

Executive summary

At approximately 10.00 am on 24 March 2004 the Supervising Scientist was advised by the General Manager Operations of the Ranger mine that the potable water system at the mine had been contaminated, probably by process water. As a result, all operations at the mine and mill had been shut down, the potable water system had been isolated and all non-essential staff had been sent home. In addition, he advised that, since Jabiru East (but not the township of Jabiru) received its potable supply from the mine, the potable supply to Jabiru East had been shut down and all businesses in the Jabiru East region, including the Airport, the Supervising Scientist's Jabiru Field Station and the Gagudju Workshop, had been advised that water remaining in their systems should not be consumed.

The Hon Dr David Kemp MP, the then Minister for the Environment and Heritage, was informed of the occurrence of the incident and Dr Kemp requested that the Supervising Scientist should conduct a comprehensive investigation into the incident and provide a report to him at the conclusion of the investigation.

Late on 25 March 2004, Energy Resources of Australia (ERA) advised the Supervising Scientist that it had now been established that, during the night of 23–24 March 2004, contaminated potable water from a holding tank adjacent to Jabiru Airport had discharged to the environment. This additional information was subsequently provided to Dr Kemp who reiterated his request for a comprehensive report from the Supervising Scientist.

This report contains the results of the Supervising Scientist's investigation of the incident, including his assessment of the likely impact on the health of workers at the mine site, on the health of people living in the vicinity of the mine and on the environment of Kakadu National Park.

Causes of the incident

This investigation has concluded that the primary cause of the contamination of the potable water system at the Ranger mine in March 2004 was that an operator, at about 9.40 pm on 23 March, opened a valve connecting the water manifold at the Fine Ore Bin (FOB) Scrubber to a one inch hose. At the time of this connection, the manifold was also connected to the process water system. Unknown to this operator, the other end of the one inch hose was connected to the potable water system and the valve at that end of the hose was open. The higher pressure in the process water system caused water to flow from the process water system into the potable water supply system.

It has not been possible to determine when, or by whom, the valve at the potable water end of the hose was opened. Nor has it been possible to determine precisely when the hose was connected to the potable water system but it occurred some time between 11.45 am on 20 March 2004 and 6.30 pm on 23 March 2004.

We have concluded that supplementing the process water supply to the FOB scrubber with potable water (that is, simultaneous supply of process water and potable water to the scrubber) has probably not occurred in the past, is not a standard ERA procedure and is not a practice knowingly adopted by any ERA operators. However, it is likely that a hose has been connected between the FOB scrubber and the potable water hosepoint in the past and that, contrary to ERA stated policy, potable water may have been used by some staff to supply water to the FOB scrubber when process water was unavailable.

It is concluded that the primary conditions that enabled the incident to occur were:

- The existence of the same type of connectors, albeit of different size, on the process and potable water systems;
- The lack of a system for early warning of contamination in the potable water system; and
- The absence of non-return valves in the potable water system.

ERA has made commitments to address these issues but it is recommended that measures to address these issues should be made requirements of the company under legislation.

However, it is the Supervising Scientist's view that the underlying cause of the incident was the poor condition of the process water distribution system at Ranger.

During the conduct of this investigation, it was identified that the Control Room Log at Ranger contains about 30 entries related to the failure of, or repairs to, various parts of the process water distribution system at Ranger in the period 1 March to 24 March 2004. A general inspection of the mill noted that leaking pipes were common, valves were broken and corroded, temporary hose connections were present, and the colour coding of pipes was in many instances obscured by rust and grime. On this basis, it was obvious that a major refurbishment of the process water system was required to bring it up to a satisfactory standard.

Discussions with staff revealed that the condition of the process water system and the need for frequent repairs led to a situation where staff were forced to use alternative water supplies to keep the scrubber operational. While accepted practice, it is clear that such a switch did not require the formal change management procedure to be followed. Staff considered that these breaches of change management procedures were necessary to keep the plant operating.

ERA had previously identified the condition of the process water system as a significant risk and had begun, and has continued to implement, a process water system refurbishment program. Part of this, the Process Water Pipe Replacement Project, remains to be completed. This project needs to be completed and it is recommended that the condition of the process water distribution system should be audited before the end of 2004. It is also recommended that steps be taken at Ranger to tighten up procedures for the management of changes to the water systems on site and to address the culture of staff that has arisen as a result of the poor condition of the current system.

In public discussion on this incident, it has been noted that the incident occurred only a few months after ERA received certification under the International Standard ISO 14001. Many have questioned the efficacy of this standard in the light of the occurrence of the incident. It should be noted that the ISO 14001 standard is designed to address environmental issues and, despite the secondary but important leak of contaminated water at Jabiru East, the primary risk associated with this incident was an Occupational Health and Safety (OHS) issue. OHS risks are not addressed in the systems implemented at Ranger under ISO 14001. It is recommended that this should be rectified.

Environmental Requirements and the Ranger Authorisation

It is the role of the Northern Territory Government to assess whether or not ERA has been in breach of the *Mining Management Act 2001* and the Ranger General Authorisation. In addition to the Ranger General Authorisation, there may be breaches of provisions of the *Mining Management Act 2001* related to ERA's duty of care to provide a safe work environment. This report has noted that the Northern Territory Minister for Mines and Energy announced on 19 May 2004 that the report of his Department on the incident had been

referred to the Northern Territory Department of Justice to consider whether a case existed for prosecution of ERA.

Energy Resources of Australia (ERA) is required to comply with the Commonwealth Environmental Requirements (the ERs) for the Ranger mine as attached to the Authority issued under Section 41 of the Commonwealth *Atomic Energy Act 1953* and to the export permit for uranium granted under the *Customs (Prohibited Exports) Regulations 1958*.

This report has reviewed the extent to which ERA may have been in breach of the Ranger Environmental Requirements. We have concluded that ERA was in breach of ER 3.4 as a result of its failure to ensure that process water is contained within a closed system. We have also concluded that ERA has been in breach of ER 5.1 as a result of its failure to ensure that radiation doses to company employees and contractors must be kept as low as reasonably achievable. It is recommended that the Commonwealth Minister for Industry, Tourism and Resources should assess whether or not action should be taken by the Commonwealth in response to the established breach of Environmental Requirements 3.4 and 5.1.

Responsibilities of the Supervising Scientist and the Northern Territory Government

The Commonwealth Government decided, in June 2000, that the inspectorial activities of the Supervising Scientist, which had ceased in 1995, should be reinstated. In making this decision, the Government made it clear that this inspectorial role should be limited, in a manner similar to that in place prior to 1995 and consistent with the Supervising Scientist's functions under the *Environment Protection (Alligator Rivers Region) Act 1978*, to assessing issues that could be relevant to off-site environmental protection.

The mechanism for implementing this decision was the commencement of Routine Periodic Inspections (RPI). These are carried out monthly and, while organised by the Supervising Scientist, are conducted jointly with the NT Department of Business, Industry and Resource Development and the Northern Land Council. These inspections focus on the environmental protection mechanisms in place at Ranger including the condition and adequacy of containment structures and bunds. They do not involve inspections of plant inside the bunds nor do they address Occupational Health and Safety issues other than radiation safety. Those are issues that are the responsibility of the Northern Territory Government. This focus on off-site environmental protection issues is the reason why the RPI process did not identify the primary conditions that gave rise to this incident

The Supervising Scientist does not review in detail the Northern Territory Government's conduct of its responsibilities for the day-to-day regulation of mining of uranium at Ranger. However, in his report on the investigation of the leak of tailings water at Ranger in 2000, the Supervising Scientist recommended that 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 the report, and design and implement a new proactive inspection regime within a risk management framework.

The Supervising Scientist is aware that the NT Department of Business, Industry and Resource Development (DBIRD) now carries out a much more comprehensive inspection and audit program at Ranger than applied in 2000. The results of these inspections and audits are not normally conveyed to the Supervising Scientist where they do not relate to environmental issues. The Commonwealth Government may wish to be satisfied that the occurrence of this incident can not be attributed to a lack of vigilance on the part of the Northern Territory Government in the discharge of its responsibilities in the day-to-day regulation of the mining

of uranium at Ranger. It is recommended that the Commonwealth Minister for Industry, Tourism and Resources should seek advice on this issue from the Northern Territory Government

Contamination of the Jabiru East potable water supply

A faulty valve at a holding tank at Jabiru East caused contaminated potable water to flow from the mine towards Jabiru East. Water quality data at Jabiru East businesses on the morning of 24 March are limited but we have been able to conclude that water consumed at the Jabiru Field Station and the Gagudju Workshop on the morning of 24 March met all drinking water guidelines and that it is highly likely that this was also true at the Jabiru East Airport.

The consumption of water from the Jabiru Field Station (JFS) of the Supervising Scientist by staff of the Supervising Scientist and Aboriginal Traditional Owners on 5 April 2004 arose from a misunderstanding by a member of staff and from the lack of tagging of potable water outlets within the JFS. We have concluded that the water from the Jabiru Field Station consumed by SSD staff and by Aboriginal Traditional Owners on 5 April met drinking water guidelines and did not represent any health risk. The Supervising Scientist will develop and implement an emergency response plan to ensure that the circumstances that led to this incident are not repeated.

Assessment of human health implications for ERA staff and contractors

A detailed assessment has been carried out on the potential for adverse long-term health effects arising for workers at the Ranger mine who were exposed to contaminated water as a result of this incident. Such long-term effects could arise, in principle, as a result of chemical exposure and radiation exposure.

For radiation exposure, it has been concluded that, even under the worst-case scenario considered, the risks arising from radiation exposure of ERA staff and contractors who consumed contaminated water at the Ranger site on 23–24 March 2004 are very low and that long-term effects on their health would not be expected. It is considered that no follow-up radiation exposure monitoring is required.

The risks to workers from chemical exposure were assessed by two different approaches. The first approach used risk assessment methods that combine information on the exposure of workers to chemicals in the Ranger incident with data on effects of such chemicals on human health in the medical and scientific literature to draw conclusions on the likely effects on people who were exposed to contaminated water. The second approach involved the measurement of a range of chemical and biological response indicators in samples of blood and urine from workers who were exposed to contaminated water, and the expert medical assessment of the results to assess the likelihood of adverse long-term effects.

These two different approaches were adopted in two separate investigations conducted on behalf of ERA and the Supervising Scientist. While the two investigations were independent and produced separate reports, they used common data sets (for example chemical data sets on the extent of water contamination and health testing analyses of blood and urine) provided by ERA and SSD as appropriate.

The principal conclusion of both investigations, supported by both the risk assessment and the medical assessment methods, was that it is most unlikely that there will be any longer-term or delayed health effects on target organs such as the brain, liver and kidney because of the brief period of exposure to the contaminated water.

Both of the health investigation reports, however, adopted a precautionary approach to their conclusions and recommended that a follow-up health monitoring program for affected workers be considered. It is recommended that ERA implements such a program following consultation with affected workers and their doctors.

Assessment of environmental impact

Two approaches have been adopted in this report in assessing the potential impact on the downstream environment of Kakadu National Park arising from the discharge of contaminated water from the water storage tank at Jabiru East on 24 March 2004.

The first approach was based upon modelling of the flow of contaminated water from the mine site to the Jabiru East tank, mixing in the tank, and overflow from the tank towards the Magela Creek. The model used very conservative assumptions and represented a worst case scenario. The results indicated that, of all the constituents present in process water, only manganese, uranium and possibly copper could have been present in Magela Creek at concentrations that would be measurable above background. Taking into account the measured attenuation of metals during overland flow towards Magela Creek, we have concluded that environmental impact downstream from the Ranger mine would not be expected.

The second approach was based upon assessment of a range of monitoring data. These included data from the Supervising Scientist's routine biological and chemical monitoring programs conducted in the vicinity of the Ranger mine, including continuous monitoring of electrical conductivity, as well as additional sampling conducted as part of this investigation. Assessment of all the chemical analyses of water samples obtained during the period of the incident demonstrate that no change occurred in the chemistry of Magela Creek downstream from the Ranger mine as a result of the incident. The creekside biological monitoring program using fish and freshwater snails was underway throughout the week in which the incident occurred. No change was observed in fish larval survival or snail reproduction at the monitoring site downstream from the mine compared to results obtained upstream.

Based on all of these data, the overall conclusion has been drawn that the potable water contamination incident should not have given rise to any impact on the ecosystems of Kakadu National Park and that there should be no impact on the health of people who consume water or food from the creek or billabongs downstream from the mine.

Recommendations

The recommendations arising from this investigation are listed below.

Recommendation 1:

The Commonwealth Minister for Industry, Tourism and Resources should advise the Northern Territory Minister for Mines and Energy that ERA should be required, either through approval of an appropriately submitted Mining Management Plan for the Ranger mine or by required revisions to such a Plan, to:

- a) *Ensure that the fittings used throughout the Ranger potable water system should always remain incompatible with all other fittings used on the site to prevent the connection of the potable water system to any other system.*
- b) *Install a water contamination probe within the Ranger potable water system. The probe should measure electrical conductivity and acidity continuously and should trigger an alarm alerting operators if the value of either of these variables changes significantly from pre-set values.*

- c) *Install non-return valves at points in the potable water system where connections may be made to other water systems. A risk analysis of the potable, process and pond water systems should be used to determine where non-return valves are required.*

Recommendation 2:

The Commonwealth Minister for Industry, Tourism and Resources should advise the Northern Territory Minister for Mines and Energy that, by the end of 2004, an independent audit of the process water distribution system at Ranger should be carried out to determine whether the Process Water Pipe Replacement Project has been completed and to identify further work required to address any remaining deficiencies in the process water system.

Recommendation 3:

ERA should introduce a permit system requiring authorisation by a Superintendent for changes to water systems and should implement a program designed to improve the standard of housekeeping on site. ERA should determine the minimum competency standards required for operators, and implement a training system that ensures that operators meet those standards.

Recommendation 4:

The Commonwealth Minister for Industry, Tourism and Resources should advise the Northern Territory Minister for Mines and Energy that ERA be required to implement a Workplace Safety System consistent with, or equivalent to, Australian Standard 4801 and that the operation of this system be the subject of an annual independent audit.

Recommendation 5:

The Commonwealth Minister for Industry, Tourism and Resources should consider whether action should be taken by the Commonwealth in response to the established breach of Environmental Requirements 3.4 and 5.1.

Recommendation 6:

The Commonwealth Minister for Industry, Tourism and Resources should seek advice from the Northern Territory Minister for Mines and Energy on the nature and extent of the audit and inspection regime at the Ranger mine and, in particular, should seek details of any concerns expressed by the Department of Business, Industry and Resource Development on the condition of the process plant and on related OHS issues.

Recommendation 7:

ERA should provide copies of the two health risk assessments contained within the Supervising Scientist's report to affected workers, should counsel these workers to seek advice from their doctors on their possible participation in the proposed voluntary monitoring program and should facilitate the implementation of this program for those workers who choose to participate, including the provision of the advice of an independent consultant neurotoxicologist. When the results of the program become available, they should be assessed by both the Rio Tinto occupational physician and the Supervising Scientist's independent expert group and these assessments should be provided to the affected workers and their doctors.

Preface

This report on the contamination of the potable water system at the Ranger mine in March 2004 has been prepared by the Supervising Scientist at the request of the then Minister for the Environment and Heritage, Dr David Kemp.

The Northern Territory Government, through the Department of Business, Industry, and Resource Development (DBIRD), conducted its own parallel investigation into the incident. Whilst this was a separate, independent investigation, DBIRD officers cooperated fully with my staff when relevant information was sought. Importantly, DBIRD openly discussed its findings with me and my staff. The findings of the two independent investigations were remarkably similar and discussions enabled minor differences to be resolved based on discussions on the evidence.

The preparation of this report would not have been possible without the full cooperation of Energy Resources of Australia (ERA), the operator of the Ranger mine. ERA provided full and open access to key personnel at the mine who needed to be interviewed, to all documents and computer logs that were sought and to all data collected by ERA that might be relevant to my investigation.

I wish to thank the group of experts from the Australian Centre for Human Health Risk Assessment who provided me with advice on the difficult issue of assessing whether or not delayed or longer-term health effects could be expected for those workers at the Ranger mine who were exposed to the chemicals in the contaminated water through drinking and showering.

I wish to acknowledge the cooperation of the Gundjehmi Aboriginal Corporation and the Northern Land Council in facilitating meetings with the Mirrar Traditional Owners and with the broader Aboriginal community in the region.

Finally, I wish to thank the staff of the Supervising Scientist Division who assisted me in the conduct of my investigation and in the preparation of this report. A large number of staff have been involved and they worked diligently and tirelessly on the tasks they were allocated.

Dr Arthur Johnston

Supervising Scientist

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