabiluka on water quality in Swift Creek and its tributaries, more frequent analysis is clearly required.
- ***North & Central Tributaries*** – currently there is no statutory monitoring of upstream locations in these water courses (although various historical data sets do exist, as compiled within Table 4). In order to be able to scientifically discern natural variation from the impacts of Jabiluka on water quality, upstream monitoring of North and Central Tributaries is clearly required. According to the Authorisation, only the locations furthest away from the IWMP are required to be sampled (ie. JSCTN/JSCTC, *not* JSCTN2/JSCTC2).
- ***Swift Creek 'West Branch'*** – although poorly documented and stated within statutory and other reports, part of the confusion (or sometimes conflict) in interpreting water quality data downstream from Jabiluka is related to the lack of a monitoring point within the 'West Branch' of Swift Creek (bottom right in Figure 21). This mainly relates to Mg and SO_4, though such confusion should not be allowed to cloud other issues such as the interpretation of U (eg. the response to concerns about water contamination in early 2002).
- ***Radium (^{226}Ra)*** – the analysis of radium, although a critical issue for radiation exposure estimates, is too infrequent – only "quarterly commencing with first flush" (Authorisation 98/2). The tributaries to Swift Creek are not required to be analysed for radium, despite being closer to the potential radium sources of the stockpile and IWMP. For reliable determination of the impact of Jabiluka on radium activities within the Swift Creek catchment, more frequent spatial and temporal analysis is clearly required. It should be noted that ERA had many difficulties in analysing radium internally (see Appendix 9) and it is now done externally.
- ***First Flush*** – the first wet season rains in the wet-dry tropics often have elevated concentrations due to low flow and the wash-out or 'flush' of solutes resulting from oxidation of sediments during the dry season. Thus, in

interpreting environmental and water quality data, elevated concentrations that may be mine-related can be dismissed as 'first flush' and of no significance. This is the case for many incidents at Ranger, including recent events this year critically analysed above. There is a clear need for more frequent sampling at the time of first flush, as well as linking interpretation more closely to detailed flow and hydrologic data. In many cases, this will mean the establishment of automatic samplers, more gauging stations (or electronically configuring existing stations) and keeping staff on call at the first rains within the Jabiluka site and Swift Creek catchment.

- ***Location / Site Maps*** – a map or plan showing the location and names of sampling sites is often missing or at least very poorly presented. For example, le Gras *et al.* (2001, 2002) has no maps (the former having only a table with GPS co-ordinates).

Recommendations

The water quality monitoring program within Swift Creek be enhanced through implementation of the following :

- The statutory monitoring point for the determination of the impact of Jabiluka downstream on Swift Creek be moved within the Jabiluka Mineral Lease.
- Separate trigger levels should be applied for the North and Central Tributaries at the sampling locations closest to the site (ie. JSCTN2, JSCTC2).
- The statutory program for Jabiluka should include upstream monitoring of water quality in the North and Central Tributaries, including radium activities.
- An additional statutory monitoring location should be established within the West Branch of Swift Creek.
- The frequency for statutory water quality monitoring (for parameters currently listed as monthly as per the authorisation) be changed to at least weekly during the first month, followed by at least three samples per month for the remainder of the wet season.
- Analysis of radium should be included with metals.
- A succinct and accurate location plan of sampling sites should always be given with relevant reports, publications or scientific papers.
- Adequate people and financial resources be allocated by ERA to ensure that personnel are available at times of first flush or other necessary and opportune times to obtain water quality or other environmental samples. Detailed electronic and automatic sampling equipment should be implemented across the Swift Creek catchment.

C Trigger levels – Swift Creek

In general, the philosophy of adopting trigger levels based on statistical variation from background water quality is reasonable. However, some specific concerns remain about the use of the trigger system and the values adopted for some specific contaminants :

- ***Uranium*** – the 'Limit' of 5.8 µg/L is some 580 times the well documented background of 0.01 µg/L. If this value is reached at the downstream point in Swift Creek (JSC) – which is within the Kakadu National Park World Heritage area – the increase in uranium loads through the Jabiluka region will be substantial – especially given the extremely low concentrations prior to development. If it is assumed that the entire 5.8 µg/L is derived from discharge from the North Tributary and this is about 1% of flow in Swift Creek, this means that the U concentration in North Tributary would need to reach 580 µg/L – equivalent to the direct discharge of IWMP water and a major failure of the generally accepted mining industry principle of waste containment on-site and 'As Low As Reasonably Achievable' (ALARA). Based on the current system, such performance would appear to be acceptable to regulators. It is unacceptable to the Mirrar that such pollution could or even might occur, regardless of the scientific merits of 5.8 µg/L from an ecotoxicological perspective. The Mirrar strongly object to the type of change – not merely the degree of change.
- ***Nitrate (NO_3) / Ammonium (NH_4)*** – ecosystems in the tropics are generally leached of nutrients such as nitrogen and phosphorous, which is reflected in the very low background concentrations found in the Swift Creek catchment (see Table 4 above and Table 9 of Appendix 6). The blasting of rock for construction works and the decline used ammonium-nitrate (NH_4NO_3), which has been detected at significantly elevated concentrations in the tributaries and at the downstream monitoring point in Swift Creek (JSC) [63] (see ERA-JAER, 1999, 2000, 2001; Mudd, 2001). The major concern is that additional nitrogen inputs into the catchment could cause aglal blooms in surface waters; it is likely that such blooms have already occurred. The initial baseline studies used a chemical detection limit for NO_3 which was too high (0.2 mg/L), with more recent data using 0.02 mg/L. When ammonia leaches into surface waters (or groundwater), it can oxidise (react with oxygen) easily, releasing acidity and converting the nitrogen to the nitrate form. This process led to major impacts on surface water and groundwater quality at Nabarlek from irrigation of evaporation pond waters rich in ammonia (see URG, 1998; Mudd, 1999). Given the poor detection limit and the impacts from blast residues leaching from waste rock, the NO_3 trigger levels are therefore derived from a data set which appears to be biased towards

[63] The NO_3 pollution issue is addressed as an appendix in ERA-JAER (2001), and an internal ERA report (Farrar *et al.*, 1999), however, they merely document the source of NO_3 and assert no impact (ignoring the concerns above). The Farrar *et al.* (1999) report should be made available on the public record in the process of deriving new trigger levels for NO_3 and NH_4.

elevated values. There are also no trigger levels for NH_4. The trigger values, as set, therefore allow an unacceptable degree of nitrate pollution in the Swift Creek catchment related to the leaching of blast residues from the site.

- ***Radium (^{226}Ra)*** – although there are trigger levels for radium at Ranger, there appears to be no statutory requirement for such at Jabiluka. It can only be assumed that the same criteria of a difference of 10 mBq/L between upstream and downstream water quality is considered for Jabiluka.
- ***Load Limits*** – the original water quality criteria for Ranger included not only concentration limits but also load (mass) limits. The current trigger system for Jabiluka includes no load limits. For example, assuming the average background concentration of 0.01 µg/L and the (OSS average) flow volume of 14,327 ML at JSC, this gives a natural uranium load of about 0.143 kg – *EXTREMELY LOW*. Assuming that North Tributary is 1% of the flow at JSC, if the concentration does reach 580 µg/L, the load entering JSC would be some 83 kg – or an increase of 580 times background.
- ***Statistical Analysis*** – as with Ranger, the trigger system applies to a single monitoring point downstream of the Jabiluka site. Although upstream water quality data is collected, it is generally not made explicit use of (radium being an exception). The trigger system would be greatly enhanced if it was to make reference not only to natural variation at the downstream point but also if there was any statistically significant difference between the upstream and downstream monitoring locations (as is done for radium).

Recommendations

The water quality trigger levels be revised to reflect legitimate Mirrar concerns and provide enhanced scientific scrutiny through the following changes :

- The 'Limit' value for uranium should be revised to a concentration much closer to the extremely low background in Swift Creek. A value of 0.05 µg/L is proposed.
- The trigger levels for NO_3 should be re-assessed, including the addition of NH_4 trigger levels, utilising a data set which includes sufficiently low detection limits and the effects of blast residues leaching removed to provide concentrations more closely representative of natural NO_3 and NH_4 in Swift Creek.
- Trigger levels for radium and other contaminants (eg. Al, Mn, P, Re, Zn) should be developed.
- The trigger system should include the loads of contaminants as well as concentrations.
- The trigger system should be enhanced to include statistical analysis of difference between upstream and downstream water quality monitoring locations.

D Water quality – Jabiluka site

According to Mudd (2001), the water quality is reasonably well quantified, with the following issues remaining to be sufficiently addressed and / or reported publicly :

- ***Mineralised stockpile*** [64] – is a source of saline, nitrate-rich seepage but with unexpectedly low uranium (4 to 9 µg / L). The small quantity of seepage (83,500 litres May 2000 to April 2001) is also strongly acidic with pH averaging 3.8. The long-term stability of the tarpaulin cover is of concern [65] and if this fails could result in the release of significant quantities of contaminants into the IWMP. Of further concern is the acidic nature of the seepage to date and whether this is indicative of sulfide oxidation, contamination from which would cause great difficulties for the IWMP).
- ***Decline seepage*** – despite being the dominant source of contaminant loads (ie. Al, Fe, U, Mn), the quality of seepage from various sections of the decline is still not adequately studied and reported publicly (although ERA are beginning to address this issue at present). This relates to the groundwater flow through the Kombolgie sandstone (above the 'unconformity'), and from various parts of the Cahill Formation (fractured rock sequences).
- ***Radium (^{226}Ra)*** – is only analysed quarterly. Curiously, radium activity in the IWMP appears to decrease over time (see Table 3; Appendix 6) – despite the continued input from decline seepage waters (radium is poorly quantified in decline seepage). The degree of uptake by algae or sorption onto sediments needs to be ascertained, especially since radium is a critical part of radiation exposure estimates when rehabilitation works are to be undertaken.
- ***Radon (^{222}Rn)*** – is not analysed at all. Given the significant contribution of seepage from the Jabiluka 2 ore body, it should be expected that radon activities would be significant. It is very common in uranium deposits for radon, due to it being a gas, to be higher than its parent isotope radium (^{226}Ra). Radon gas decays into isotopes which are particulate in nature. The progeny are important in radiation exposures assessments (especially for workers on-site [66]). Although the radon would degas from the IWMP relatively quickly after reaching the surface, the radon source term for the pond is quite likely to be elevated over pre-mining background fluxes of 0.025 Bq / m^2 / s (Auty & Du Preez, 1994). This data should be on the public record and reported in the Annual Environmental Interpretative Report.
- ***Uranium Behaviour in IWMP*** - it is noted in recent documents by ERA that the loads (ie. concentrations) of U and SO_4 have been decreasing in recent times. There is no explanation given by ERA for this behaviour, though it is hard to believe they have not studied the algal blooms in the pond which

[64] Containing 47,000 t of ore grading 0.123% U_3O_8 (including 10,000 t at 0.27% U_3O_8), and averaging 0.12% S.
[65] A "small tear" was noted by Mirrar representatives on a site visit on 16 November 2001, reported by the 19-20 November 2002 mid-term environmental management audit (DBIRD, OSS, NLC) (pp 4).
[66] Radon and progeny activities in air are required to be measured for radiation exposure assessment as per Annex C (Occupational Health Monitoring Program) and Annex D.3 (Radiation and Atmospheric Monitoring), Authorisation 98 / 2. The quarterly and annual radiation reports are not public and should be made available.

also proved troublesome for the smooth operation of the Reverse Osmosis water treatment units. If seepage from the decline continues to be pumped to the IWMP, U loads will gradually increase over time (minus removals such as irrigation or treatment). The only distinction, therefore, is whether the U remains dissolved in solution, sorbs to the bottom sediment (sludge) or is concentrated by algae. Given proper measurements, a mass balance should be performed and the total quantity of U (and other contaminants) be accounted for.

Recommendations

The water quality monitoring program for the Interim Water Management Pond should be enhanced through the following changes :

- A concept of guideline triggers be established for the IWMP to establish potential levels of intervention to manage on-site water quality.
- Analysis of radium and radon should be included with metals, and all tested monthly.
- Detailed studies be undertaken to characterise in sufficient detail the quality of various sources of seepage into the decline to allow more realistic quantification of proposals for long-term water management. This work must be reported publicly and promptly.
- Studies documenting the biological and goechemical (limnological) processes within the IWMP should be undertaken and reported publicly. This should enable an accurate mass balance for contaminants such as U, SO_4, ^{226}Ra and others.

E Water quantity – Jabiluka site

The management of water in the IWMP at Jabiluka is part of Authorisation 98/2 (see Appendix 7), however, the reports pursuant to this are not public. The main public report, the Annual Environmental Interpretative (or Management) Report (pursuant to Annex D.2 of Authorisation 98/2), has historically not contained sufficient information concerning the sources of water entering the IWMP (decline seepage and rainfall runoff) and the quantity of water stored within the IWMP over time, for example :

- *2001 Annual Report* (ERA-JAER, 2001) - only presents brief text mentioning IWMP capacity, changes to catchment area, operating levels and minimum and maximum stored volumes during the reporting period. *NEITHER TABLE NOR GRAPH*.
- *2000 Annual Report* (ERA-JAER, 2000) - only presents brief text mentioning IWMP capacity, changes to catchment area, operating levels and minimum and maximum stored volumes during the reporting period. *NEITHER TABLE NOR GRAPH*.
- *1999 Annual Report* (ERA-JAER, 1999) - only presents brief text mentioning IWMP capacity, changes to catchment area, operating levels and minimum and maximum stored volumes during the reporting period. *NEITHER TABLE NOR GRAPH*.

The main details concerning water management should be covered in the "Annual Water Management Report" pursuant to Annex D.1 of Authorisation 98/2 (see Appendix 7) and due by the end of October each year. A further report is the "Water Management Systems Operation Manual" (pp 13, ERA-JAER, 2001; Schedule 6 of Authorisation 98/2), submitted by the end of November for approval by the NT Minister for Resources (through DBIRD, presumably with some comment from the OSS). These are not public documents.

The integrity of the plastic (high density polyethylene or HDPE) liner is also of concern. The upper sections of the pond which are above the maximum operating level are exposed continuously to the hot tropical sun. There is concern that potential for cracking will lead to failure over time. According to an April 2002 report, the HDPE liner has experienced some 80% antioxidant depletion at the top of the batter and may begin to show signs of embrittlement and cracking if under load within the next 2-3 years [67]. Although no cracks have been identified and formally reported as yet, if the Jabiluka site is to remain undeveloped for the next decade, the integrity of the HDPE liner is clearly a critical issue.

Recommendations

The public reporting of volumes of contained water in the IWMP is very poor and needs to be improved by inclusion of sufficiently detailed tables and graphs within the Annual Environmental Interpretative Report.

The annual reports "Water Management Systems Operation Manual" and "Water Management" should also be made public documents.

F Contaminated water disposal through reverse osmosis and irrigation

In early 2000, towards the end of the 1999-2000 wet season, ERA began looking into ways of disposing of the excess water build-up within the IWMP over only two wet seasons (remembering that the IWMP was a one-year step for the Ranger Mill Alternative). Although ERA preferred land application, at the insistence of the OSS and NLC a trial of Reverse Osmosis (RO) water treatment was initiated. The process for discussing water management issues at Jabiluka were a series of "informal" Minesite Technical Committee (JMTC) meetings (29 March and 19 July 2000). It is disappointing that issues of such gravity were only dealt with at "informal" regulatory meetings.

A detailed chronology of the use of Reverse Osmosis and its eventual failure is given in Appendix 6. Irrigation issues are also addressed in detail in this section.

[67] Information courtesy of the Northern Land Council (Email 29 July 2002).

An RO unit produces a treated water stream of relatively high quality while concentrating the contaminants in a waste stream. The RO trial gave positive results and in August 2000 ERA sought and received approval to begin treatment of contaminated IWMP water by RO, discharging the waste stream back to the IWMP and irrigating the treated water over 3.76 ha of the disturbed area of the Jabiluka site. Although the continued use of RO should see a gradual decrease in IWMP water quality (an increase in salinity and possibly metals) due to the continual recycling of the waste stream back into the IWMP, the effect of the RO units on IWMP water quality appears to have been minimal, especially in comparison to the variation of inputs such as decline seepage. This is demonstrated in the IWMP water quality in Figure 22.

The use of RO technology failed to meet expected performance targets and was plagued by problems such as algae (biological fouling) and chemical compatibility (which required the use of sulfuric acid to dose the water to an acceptable pH). An example of the adhoc nature of ERA's approach was to add in sand filters between the IWMP and RO units to try and prevent these problems (it was only partially effective).

It is understood that the RO units at Jabiluka were not of "Best Practicable Technology" (BPT) standard. That is, the units were clearly not of the highest technical quality - which should have been expected for operating within the socio-environmental context that exists in Kakadu. The units were second hand with spare parts being a constant problem for maintenance and enabling adequate performance of the RO units. These issues have been acknowledged publicly.

Persistent claims that RO will not work in the future at Jabiluka (eg. ERA, DBIRD) are entirely inconsistent with recent water treatment trials at Ranger. A major pilot trial to treat highly contaminated process water was undertaken during 2001, using a mixture of technologies including chemical pre-treatment and RO. The results have been described as excellent and demonstrate that properly funded, designed and operated equipment should easily be able to treat the less saline IWMP water at Jabiluka (which is essentially only heavily contaminated with uranium).

In February 2001, ERA began pumping IWMP water into the decline for temporary storage, since the 2000-01 wet season was again significantly above average (1,954 mm). It can be reasonably expected that had high quality RO units been used this may have been avoidable.

Of major concern is that at the time of IWMP water being pumped into the decline, assurances were given to the Mirrar that this would not lead to deterioration of water quality, mainly uranium concentrations, when the water was pumped back to the IWMP in the 2001 dry season. It is very clear, however, that the IWMP water quality data in Figure 22 shows a significant increase in uranium concentrations in IWMP water - that is, a major decrease in water quality. The quantity of water pumped from the decline between early May and 19 June 2001 was about 20 ML.

Due to the worsening performance of the RO units, in September 2001 ERA applied and promptly received approval for combined irrigation of the small quantity of RO treated water with contaminated IWMP water over an area of 6.34 ha. The load limits were approved by the NT Minister for Resources on 11 October 2001 with neither consultation nor advice from the OSS (as required under the *Working Arrangements*; see above).

Between 16 October and 17 December 2001, ERA irrigated 14,943,000 litres of contaminated IWMP water mixed with 4,325,000 litres of RO treated water. The loads of uranium and sulfate were estimated to be about 8 kg and 996 kg, respectively. This gives an average uranium concentration in the mixed water of about 415 µg/L (currently, 13 May 2002, about 461 µg/L).

The combined RO-IWMP irrigation loads - as authorised by the NT Minister for Resource Development - allowed for 40 kg of uranium to be irrigated within any month and a maximum annual load of 240 kg uranium. The annual uranium load from irrigation at Jabiluka is therefore about 38 kg/ha, compared to the annual average load at Ranger of about 11 kg/ha. An important issue which is not adequately addressed by regulators – including DBIRD and the OSS – is that loads are cumulative [68]. Soils have a finite capacity to retain uranium, based on their site-specific geochemistry.

The soils at Jabiluka have low organic carbon, iron, manganese and clay content which could, all or in part, act to retain uranium in the soil if present in sufficient concentrations. Based on Jabiluka's site-specific soil geochemistry, there is therefore no realistic expectation that uranium can be retained in the long-term, and significant uncertainty remains about the use of irrigation in the short-term.

Representatives of the Mirrar inspected the use of combined IWMP-RO irrigation on 16 November 2001. Concerns were raised at the ability of the sandy soils to retain uranium. OSS and ERA personnel stated that since irrigation was used at Ranger it should work at Jabiluka. The soils at Jabiluka, however, are fundamentally different to those at Ranger and these assurances were inadequate to address the legitimate scientific concerns raised.

Given that the soils at Jabiluka are extremely low in uranium (generally <0.1 to 0.5 mg/kg with an average of 0.2 mg/kg; eg. Kinhill, 1998; Hollingsworth *et al.*, 1998; ERA-JAER, 1999 to 2001), the load from either mixed IWMP-RO water or even direct IWMP water could lead to a 10 to 100-fold increase in uranium concentrations in soil. This would pose a major, long-term risk to water quality downstream of Jabiluka.

The reporting of Swift Creek water quality data in early 2002 and the subsequent analysis of this data is presented in the next sub-section G.

[68] The cumulative uranium load for some *15 years* of irrigation at Ranger is about 169 kg/ha.

For the 2002 dry season, ERA applied in June 2002 for direct irrigation of contaminated IWMP water (since the poorly performing RO units were dismantled and removed in late December 2001). It is understood that this irrigation is continuing as of the date of this submission.

In documents associated with the 2002 irrigation application, it is stated that Jabiluka soils still have the capacity to retain some 16.35 kg of uranium (based on further studies of the 2001-02 wet season irrigation and a report from May 1996 [69]). The IWMP currently has a mass of about 55 kg U (it was up to 71 kg in 2001, the reasons for the changing mass balance are uncertain and need to be ascertained).

The 2002 application states the desire for irrigation of 46 ML of IWMP water, which given the current concentration of about 461 µg/L (13 May 2002), gives about 21 kg U to be irrigated – compared to the supposed remaining capacity of Jabiluka soils to retain 16.35 kg U.

The use of direct irrigation of IWMP water is clearly only a very short-term solution and should not be continue to be used by ERA, nor authorised by the NT regulators nor supported by the OSS.

The OSS has noted, in response to the 2002 irrigation application, that they "will only agree to this extension of irrigation of pond water at Jabiluka in 2002 within the context of an agreed overall long-term strategy for management of water at Jabiluka that will minimise, or exclude entirely, the irrigation of water with significant concentrations of uranium" (pp 10, OSS, 2002 irr). (The meaning of 'significant concentrations' is notably unspecified by OSS).

The OSS also requested, with the agreement of DBIRD, that the area for irrigation over the 2002 dry season should be reduced by 27% to just 4.61 ha. This is an attempt to minimise the repeat of the uranium contamination of North Tributary over the 2001-02 wet season which the OSS argued conclusively was related to the 2001 irrigation works (see OSS, 2002, irr).

The Mirrar continue to support the use of high quality Reverse Osmosis technology, which they believe can treat water from the IWMP based on their knowledge of RO use internationally at uranium mines or decommissioning projects. The Mirrar remain opposed to the use of irrigation, especially direct irrigation of IWMP water. Other equivalent high quality water treatment technology may also be supported by the Mirrar, in the context of moving towards backfilling of the decline as per the 23 July 2002 resolution (see above).

[69] Taylor, G F, Hollingsworth, I D, Hignett, C F & Nefiodovas, A, 1996, *Characterisation of Soils From Potential Disposal Sites for Jabiluka Waste Water Management*. CSIRO prepared for ERA Environmental Services Pty Ltd, May 1996, 28 p. This suggests that ERA was perhaps always planning to use irrigation at Jabiluka.

These issues are of the utmost importance to address in the context of prolonged "environmental care and maintenance", as discussed in sub-section A. Although ERA and its parent company Rio Tinto Ltd have publicly reiterated their commitment to not proceed with further consideration of Jabiluka until the "next decade", there continues to be a distinct lack of a pro-active and truly long-term approach to water management. The piecemeal approvals and adhoc approach adopted by DBIRD, OSS and ERA to date is patently inadequate to deal with the gravity of the water management crisis at Jabiluka.

Recommendations

That Reverse Osmosis water treatment (or another technology) of a high quality be established on the Jabiluka site, with a view to ensuring that there is, under any possible scenario, NO NEED for irrigation of water containing significant uranium concentrations (that is, water >5 µg/L uranium).

G Water quality downstream of Jabiluka : Swift Creek and the effects of irrigation

The retention characteristics of Jabiluka soils, uranium loads in irrigation and the lack of appropriate high quality treatment technology on-site at Jabiluka demonstrate that the concerns for the short and long-term impacts on water quality in the Swift Creek catchment are well-founded. The events of early 2002 have confirmed these concerns, remembering that the following comment was made by a Mirrar representative during media interviews after the site visit to Jabiluka on 16 November 2001 [70] :

> "The concerns of the traditional owners regarding the possibility of contaminants leaving that site when the first flush of the wet season occurs, they weren't allayed by today's visit."

On the morning of 25 February 2002, the NLC informed representatives of the Mirrar of the 'focus' and 'action' levels being exceeded in water quality samples taken at the downstream monitoring point in Swift Creek (JSC) during January and early February. The data, given in Figure 23, showed an increasing ratio of uranium downstream relative to upstream data. Detailed discussions were held with the NLC that night, canvassing issues such as analytical contamination, possible first flush effects and whether the elevated signature was indeed related to the poor performance of the IWMP-RO irrigation. The concentrations were agreed to be low - but were they related to irrigation ? Although there was no definitive answer agreed to by both the NLC and representatives for the Mirrar, it was clear that concerns for the impacts of irrigation were serious and should not be downplayed by ERA, OSS or DBIRD.

[70] Australian Broadcasting Corporation, News, 8:05 pm (ACDT), 16 Nov. 2001, "*Concerns Over Run-Off at Jabiluka Mine*". Website – www.abc.net.au/news/

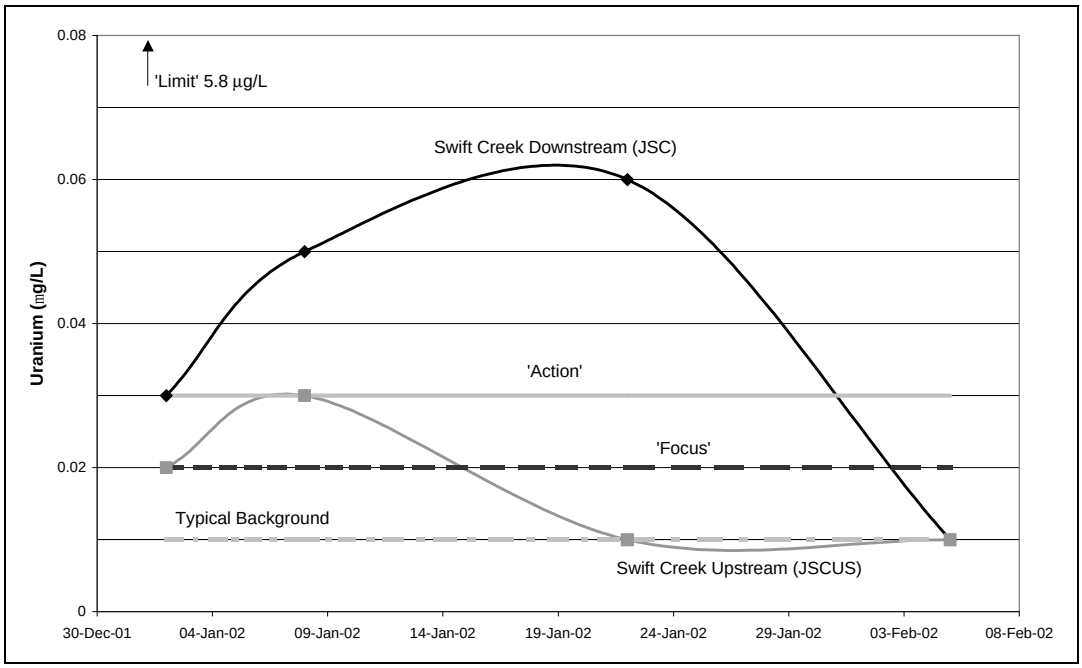

Figure 23 – Original Swift Creek uranium data as presented to Gundjehmi Aboriginal Corporation, 25 February 2002

The water quality data also showed elevated Mg and NO_3. The failures by ERA with respect to the reporting of this data, as per the protocols for the trigger level system, include :

- 2 Jan. 2002 – 'action' level reached for U and Mg and 'focus' reached for EC and SO_4 at downstream point JSC : Stakeholders should have been informed immediately with additional sampling initiated (noting that the first rains were 31 December 2001 – ERA failed to adequately capture the first flush by some 2 days). ERA claims, however, that these were 'first flush' samples, that upstream data indicated that the Jabiluka site was not the source and no additional sampling was required but conceded that stakeholders should have been notified (data received 7 January 2002);
- 8 Jan. 2002 – 'limit' guideline value exceeded for Mg, 'action' level significantly exceeded for EC and U and 'focus' reached for NO_3 at downstream point JSC : Stakeholders should have been informed immediately with additional sampling initiated (it is acknowledged that Swift Creek was not flowing 3-7 January) (data received 17 January 2002). ERA claims that upstream data indicates for EC that the Jabiluka site is not the source, though for U the trend was unclear but should have been reported. The elevated NO_3 is attributed to the Jabiluka site;
- 22 Jan. 2002 – 'action' level remains significantly exceeded for U and 'focus' reached for SO_4 at downstream point JSC, especially relative to upstream (JSCUS) : Stakeholders should have been informed immediately with additional sampling (data received 25 January 2002). ERA acknowledges that the U data should have been reported and additional sampling undertaken (which was not done) and stated that upstream data indicates that the Jabiluka site was not the source of SO_4;
- 5 Feb. 2002 – all parameters below 'focus' (data received 13 February 2002).

As highlighted previously, the main concern for the Mirrar about the trigger levels as applied to Jabiluka relate to uranium – especially the 'limit' of 5.8 µg/L – and NO_3 (and potential algal blooms and impacts on aquatic ecosystems).

The OSS recently summarised its monitoring data for water quality in Swift Creek in le Gras *et al.* (2002). The graphs and tables presented therein are important in assessing the January-February 2002 data.

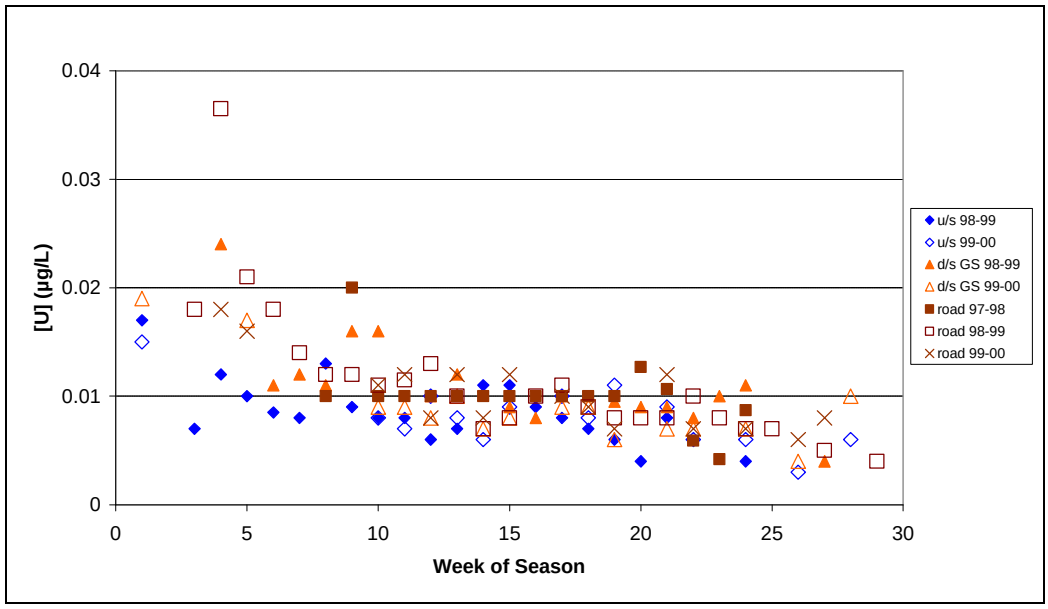

Figure 24 – Spatial and temporal variation of U in Swift Creek (le Gras *et al.*, 2002 [71])

The monitoring data for Swift Creek, as summarised in Table 4 with OSS data in Figure 24, generally shows a 'first flush'. The long-term average for the wet season, however, is clearly about 0.01 µg/L. The OSS data was already available as le Gras et al. (2001) and thus the data of January-February 2002 should have been able to be interpreted with prompt reference and comparison between ERA and OSS data [72]. Such a comparison reveals that the values of 0.05 µg/L and especially 0.06 µg/L (relative to the 0.01 µg/L upstream) are higher than previous data sets. This should have highlighted concerns about irrigation and prompted more thorough scientific investigation of all water quality data (ERA, OSS and DBIRD) as well as assessing the uranium apparently still retained on the irrigated soils.

At the time of the data being presented to Mirrar representatives on 25 February 2002, the Alligator Rivers Region Technical Committee (ARRTC) was meeting in Jabiru and considering water management issues at Jabiluka. The monitoring data for Swift Creek – and the possible interpretation relating to the effects of irrigation – was not raised within the ARRTC meeting by ERA, OSS or DBIRD, despite representatives of these organisations being aware of the data and its significance.

[71] Electronic copy courtesy of OSS (Emailed 30 July 2002).
[72] DBIRD is reported through NTSA (various), however, the source of the data presented in tables or graphs is often not distinguished between ERA and DBIRD.

By the end of the meeting (27 February 2002), ARRTC had discussed water management issues for Jabiluka and passed the following resolution [73] :

> "Information provided during discussion augmented the briefing material to demonstrate to ARRTC that the decisions were based on a substantial knowledge (science) base.
>
> The Water Management System implemented at Jabiluka for the 2001/02 Wet season is protecting the aquatic ecosystems downstream of Jabiluka."

Given that ARRTC had failed to independently fulfill its expectations with respect to science issues, action was taken through the media in early March 2002 to highlight the issues, which are seen as being of fundamental importance. The lack of reporting and the possible impact of irrigation were the principal concerns.

The OSS does acknowledge, however, that if prompt scientific investigation had been undertaken upon the immediate receipt of the elevated uranium data, "unnecessary public concern would have been avoided" (pp 12, OSS, 2002b). It is disappointing to the Mirrar that such investigation has to prompted by media attention rather than reasonable requests and scientific understanding of the issues.

At the Jabiluka Minesite Technical Committee meeting of 12 March 2002 [74], the water quality monitoring data was discussed in some detail, including the re-analysis of the 0.06 µg/L sample from 22 January (JSC). The new value for this particular sample was now just 0.014 µg/L (other samples were apparently not re-analysed). The OSS data concurred with this new value, and it was agreed that the various (downstream or JSC) data sets (ERA and OSS) showed no variation from previous years and therefore no impact (eg. JMTC minutes, 12 March 2002).

An important issue, however, was raised by the OSS in the JMTC meeting. The Northern and Central Tributaries had elevated uranium concentrations, including one (unnamed) tributary reaching 0.25 µg/L. The OSS questioned whether this was related to irrigation, which ERA simply dismissed by stating that "previous years have ranged to similar levels" (pp 3, JMTC Minutes).

The OSS released a report on the Jabiluka water quality issue (together with the analysis of the incorrect stockpiling of low grade uranium ore at Ranger) on 26 April 2002 (OSS, 2002 RJ rpt). The concern was presented almost entirely as a reporting issue – contamination was downplayed and the mantra of "no impact on Kakadu" maintained. This ignored many Mirrar concerns.

The elevated uranium concentrations in the Northern and Central Tributaries was completely ignored by the OSS in its report on the issue (pp 11-13, OSS, 2002b).

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[73] pp 9, Summary Record, 25-27 February 2002, Alligator Rivers Region Technical Committee, Jabiru, NT. 'Draft' only (1 August 2002). (see www.ea.gov.au/ssd/communication/committees/arrtc/)
[74] Minutes, Jabiluka Minesite Technical Committee, 12 March 2002, 3 p.

At the Senate ECITA Committee Estimates hearings on 30 May 2002 [75], the issue of water quality contamination at Jabiluka was discussed at some length. In response to questions about enforcing the reporting requirements for Jabiluka, which are based on the understanding that Ranger's ERs also apply despite the different ER's for Jabiluka under the 1982 Agreement and mineral lease, the Supervising Scientist, Dr Arthur Johnston, stated (pp 362-363, ECITA, 2002) :

> **Dr Johnston** - ... The environmental requirements at Jabiluka have not been revised since they were established in 1982 and we would like to see that happen. There are, however, complications in doing so. We have requested - and the Northern Territory government, the mining company, the NLC and ourselves all agree - that in principle we will be working at Jabiluka as if those same environmental requirements that apply at Ranger also apply at Jabiluka. It is not a legal requirement, but that is the practice that we are attempting to achieve.
>
> **Senator CROSSIN** - Yes, it is that very loophole, is it not, that it is not a legal requirement at Jabiluka that allows you to excuse the company in this report. Is that correct, Dr Johnston ?
>
> **Dr Johnston** - Legally, strictly speaking, yes; and we are trying. In response to a report, the minister has requested that we attempt to change the arrangements so that the same requirements that apply at Ranger will be requirements at Jabiluka. We have discussed that issue with the Northern Territory. We believe we have a way of doing it without actually altering the original environmental requirements.
>
> **Senator CROSSIN** - Why was that not a recommendation of this report ?
>
> **Dr Johnston** - I did not think of it. It is as simple as that.
>
> [... edited ...]
>
> **Senator CROSSIN** - ... Did you never recommend through the mine site technical committee that the environmental requirements for Jabiluka should be revised to include those action levels for reporting ?
>
> **Dr Johnston** - That issue has been the subject of discussion for many years. The environmental requirements at Jabiluka, unlike those at Ranger, are attached to the mineral lease approval issued by the Northern Territory while at Ranger they are attached to the authority under the Commonwealth Atomic Energy Act. There is a very distinct difference in the way in which they apply. I am no expert in this region, but the legal advice is that it would be best at the moment not to attempt to revise the conditions of the lease. So we are trying to find an alternative way which achieves the same outcome without changing the conditions of the lease.

Despite an apparently 'exhaustive' environmental impact assessment process, critical monitoring and reporting procedures are not legally enforceable upon ERA at Jabiluka – a situation most unacceptable to the Mirrar.

Recommendation

The OSS, DBIRD and ERA adopt an approach to ensure that the expected monitoring and reporting requirements, can be enforced legally to the satisfaction of the Mirrar and broader public.

[75] Proof Committee Hansard, Senate Environment, Communications, Information Technology & Arts, Consideration of Supplementary Estimates, 30 May 2002.

The tributary contamination issue remained unresolved (despite attempts by Gundjehmi to access the water quality databases of ERA and OSS [76] after noting the JMTC discussion), until the June 2002 application for irrigation by ERA. A response to this application was prepared (OSS, 2002 irr) which examined the complete OSS and ERA water quality data sets for Swift Creek, *including the tributaries.*

The mean or average uranium concentration downstream (JSC) and the tributaries (JSCTN, JSCTC) is calculated and presented graphically, presented as time series data from 1997-98 to 2001-02. The various graphs are given below in Figures 25 to 27.

Although there has been quite vigorous debate over interpretation of the data sets between the OSS and ERA, it is clear that the OSS data is of higher integrity and quality compared to that of ERA. The OSS state (pp 6, OSS, 2002 irr) :

> "There can be little doubt, however, that the increase in uranium concentrations in North Tributary in 2001–02 is attributable to irrigation at the Jabiluka site during the 2001 dry season."

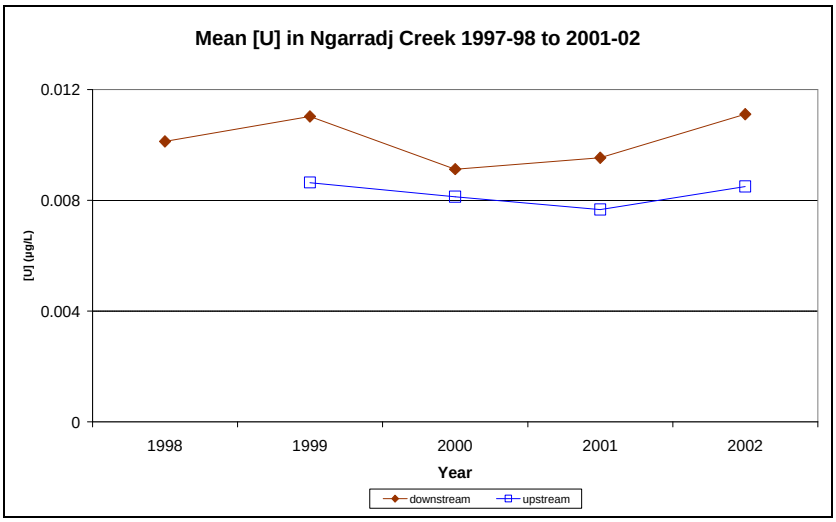
For the Central Tributary, the increase is notable but not as sharp as that for the North Tributary, which the OSS hinted may indicate "another source of uranium" (pp 6). This could only mean the 'non-mineralised' waste rock dump, which although <0.02% U_3O_8 could contain 0.001-0.015% U_3O_8 (OSS does not state this).

It was noted above that the tributaries are a small fraction of the total flow in Swift Creek (eg. North is about 1%). The OSS repeats its 'mantra' that there has been "no impact" downstream, based on the JSC data in Figure 25. However, this completely ignores the growing impacts on the tributaries and the fact that irrigation is clearly contributing to increasing loads into Swift Creek.

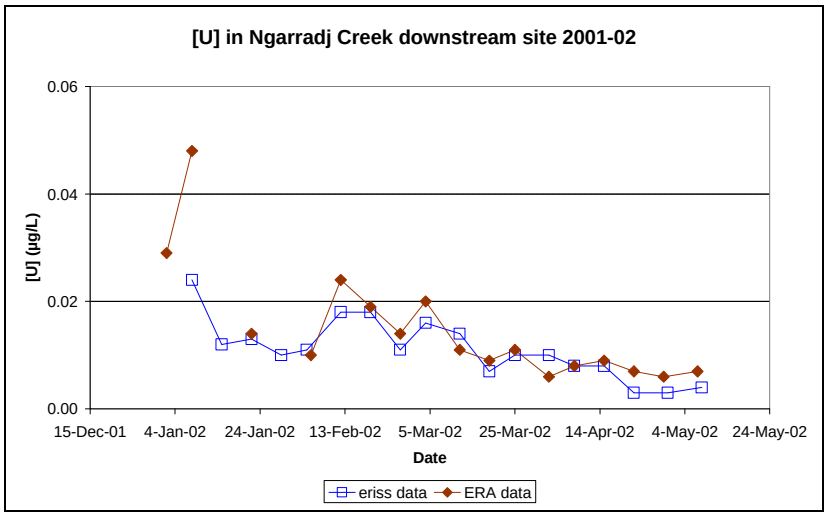
The response from the OSS is to merely reduce the area of irrigation for 2002 by some 27% (1.73 ha) to minimise the possibility that uranium can reach the North Tributary – not to question the appropriateness of irrigation entirely. The OSS also completely ignores the high cumulative loadings of uranium on soils at Jabiluka, especially given its low retention capacity based on soil geochemical considerations. For the re-engineering of Retention Pond 1 at Ranger it took some 4 wet seasons for action by ERA to be demanded by the OSS. It is hoped that the lessons from the 2001-02 wet season at Jabiluka is forcing the OSS to move to a more independent culture.

It is most disappointing that, in initial consideration of Swift Creek uranium data during March 2002, the OSS noted the elevated concentrations in the tributaries at the JMTC only to ignore this in its April 2002 report. However, in early July 2002 (after this inquiry was referred to committee) the OSS highlighted the impacts due to irrigation on the tributaries.

[76] The OSS supplied all of their Swift Creek water quality data by email on 1 August 2002.

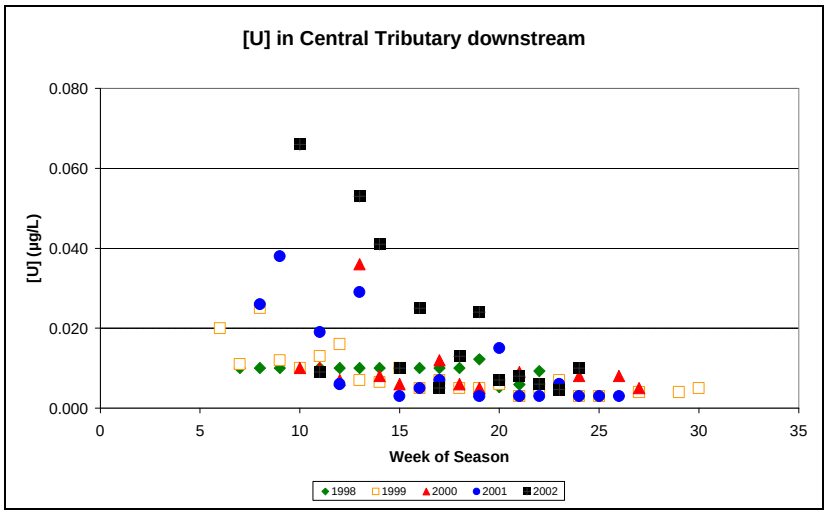


Mean OSS downstream U data (JSC) 1998-2002



OSS and ERA downstream U data (JSC) 2001-02

[Note – ERA data appears different to that presented earlier.]



U data Central Tributary (JSCTC) 1998-2002

Figure 25 – Spatial and temporal variation of uranium concentrations in Central Tributary and downstream in Swift Creek (OSS, 2002d; see also le Gras *et al.*, 2002)

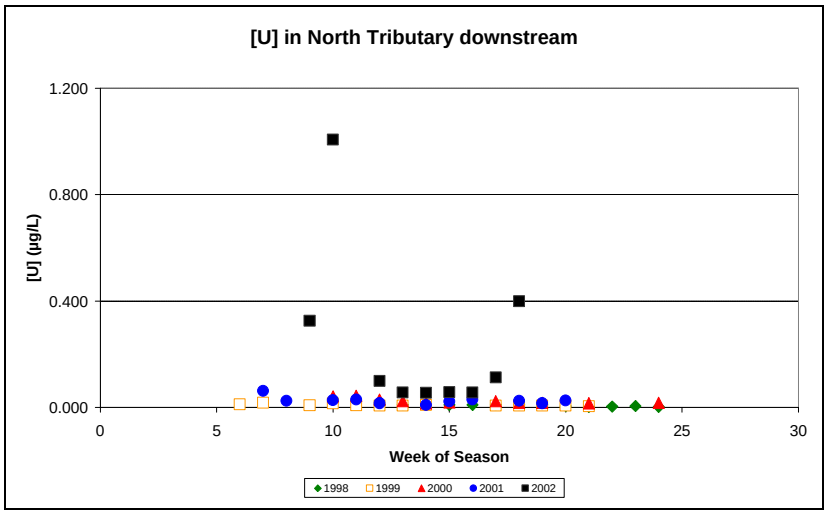


Figure 26 – Spatial and temporal variation of uranium concentrations in Northern Tributary 1998-2002 (OSS, 2002d; see also le Gras *et al.*, 2002)

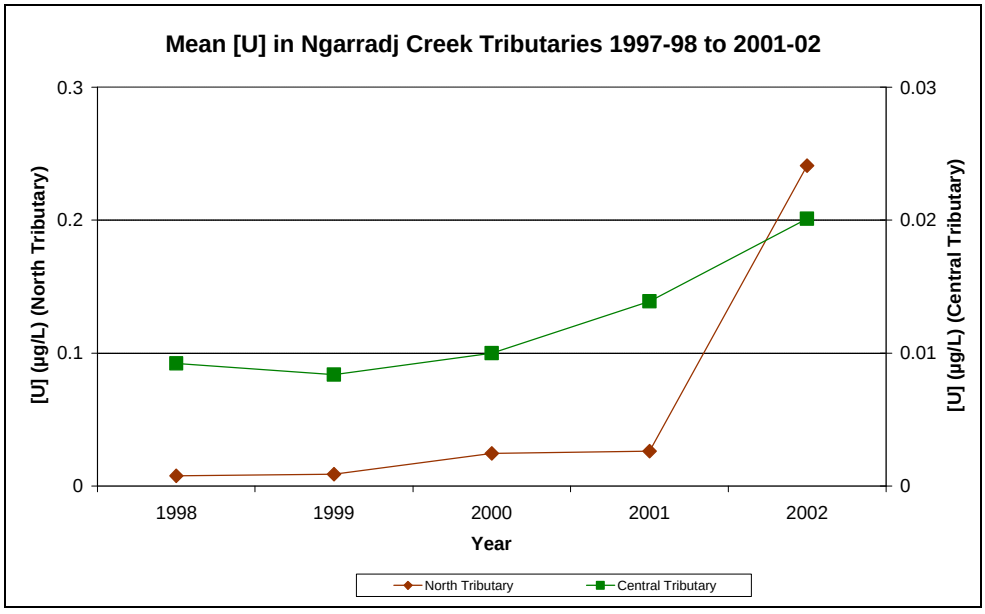


Figure 27 – Mean annual uranium concentrations in Central and Northern Tributaries over the 1997-98 to 2001-02 wet seasons (OSS, 2002d)

The Mirrar wish to see all of their traditional lands protected, including both the mineral lease at Jabiluka as well as Kakadu National Park. By blindly repeating its mantra of "no impact on Kakadu", the OSS (and DBIRD [77]) fails to understand that Mirrar seek to protect their interests in minimising damage to the mineral lease. Thus, the many legitimate concerns of the Mirrar remain heightened and recent events have increased their demands for urgent rehabilitation works to prevent the situation from degrading further.

[77] DBIRD also use the standard response of "no impact on Kakadu".

Recommendations

In order to prevent increasing uranium (and other) contamination of the tributaries and hence Swift Creek and Kakadu National Park, direct irrigation of IWMP water be suspended immediately and a high quality RO or equivalent technology be re-established on the Jabiluka site.

Detailed investigation of the soils at Jabiluka needs to be undertaken, assessing issues such as retention capacity (ie. cation exchange capacity, adsorption, complexing, etc.) and the rates at which uranium might leach from existing irrigation impacted areas.

The uranium grade of the non-mineralised stockpile must also be reported and this investigated as a future source of continuing uranium into the Central Tributary (which could happen regardless of whether irrigation is continued). All irrigation of this site must cease.

The OSS, DBIRD and ERA need to pro-actively move towards backfilling the decline with the mineralised ore and undertake proper rehabilitation of the Jabiluka site. The plugging of the decline could be an important first step in this direction.

4C(e) Critique of Groundwater Management

As discussed previously, groundwater seepage into the decline is the source of uranium contamination of the IWMP at Jabiluka. To date, there has not been a single report which presents a proper geological or hydrogeological cross-section of the decline as constructed and an interpretation of the geology along its length (see ERA-JAER, 1999 to 2001). Although generic cross-sections are available in documents such as the Draft EIS (Kinhill, 1996) and PER (Kinhill, 1998), these do not extend to the east where the current site infrastructure has been constructed.

It is disappointing that such important information, especially in the light of rehabilitation designs for backfilling the mineralised ore into the decline, is not being reported by ERA nor demanded by the OSS and DBIRD.

It has been noted above that seepage flow rates into the decline change according to the stage of the wet or dry season. This suggests a degree of hydraulic connectivity between the shallow and deeper aquifer systems. The information presented publicly to try and quantify the source of this variation has been poor and, in reality, mostly non-existent.

For the reports submitted as part of the World Heritage assessment for Jabiluka, important issues such as fractures and other preferrential (rapid) groundwater pathways were assumed to be insignificant in the numerical modelling (eg. Kalf & Dudgeon, 1999).

These models were therefore based on unrealistic properties and used almost entirely assumed data – very little actually field measured or determined properties having been reliably established for the Jabiluka site. This issue was raised at the February 2002 ARRTC meeting though downplayed by ERA and the OSS agreeing with ERA.

The lack of proper hydrogeological studies during construction and operations to date highlight the failure of the approvals process and the lack of rigour applied by agencies such as DBIRD and the OSS to groundwater issues.

The Mirrar remain firmly opposed to drilling or any other development works in Mine Valley.

Representatives of Gundjehmi Aboriginal Corporation also recently received information about Mine Valley Billabong. It was suggested that the chemistry of this billabong would be a good place to monitor. According to Figure 6.1.3 of the Draft EIS (Kinhill, 1996), there is a gauging station at this site and some historical data does exist for this site (mainly water quality research in billabongs).

Given the potential for groundwater impacts from the decline, which acts as a local sink for groundwater, it may be that Mine Valley Billabong is being affected by the seepage into the decline.

It is understood that no work has ever taken place in this area in recent years, and it is of the utmost concern that if the OSS, DBIRD or ERA have any monitoring data at all, that it be placed on the public record.

SECTION 4D: SUMMARY OF KEY ENVIRONMENTAL MANAGEMENT ISSUES

The mining and milling of uranium creates unique environmental challenges, especially when conducted on Aboriginal land surrounded by a World Heritage national park. The environmental monitoring and reporting must therefore be of the most professional and rigorous scientific standard achievable. This submission has identified a number of key areas where the current systems for Ranger and Jabiluka do not meet legitimate stakeholder and community expectations.

In summary, the Mirrar wish to see the following enhancements of the arrangements for environmental monitoring and reporting :

1) MORE FREQUENT SAMPLING

- Greater frequency of sampling ensures that trends of contaminated water are not missed and early warning is given. More statistically meaningful interpretations can also be presented.

2) MORE COMPREHENSIVE ANALYSIS

- In order to ensure that operations comply with the spirit of the Authorisations and Environmental Requirements and that the impacts on the Ranger and Jabiluka sites are minimised, more comprehensive chemical and radiological analysis of water samples is required. For example, radium is often only analysed quarterly in waters which are receiving drainage or seepage from uranium-rich sources. Nutrients are also important, as are other metals.

3) EVENT-BASED MONITORING

- The use of automated sampling equipment would allow the use of event-based monitoring. That is, the rapid collection of samples in response to significant rainfall events or the need to source a leak / problem. ERA installed and used an event-based sampler between March to April 2002 to check for possible continuing impacts from the southern stockpile region. Thus ERA should be able to establish a broad-based and thorough event-based monitoring system at key locations such as 009, Gulungul, Coonjimba and Corridor Creeks at Ranger, as well as in the North and Central Tributaries and Swift Creek at Jabiluka (JSC & JSCUS). There has been a long history of event-based monitoring in the USA (see Wagner *et al.*, 2000). Given that ERA has in situ pH and EC probes at many locations it is reasonable to expect that a more rigorous field system could be established.

4) IMPROVED TRIGGER LIMITS

- The trigger system of water quality needs to be more thorough and incorporate a wider range of potential minesite contaminants or stressors, such as nutrients, radium and other metals.

- The current uranium concentration limit of 5.8 µg/L is simply too high over the average background concentrations in the waters of Magela and Swift Creeks. Proposed limits for Ranger and Jabiluka are 0.5 and 0.05 µg/L respectively.
- The re-introduction of maximum loads for water quality compliance should also be adopted and they should be assessed based on background loads through aquatic ecosystems. Guideline loads should be established for individual sub-catchments of a mine site.

5) SEVERAL SITES FOR TRIGGER LIMITS

- The current statutory system for the determination of surface water impacts from Ranger and Jabiluka is based on one monitoring point downstream of each site. In order to minimise impacts on existing site areas, as required by the Authorisations and Environmental Requirements, a series of trigger levels should be established for key locations around the site. For example, at Jabiluka a trigger system should be established within the mineral lease area and along North Tributary, as well as in Central Tributary; while at Ranger separate trigger levels should be developed for Coonjimba Creek (i.e. RP1), Gulungul Creek, Corridor Creek and at 009 in Magela Creek.

6) STATUTORY : LEGAL FORCE

- The current statutory system for Ranger and Jabiluka allows too much interpretation and advice. Critical issues such as upstream sites, statistical analysis and legal compliance should be unambiguously codified and enforceable without regard to opinions or advice. This could be achieved through the legislative overhaul proposed in this submission.

7) TRANSPARENCY & ACCOUNTABILITY

- As a matter of principle, all documents concerning the results, analysis or interpretation of environmental monitoring data should be made publicly available. All documents or reports required under the Environmental Requirements and Authorisations should be released publicly for all stakeholders and the general public.
- All ERA, OSS and DBIRD reports concerning environmental monitoring and research should be made available, as a matter of course, via the internet for public access and use.

8) MORE RIGOROUS RESEARCH ON SPECIFIC ISSUES

- There are many issues which are critical to ensuring that the short and long-term environmental impacts on the Ranger and Jabiluka site areas are the lowest technically achievable, including tailings management, groundwater contamination and protection, contaminant behaviour in irrigated soils and wetlands, radon fluxes, stockpile leaching and the like. It is crucial that these issues are researched in detail both in the field and the laboratory.

SECTION 5: PROPOSED REFORM OF THE REGULATORY ARRANGEMENTS AT JABILUKA AND RANGER

As demonstrated in previous chapters the regime for regulation of uranium mining at Ranger and Jabiluka is overly complex, confusing, inconsistent and incomplete. Moreover, it does not provide for Traditional Owners to effectively participate in management of Aboriginal land subject to mining interests via *Land Rights Act* agreements.

The Gundjehmi Aboriginal Corporation contends that such an ad hoc system of regulation would be deemed unacceptable in most other areas of public administration.

The Gundjehmi Aboriginal Corporation can see little long-term benefit in proposing recommendations that attempt to 'fix' the current 'system'. For example, it is highly questionable whether the long overdue implementation of the various Agreements between the Commonwealth and Northern Territory would bring any benefit given that, as discussed previously in this submission, such instruments (and sub-instruments they purport to create) are wholly inappropriate for the proper regulation of uranium mining on Aboriginal Land.

Instead the Gundjehmi Aboriginal Corporation proposes that the Commonwealth Parliament urgently develop and implement an Act to reform the regulation of uranium mining in the Alligator Rivers Region of the Northern Territory.

The new legislation would:

1. **Set out the responsibilities of the Commonwealth in relation to uranium mining in the Alligator Rivers Region, including:**

    - Affirming that prescribed substances in the Northern Territory are the property of the Commonwealth

    - Stating that the Commonwealth has final accountability for uranium mining in the Northern Territory

    - Affirming that the Commonwealth has a responsibility to monitor the environmental impact of uranium mining in the Alligator Rivers Region through the Office of the Supervising Scientist and the Environmental Research Institute of the Supervising Scientist.

    - Affirming that proposals for uranium mining in the Alligator Rivers Region are actions having significant impact for the

purposes of the *Environment Protection and Biodiversity Conservation Act 1999 (Cth)*

- Acknowledging that the Commonwealth leases Aboriginal Land within Kakadu National Park, jointly administers Kakadu National Park in conjunction with Aboriginal landowners and has international responsibilities in relation to the Kakadu World Heritage Area.

- Acknowledging that the export of uranium requires approval from the Commonwealth Minister under the *Customs (Prohibited Exports) Act 1901* (Cth)

- Acknowledging that the Commonwealth administers the *Aboriginal Land Rights (Northern Territory) Act 1976* (Cth) and that mining in the Alligator Rivers region currently takes place on Aboriginal Land

2. Set out the responsibilities of the Northern Territory in relation to uranium mining in the Alligator Rivers Region, including:

- The Northern Territory is responsible for granting mineral leases for uranium mining under the *Mining Act 1982* (NT)

- The Northern Territory is responsible for authorising and regulating uranium mining actions under the *Mining Management Act 2001 (NT)*

- The Northern Territory Minister responsible for the *Mining Act 1982* (NT) and the *Mining Management Act 2001 (NT)* has executive authority under section 35 of the *Northern Territory (Self Government) Act 1978* (Cth) for matters relating to uranium mining arising under these Northern Territory Act, subject to the proposed new Commonwealth Act.

- The Northern Territory has primary responsibility for good governance in the Alligator Rivers Region subject to the provisions of the *Northern Territory (Self Government) Act 1978* (Cth)

- The Northern Territory is responsible for protecting sacred sites under the *Northern Territory Aboriginal Sacred Sites Act 1989* (NT)

3. **Set out the Joint Responsibilities of the Commonwealth and Northern Territory in relation to uranium mining in the Northern Territory including:**

   - The Commonwealth and the Northern Territory are jointly responsible for protecting the environment of the Alligator Rivers Region from the impacts of uranium mining.

   - The Commonwealth and the Northern Territory are jointly responsible, to the greatest extent practicable, for minimising the negative impacts of uranium mining activities on the Aboriginal traditional owners of land subject to Authorisations under the new Act.

4. **Set out the responsibilities of the Supervising Scientist and the Environmental Research Institute of the Supervising Scientist, including the co-operative relationship with the Northern Territory Supervising Authority.**

5. **Set out the functions of ARRAC, ARRTC and the Minesite Technical Committees OR create a single entity with the consolidated functions of these committees.**

The matters set out in 1-5 would allow the **repeal** and / **or replacement** of:

- the *Agreement between the Commonwealth of Australia and the Northern Territory of Australia in relation to principles to be applied in the regulation of Uranium Mining in the Northern Territory of Australia* (dated 17 November 2000) ["the MOU"]
- the *Revised Working Arrangements for Co-ordinating the Regulation of Environmental Aspects of Uranium Mining in the Alligator Rivers Region* (September 1995) ["the Working Arrangements"]
- Part III of the *Atomic Energy Act 1953* (Cth)
- *Environment Protection (Alligator Rivers Region) Act 1978* (Cth)

6. Reform the system of Authorisation for uranium mining in the Alligator Rivers Region

- The mining of prescribed substances on in the Alligator Rivers Region would only be permitted in accordance with the new Act.
- The Commonwealth Minister would have the power to grant, grant with conditions, or refuse to grant authorisations for the mining of prescribed substances, subject to the provisions of the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) and the *Aboriginal Land Rights (Northern Territory) Act 1976* (Cth)
- In exercising powers under the new Act, the Commonwealth Minister would seek the advice of the Minister responsible for the EPBC, the Minister responsible for the ALRA, and the Territory Minister responsible for mining of prescribed substances.
- In exercising powers under the new Act the Minister would have primary regard to:
  i) the protection of the environment
  ii) the minimisation of negative impacts on the Aboriginal traditional owners of land subject to the mining interest or proposed mining interest

Ranger and Jabiluka

- On and after the commencement date of the new Act, an Authorisation set out in a Schedule to the Act would have the same effect as if it had been granted under the Act.
- The Authorisation for mining of prescribed substances on the Ranger Project Area would be set out in Schedule One of the new Act (similar to s.41 Authority and Ranger Environmental Requirements)
- The Authorisation for mining of prescribed substances on the Jabiluka Project Area would be set out in Schedule Two of the new Act.
- Nothing in the new Act would affect the validity of an Authority granted under s.41 of the *Atomic Energy Act* 1953 (Cth) or a Mineral Lease granted under the *Mining Act 1982* (NT) to the extent that such an Authority or Mineral Lease is consistent with an Authorisation under the new Act.

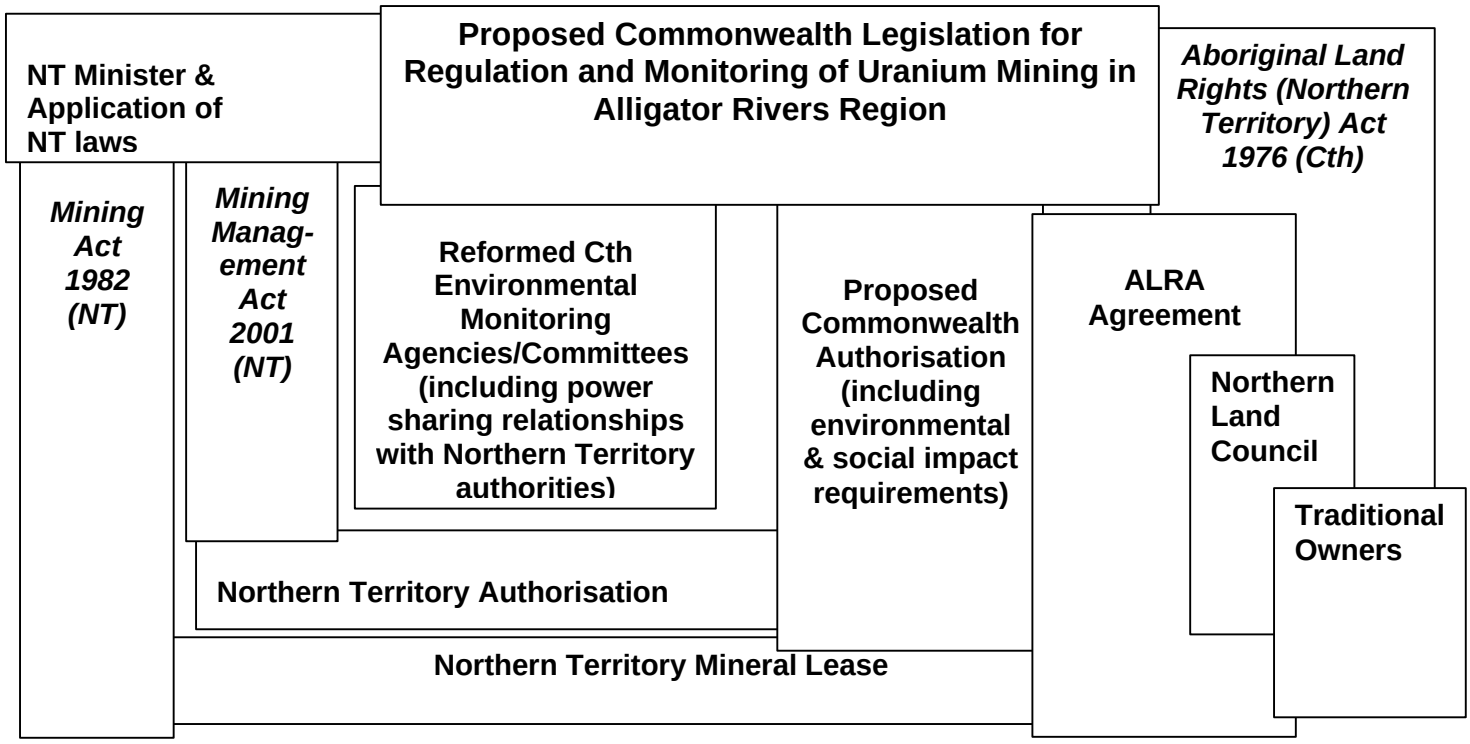
7. Establish the relationship of Northern Territory laws in relation to Commonwealth authorisations

- Nothing in the new act is intended to exclude or limit the operation of any provision of a law of the Territory that is capable of operating concurrently with the new Act.
- To this end, mineral leases for prescribed substances granted under the *Mining Act 1982* (NT) and authorisations for actions involving uranium or thorium under the *Mining Management Act 2001* (NT) will have full effect, but should be consistent with, by incorporating or adopting by reference, any Authorisation currently in effect under the new Act.

8. Ensure Commonwealth Authorisations comply with a prescribed agreement under the *Aboriginal Land Rights (Northern Territory) Act 1976 (Cth)*

- Notwithstanding anything contained elsewhere in the new Act, an Authorisation shall comply with such other conditions and restrictions as may be determined pursuant to a "prescribed agreement" [an Agreement for mining of prescribed substances under the *Aboriginal Land Rights (Northern Territory) Act 1976* (Cth), including the s.44 Ranger Agreement and the s.43 Jabiluka Agreement].
- In the event of any inconsistency with other conditions or restrictions contained in an Authorisation under the new Act, those determined as referred to in the relevant prescribed agreement shall prevail.

Proposed reform of regulatory arrangements for uranium mining in the Alligator Rivers Region



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