

**Investigation of
tailings water leak
at the Ranger
uranium mine**



Supervising Scientist

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Executive summary

During the 1999–2000 Wet season, a leak occurred in the tailings water return pipe at the Ranger uranium mine in the Alligator Rivers Region of the Northern Territory. The first indication to the authorities that a leak had occurred was in a facsimile message from Energy Resources of Australia (ERA), the mine operator, to the Office of the Supervising Scientist (OSS) on the afternoon of Friday 28 April 2000. This message advised that approximately 2000 cubic metres of tailings water (process water) had leaked from a pipe in the Tailings Dam Corridor of the Ranger site between late December 1999 and 5 April 2000. The facsimile message was also sent by ERA to the Northern Territory Department of Mines and Energy (NTDME), Northern Land Council (NLC) and the Department of Industry, Science and Resources (DISR).

Water in the tailings dam at Ranger is pumped from the dam back to the mill through the Tailings Water Return Pipeline for use in the process plant. The primary containment system is the pipeline itself. A secondary containment system is in place to protect the environment from any adverse effects arising from a failure anywhere along the pipeline. This secondary containment system consists of a bunded roadway that collects any spilled water and directs it to a sump, the Tailings Dam Corridor Sump. Water that is collected in this sump is returned to the mill water management system. Should both the primary and secondary containment systems fail, a third barrier for the protection of the environment is in place in the form of constructed wetland filters which are designed to partially remove contaminants from the water as it passes through the filter system.

Although a leak had been reported, no indication was given that the secondary containment system may have been breached. Indeed, the report stated that no infringement of the Ranger General Authorisation had occurred. On receipt of the facsimile, the OSS contacted ERA to clarify the circumstances surrounding the incident. The Department of Industry Science and Resources also sought advice from ERA on the nature and the timing of the leak. During telephone conversations between OSS and ERA staff, information on water quality at a number of sites was provided which indicated that a proportion of the process water had entered the Very Low Grade Corridor Road Culvert (VLGCRC) built under the Tailings Dam Corridor, and hence had escaped the secondary containment system consisting of bunds and a sump, designed to collect any spillages from the pipes in the tailings corridor.

Based on this information, the Supervising Scientist concluded that a breach of the Environmental Requirements had occurred and immediately notified the office of the Minister for the Environment and Heritage. On Sunday 30 April, the Supervising Scientist provided a formal brief to the Minister on the incident. Following receipt of this brief, the Minister requested that the Supervising Scientist investigate the incident and provide a report to him. A similar request was received from the Minister for Industry, Science and Resources who is responsible for the administration of the *Atomic Energy Act 1953* under which approval has been given for ERA to operate the Ranger Mine. This report is in response to these requests.

In preparing this report, the Supervising Scientist has consulted all the major stakeholders including ERA, NTDME, NLC and the Gundjehmi Aboriginal Corporation. On technical aspects of the assessment, a report was prepared by ERA in close cooperation and consultation with staff of the Supervising Scientist and the NTDME. In addition ERA commissioned a report from a specialist pipeline inspection company, Intico, on the condition of pipes in the Tailings Corridor and the Supervising Scientist commissioned a review from

Sinclair Knight Merz on the adequacy of the design, operation and maintenance of the tailings corridor system. NTDME also prepared a report on the incident.

The issues that needed to be addressed were:

- The origin of the leak and the adequacy of remediation measures taken to prevent similar occurrences in the future
- The extent to which the people and the environment of Kakadu National Park have been adversely affected by the leak
- The extent to which Energy Resources of Australia has complied with the reporting requirements specified in the Environmental Requirements that apply to the Ranger operation.

A number of other issues arose in the course of the investigation.

The main findings of the investigation are summarised below.

Origin of the leak and adequacy of remediation measures

It has been established that the volume of water that leaked from the tailings water return pipeline was about 2000 cubic metres during the 1999/2000 wet season. Of this, only a small fraction, about 85 cubic metres, entered the culvert which flows to the Corridor Creek Wetlands. The remainder was collected in the tailings corridor sump and returned to the water management system.

The cause of the leak was corrosion and subsequent failure of three bolts that secure the jointing of two flanges in the pipeline. The principal cause of corrosion was the burial, under moist conditions for up to 6 months of the year, of the relevant section of the pipeline under silt derived from erosion in the vicinity of the tailings corridor roadway. A contributing factor to the failure may have been the use of undersized bolts.

The gradual burial of the pipeline and the absence of measures to remediate the situation are attributable to a reduction in the standard of maintenance carried out by ERA in the pipeline corridor in recent years. The failure of the mine inspection program carried out by the Northern Territory Department of Mines and Energy and, to a lesser extent, that of the Office of the Supervising Scientist, to observe and require remediation of the buried section has also been a contributing factor to the leak.

The failure of the pipeline to contain tailings water would not of itself normally have resulted in the discharge of this water to the external environment. That the leaked water did reach the external environment is due to a failure of the bunded corridor system to fully contain any spilled water. The cause of this failure was that the engineered structure between the roadway and a culvert that drains water from the nearby waste rock dump was not impermeable.

The statutory monitoring program has been found to be deficient in two ways. First, other than visual inspection, it has not been designed to include monitoring locations within secondary containment systems that would indicate the failure of primary containment systems. In the present case, no statutory reporting of the quality of water in the tailings corridor sump is required under the Ranger General Authorisation. If the routine analysis of ammonium ion and manganese in corridor sump water had been required, the existence of a leak in the pipeline may well have been detected several months before it was found and rectified. Second, there is no systematic monitoring program designed to check the integrity of the secondary containment systems. If these monitoring systems had been in place, the current incident could well have been avoided.

The original leak in the pipeline has been repaired and the complete pipeline has been tested to determine its integrity. The system is now operating satisfactorily. The silt that buried the pipeline has been removed and steps implemented to ensure that no build-up of silt will occur in the future. A concrete slab has been installed at the section of roadway that passes over the culvert to prevent infiltration in the future. A full review of the Tailings Dam Corridor has been recommended with particular emphasis on the efficacy with which it performs the task of providing secondary containment.

Impact on people and the environment

Assessments of possible ecological impact arising from the leak have been carried out both using actual monitoring data and by modelling.

An examination of the chemical monitoring data at the gauging station on the Magela Creek upstream of the point at which the Creek enters Kakadu National Park shows that no change occurred during 1999/2000 in the concentrations of the principal constituents of concern compared to similar observations in previous years. The concentrations of all constituents were within the natural range observed previously. Similarly, biological monitoring at the gauging station and at a point upstream from the minesite shows no difference in the response of animals exposed to water at the downstream and the upstream sites. Even at the monitoring site at Georgetown Billabong, which is located on the mine project area downstream from the source of the leak but upstream of the confluence of Georgetown Creek and Magela Creek, no increase in the concentration of any of the principal solutes was detectable.

Modelling of the possible ecological impact was carried out by calculating the likely increase in concentrations at the gauging station using information derived in this study on: the maximum possible volume of leaked tailings water, the most probable value for this volume, the measured concentrations of solutes in tailings water, measured rates of attenuation of solutes in the constructed wetland filter systems and the flow rates in Magela Creek. Even if one ignores the losses in the wetland filters and uses the maximum possible volume of leaked tailings water, the calculated increase in the concentration of all constituents is much lower than the naturally observed concentrations at this point.

We have concluded that the leak of tailings water had no adverse ecological impact on Kakadu National Park.

The radiological impact was assessed using the information derived in this study on the quantity of water released and the concentrations of radionuclides in tailings water together with the results of the past research program of the Supervising Scientist on the dispersion of radionuclides in the surface water system and the uptake of radionuclides in animals and plants. The maximum conceivable dose received by members of the public as a result of the leak is lower than the public dose limit by more than a factor of 1000. The best estimate of the dose received is lower by a further factor of 30. Even these estimates ignore the reduction in dose resulting from absorption of radionuclides in the wetland filter system.

The overall conclusion reached is that the leak of tailings water into the external environment has had a negligible impact on people and the environment.

Compliance with reporting requirements

Under the Environmental Requirements, ERA must directly and immediately report any breach of the Environmental Requirements and any mine-related event which:

- (a) result in significant risk to ecosystem health; or

- (b) have the potential to cause harm to people living or working in the area; or
- (c) are of or could cause concern to Aboriginals or the broader public.

It has been concluded that ERA did not comply with this requirement on two grounds: (i) the leak of tailings water to the external environment is a breach of Environmental Requirement 3.4, and (ii) there should have been no doubt that such a leak would have been of concern to the local Aboriginal people and the broader public.

The reasons for the lack of reporting have been the subject of an internal ERA investigation and the Supervising Scientist has received correspondence from, and has discussed with, the Chief Executive of ERA the outcomes of the review. ERA believes that there was no deliberate intent to deceive or dissemble. Rather, two principal factors are believed to have contributed to the omission. First, recent changes in staffing at Ranger have resulted in the absence of a senior scientist with the ability to effectively identify, interpret and rectify environmental incidents. The lack of interpretive ability was a key factor in the lack of recognition that the data which were available to ERA staff implied that tailings water had reached the external environment. Second, there is a lack of recognition by the Ranger Management Team of the needs and expectations of stakeholders that resulted in emphasis being placed on the absence of environmental impact rather than the issue of whether or not the incident would be of concern to Aboriginal people.

From his discussions with senior ERA personnel, the Supervising Scientist is satisfied that there was no deliberate attempt to deceive the authorities. He accepts the conclusions of ERA and has made recommendations to address the deficiencies identified.

Other issues

In the course of this investigation into the leak of tailings water during the 1999/2000 Wet season, evidence has been obtained that water with the characteristics of tailings water was probably discharged into the same culvert during the 1998/1999 Wet season. Due to time constraints, the cause of this discharge has not been fully established. A possible explanation that is being investigated is that tailings water associated with a leak in the tailings pipeline on 13 December 1998 seeped in to the VLGCRS during the 1998/99 Wet season. While the Supervising Scientist is concerned that the probable presence of tailings water in the VLGCRS went undetected until now and that a full explanation for its origin is not yet available, he is satisfied that the 1998/99 leak caused no harm to people or the environment of Kakadu National Park. ERA should complete a comprehensive investigation of additional sources of contaminants in the VLGCRS, including previous tailings spills in the Tailings Dam Corridor, and provide a report to the Minesite Technical Committee.

During the past few years, there has been an increase in public expressions of concern about the ability of the Supervising Scientist to provide reliable assurances to the public when he has to rely heavily on information and monitoring data provided by ERA and/or by the Department of Mines and Energy which is seen primarily as a proponent of mining. These concerns have heightened following the reporting of the tailings water leak. In particular, the Mirrar, traditional owners of the land containing both the Ranger and the Jabiluka projects, expressed their concerns on this issue at a recent meeting with the Supervising Scientist. We have concluded that, in order to keep pace with these changing expectations on the independent nature of the assessments carried out by the Supervising Scientist, the Supervising Scientist should ensure that there is an adequate and independent on-site audit program, and develop and implement an environmental monitoring program. These programs

should focus on the potential off-site environmental consequences arising from operation of the Ranger mine and mill.

There are difficulties with the current requirements for the reporting of incidents at Ranger. First, they often require a judgement by ERA staff on whether or not the incident would give rise to concern by Aboriginal people or the general public. Such judgements may be difficult to make. Second, the demand for a completely open and transparent system of reporting often results in an unjustified but very genuine concern, even fear, on the part of traditional owners. Guidelines need to be developed to clarify the reporting requirements in a way that will, while retaining the transparency of the current system, reduce the element of judgement needed and assist in minimising undue concern for Aboriginal people and the broader community.

Recommendations

The recommendations arising from this investigation are listed below.

Recommendation 1

ERA should undertake a full review of the Tailings Dam Corridor with particular emphasis on the efficacy with which it performs the task of providing secondary containment. The Terms of Reference for the Review should be approved by the Supervising Scientist.

Recommendation 2

All Recommendations on maintenance procedures in the Tailings Dam Corridor made in the Sinclair Knight Merz Review of the Tailings Dam Corridor should be implemented.

Recommendation 3

ERA should strengthen the Ranger Management Team to ensure that there is an effective interface with external stakeholders and that decisions are made quickly to meet the expectations of the stakeholders.

Recommendation 4

ERA should take immediate steps to put in place an employee training program designed to ensure that all employees appreciate the need to keep the authorities informed of any event that could be perceived to be of concern to the local Aboriginal people or the broader community, not just incidents that are acknowledged infringements of the Ranger General Authorisation or the Environmental Requirements.

Recommendation 5

The Supervising Scientist should offer to assist ERA in the above training program. In particular, the Supervising Scientist should provide a briefing to ERA employees on issues of significance in this report, and any other issues that are considered to be of concern to members of the public.

Recommendation 6

ERA should upgrade the environment protection staff structure at Jabiru to ensure that the company has the on site ability to effectively identify, interpret and rectify environmental incidents.

Recommendation 7

ERA should complete a comprehensive investigation of the additional sources of manganese, including previous tailings spills in the Tailings Dam Corridor, and provide a report to the Minesite Technical Committee.

Recommendation 8

The Minister for Industry Science and Resources should consider what action should be taken in response to the established breach of Environmental Requirements 3.4 and 16.1 taking into account:

- *The radiological and ecological impact arising from the leak of tailings water to the environment has been negligible*
- *The leak resulted from poor maintenance practices in the Tailings Dam Corridor*
- *The view of the traditional owners of the Ranger Project Area is that Aboriginal people will only believe that the Government takes their concerns seriously if substantive action is taken.*

Recommendation 9

The statutory environmental monitoring program should be extended to enhance its capacity to provide early warning of unplanned releases of contaminants. This extension should include the establishment of additional monitoring locations within secondary containment systems that would indicate the failure of primary containment systems.

Recommendation 10

The Minesite Technical Committee should review the inspection and monitoring system at Ranger to establish and implement measures that will detect failures in the secondary containment systems and structures.

Recommendation 11

ERA should provide the Supervising Scientist and the Supervising Authorities with all research data as they become available rather than at the end of research projects. Protocols should be developed for the appropriate use of research data.

Recommendation 12

The Northern Territory Department of Mines and Energy should undertake a comprehensive review of its site inspection regime in the light of deficiencies identified in this report, and design and implement a new proactive inspection regime within a risk management framework.

Recommendation 13

The Supervising Scientist should ensure that there is an adequate and independent on-site audit program related to potential off-site environmental consequences arising from operation of the Ranger mine and mill.

Recommendation 14

The Supervising Scientist should develop and implement a routine environmental monitoring program whose focus should be the provision of advice on the extent of

protection of the people and ecosystems of Kakadu National Park. A component of the program could also provide support to the on-site audit program referred to in Recommendation 13.

Recommendation 15

The Working Arrangements between the Commonwealth and the Northern Territory regarding the regulation of uranium mining activities in the Alligator Rivers Region should be reviewed and amended to take into account changes in the activities of the Supervising Scientist arising from this report.

Recommendation 16

The Mine Site Technical Committee should develop guidelines clarifying requirements for the reporting of incidents which retain the transparency of the current system, are consistent with Environmental Requirement 16.1, reduce the need for the exercise of judgement by staff of ERA and will assist in minimising undue concern for Aboriginal people and the broader community.

Recommendation 17

The Working Arrangements between the Commonwealth and the Northern Territory regarding the regulation of uranium mining activities in the Alligator Rivers Region should be reviewed and amended to require the Department of Mines and Energy and the Supervising Scientist to immediately inform each other of any information they may acquire independently which could be of environmental significance.