Friends of the Earth Australia

15th August 2002

The Secretary
Senate ECITA References Committee
Parliament House
Canberra ACT 2600

To The Secretary,

Re: Senate Inquiry into Environmental Regulation of Uranium Mining

Please find attached the Friends of the Earth, Australia (FoEA) submission to the Senate Inquiry into Environmental Regulation of Uranium Mining. FoEA is an international environment organisation with groups in over 60 countries. The organisation has 30 years experience in Australia in uranium and nuclear issues. FoEA has been an active player in issues surrounding the establishment and operation of uranium mines being reviewed in this inquiry.

FoEA welcomes the opportunity to provide evidence to this inquiry. FoEA has long held concerns about the inability to safeguard both people and the environment from the effects of radiation associated with the mining and milling of uranium.

FoEA would appreciate the opportunity to present further evidence at hearings conducted by the Senate ECITA References Committee. Please contact if any further information is required.

Yours sincerely,

Bruce Thompson.

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Inquiry into Environmental Regulation of Uranium Mining

Senate Environment, Communications, Information Technology and the Arts References Committee

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August 2002

Inquiry into Environmental Regulation of Uranium Mining

Terms of Reference:

The regulatory, monitoring, and reporting regimes that govern environmental performance at the Ranger and Jabiluka uranium operations in the Northern Territory and the Beverley and Honeymoon in situ leach operations in South Australia, with particular reference to:

(a) the adequacy, effectiveness and performance of existing monitoring and reporting regimes and regulations;

(b) the adequacy and effectiveness of those Commonwealth agencies responsible for the oversight and implementation of these regimes; and

(c) a review of Commonwealth responsibilities and mechanisms to realise improved environmental performance and transparency of reporting.

Submission prepared by

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Introduction

Recent incidents at uranium mines involving the release of radioactive materials into the environment have drawn renewed attention to what has long been a highly controversial industry. In the past five years, since the removal of the ALP 'Three Mines' policy, there has been an increase in uranium projects seeking or gaining approval. While the political climate has been supportive of development it has failed to uphold public interest and environmental protection.

Assessment of recent uranium mining applications has failed to adequately address potential operational issues and long term environmental hazards associated with mining and milling. Failure at the assessment stage to independently establish these issues has lead to incomplete regulatory mechanisms when in operation. Regulatory control of uranium projects once operational remains focused on the issues of monitoring and reporting. Application of mechanisms to ensure improved performance remains notably absent.

Comments

Assessment and Approval

Assessment of uranium projects is conducted under established Environment Impact Assessment (EIA) practices under the Environment Protection and Biodiversity Conservation (EPBC) Act, 1999 and previous Environment Protection (Impact of Proposals) (EPIP) Act 1974. While the EPBC legislation establishes a framework for environmental protection, in practice it mitigates certain impacts while facilitating intrinsically hazardous developments.

Jabiluka Uranium Project
The approval of the Jabiluka project situated within World Heritage listed Kakadu National Park clearly demonstrates a failure to represent public interest and environment protection ahead of private interest. Mining, milling and tailings waste disposal within a sensitive ecosystem subject to monsoonal rainfall will inevitably have environmental impacts.

Beverley Uranium Project
The Beverley uranium mine was the first mine using the controversial in-situ leach technique in Australia and remains the only uranium mine using a sulfuric acid leachate in this process in the OECD. Approval of the project was made despite significant uncertainties remaining about potential groundwater contamination and liquid waste disposal. Significant scientific debate remains unresolved about how 'contained' the aquifer being mined is. Reports of groundwater 'excursions' were revealed to the public only after approval had been granted. These impacts will accumulate over the period of operation and remain when the project is decommissioned.

Honeymoon Uranium Project
The Honeymoon project, involving a similar mining technique to the Beverley mine was given approval again within a cloud of controversy. In the case of the Honeymoon mine there is clear evidence that the aquifer mined is connected to surrounding groundwater. An excursion during trial operations was again recorded.

Recent approvals tend to ignore environmental impacts or assume this is a reasonable consequence given the perceived 'benefits' of mining. However environmental protection is not just a matter of principle, impacts of the processes have consequences for communities in these regions and may prevent utilisation of resources, notably water supply in the future. The EIA process provides the key point in mitigating environmental impact from industrial actions. Given the nature of uranium mining and long term waste management it can be impossible to reverse impacts when in operation.

eg. Olympic Dam Tailings Leakage
In February 1994 WMC reveal that up to 5 billion litres of tailings liquid has leaked from its tailings retention system at Roxby Downs. According to WMC the leak had been happening for at least two years but only became fully understood in January 1994. A plume now extends vertically and laterally below the tailings dam. While attempts can be made to decrease the liquid content of tailings effluent, the impact is difficult to mitigate and impossible to reverse.

eg. Honeymoon Groundwater Contamination
On the 5th December 2001, only one week after receiving final government approval for the mine, Southern Cross Resources confirmed an acid excursion that occurred in 1999. The leach acid solution, which is injected into a bottom aquifer at the mine site to dissolve uranium ore, escaped into an overlying middle aquifer.

Regulation
While uranium is given unique status under Federal EIA and export controls, practical regulation of mining operations remains less ineffectual than other hazardous industries. In South Australia uranium mining remains exempt from the Environment Protection Act with no on-ground Federal monitoring of operations. Repeated incidents at mines both in South Australia and Kakadu demonstrate a clear failure of existing regulatory regimes to improve mining practices once in operation.

Monitoring
Adequate effective monitoring of radioactive release into the environment remains an issue of debate. The physical nature of radiation and the mechanisms of release make monitoring a difficult task. However steps can be made to expand present monitoring allowing for assessment independent of the mine operator.

Monitoring in general remains periodic rather than continuous and does not cover the spectrum of potential radiological exposures / release. The location of monitoring stations in most case is not sufficient to assess intermittent and accumulative impacts.

Aside from long term accumulation of radiation, potential worker exposure is a significant issue. Current practice in assessment of human exposure continues to use 'risk' analysis with 'acceptable' worker and accident doses above general population. There remains no government collection of records to assess long term health impacts to workers. Given the health impacts now recognised with asbestos mining long term health assessment should be a public duty of care.

Reporting
Recent incidents at uranium operations have failed to be promptly reported to authorities or the public. It should not be the judgment of the mine operator whether reporting should be made or whether it is in the interest of the broader community.

Enforcement and Penalty Mechanisms
Comparable incidents involving the discharge of pollutants occurring in other industrial operations would face significant penalties or be shut down. Impacts on artesian water in an arid region, or World Heritage wetlands should attract the same penalties associated with discharge of industrial pollutants to an urban sewer. Repeated incidents show a clear failure by both mine operators and regulators to improve operational practices onsite.

eg. Olympic Dam Fires
The Olympic Dam Operation has had two major kerosene fires in the immediate vicinity of concentrated uranium oxide plant in the last two years. Kerosene, used as a solvent in uranium extraction, is stored in an open pool 20m adjacent to the uranium extraction plant. Official reports describe flames reaching 50-100m with a plume of smoke extending 30km.

Such extreme fire should never have occurred within the vicinity of uranium oxide concentrate, to be repeated within 12 months is gross negligence. The example demonstrates an absurd design failure that should have been identified during the EIA assessment of the Olympic Dam Expansion (1995). To repeat the same incident shows a failure of regulators to amend operating practice based on experience.

eg. Beverley
Over 20 major spills involving mining solution have occurred at Beverley uranium mine within two years of operation. During the EIA process the company Heathgate (US General Atomics) had claimed that the operation was 'a closed system' and as such there would be no release of radioactive material to the surface environment. Since operation the company has publicly denied impact rather than commit to improved practice.

Given repeated and at times chronic incidents the present regulatory structure fails to enforce environmental protection. Regulation requires independence and potency to deliver effective control over mining operations. In South Australia regulation remains primarily with Primary Industries and Resources (PIRSA).The department is responsible for facilitating of mineral exploration and project development by private companies. This relationship fails to provide the independence or disinterest required to establish firm regulation. Further to have measurable impact on operators practice, regulators must have active powers of enforcement. Given the nature and repetition of incidents there needs to be stronger use of financial penalties combined with the suspension or revocation of operating licences.

Summary

Increasing environment protection against the impacts of uranium mining requires an understanding of the systemic issues created by inadequate EIA approval. Regulatory structures require increased independence and stronger power to suspend or revoke operating licences. Long term impact assessment and mitigation requires expanded and continuous monitoring combined with effective public reporting. Further, health records should be maintained independently to assess cumulative effects on workers.

Spills & Leaks:

Accountability at Uranium Mines in SA

July 2002

Introduction

Over a period of some six months from October 2001 to May 2002, numerous spills, leaks, excursions or 'incidents' were reported at the three uranium mining and/or milling operations in South Australia. Some of the spills were significantly large (up to 420,000 litres) and engineering / environmental design and/or management systems failed to perform adequately. The incidents have brought renewed attention to what is a highly controversial industry

Friends of the Earth, Australia has been actively engaged in the debate for some years concerning environmental protection standards for the Olympic Dam, Beverley and Honeymoon uranium projects. The following report document's existing known leaks and failures at these facilities. The report makes a comparison to similar facilities in the USA (for in situ leach mines) and develops a set of reporting principles which lay the basis for fair and reasonable reporting procedures which meet legitimate public expectations.

Hazards & Potential Consequences

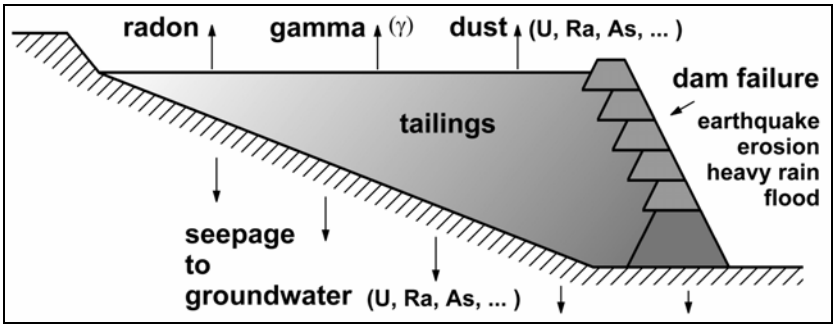
There are many potential causes of spills, leaks or 'incidents' at uranium mines, including :

- Processing chemicals (solvents, acids, oxidants, etc.)
- Heavy metals (As, Hg, Co, Cr, Cu, Mn, Pb, U, Zn, etc.)
- Radionuclides (^{238}U, ^{235}U, ^{230}Th, ^{226}Ra, ^{222}Rn, ^{214}Bi, ^{210}Pb, etc.)
- Salinity, acid/base, redox (Na, K, Ca, Mg, Cl, CO_3 / HCO_3, SO_4, NO_3 / NH_3, pH, EH, etc.)
- Corrosive gases (sulfur dioxide or SO_2, etc.)
- Physical risks (dust, heat stress, electricity, transport, lifting, etc.)

From an environmental and public accountability viewpoint, it is primarily the first three points which lead to greatest concern. The sources of these are many within a mining and milling operation, especially large and complex facilities such as Olympic Dam. For in situ leach facilities using acid solutions, the large volumes of liquid wastes and the high heavy metal and radionuclide content also raise significant legitimate concerns.

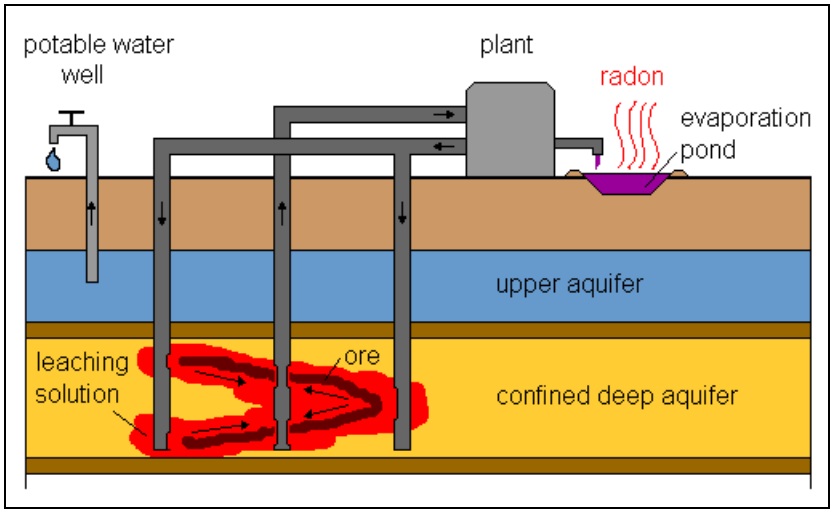
Mechanisms For Environmental Impact

Uranium Tailings (Olympic Dam Project)

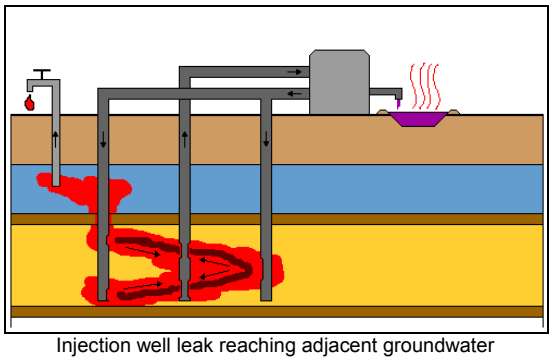


Simplified scheme of uranium tailings dam risks

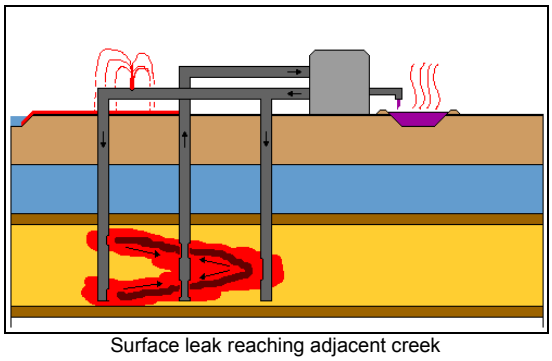
In Situ Leach (Honeymoon and Beverley Projects)



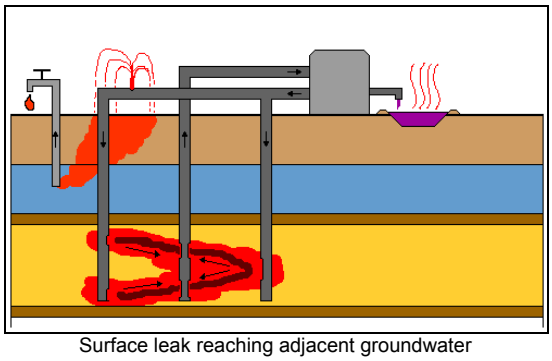
Simplified scheme of in situ leach uranium mine



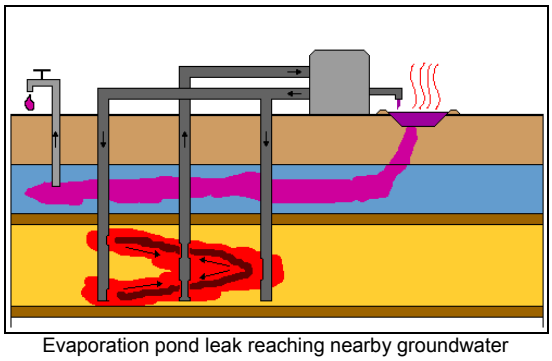
Injection well leak reaching adjacent groundwater



Surface leak reaching adjacent creek



Surface leak reaching adjacent groundwater



Evaporation pond leak reaching nearby groundwater

A compilation of the various spills, leaks and 'incidents' at Beverley, Honeymoon and Olympic Dam is given in Appendix 1. There is a precedent for every hazard identified earlier, including large diesel spills, surface spills, plant failures (sometimes very large), industrial fires, and spills of both injection and extraction solutions for ISL mines.

As a further comparison for ISL mines, a brief list is presented in Appendix 2 of such facilities in the USA. They demonstrate that, even for facilities which are supposedly 'world's best practice', large leaks are seemingly routine – from every major source within an ISL mine such as injection, extraction and liquid waste disposal bores, pipe failures at ponds, process plant spills, leaking pond liners, 'bleed' pipelines, repeated and recalcitrant excursions into groundwater, etc.

Key Issues Raised During Assessment and Approval Process

It is the position of Friends of the Earth that many of the potential consequences of operational failures at Beverley, Honeymoon and Olympic Dam have failed to be adequately recognised and taken seriously. Many of these issues were raised during the environmental impact assessment process but largely ignored by Commonwealth agencies since approval.

These include :

Olympic Dam

- Leaks to groundwater through preferential pathways in the limestone. Eg :
  - *70 million litres LOST in ONE HOUR* through seepage at a retention pond in the late 1980s at the desalination plant) (eg. Showers, 1999);
  - *5 billion litres LOST* through seepage by February 1994 (eg. ERDC, 1996).

Beverley

- Surface spill of *61,0000 litres in a matter of minutes* - if this had been at the wellfield at night during a storm, the consequences could have been much more environmentally damaging.

Honeymoon

- Excursion during trial mining in groundwater, *impacting on the adjacent 'Middle Aquifer'*. This was only properly reported after project approvals had been given.

Friends of the Earth contend that the repeated spills, leaks and incidents and the failures of the principal environmental regulator, the Mines department (now PIRSA), demonstrate that the long-term impacts of operations and incidents are not being taken seriously.

It is therefore imperative that all spills, leaks or incidents be thoroughly investigated and publicly reported to ensure that claims of minimal environmental impact from the respective operations can be held to account.

This also requires the use of independent verification (that is, outside the mining industry) of spill data, soil and water quality and environmental assessment of each major incident and the ongoing cumulative impacts of smaller occurrences.

Some other types of accident scenarios where full disclosure is important include :

- ***Process fluids spills*** (eg. Beverley, January 11, 2002; Honeymoon, October 3, 1999), which contain high ***radon gas*** activities. Spills of this material would have to involve short-term radon exposures which are extremely high due to degassing. Based on the available reports and media to date, there was no radon monitoring data or testing done at the above spills, nor any post-spill estimate of potential radon exposure to workers and the environment. Another important radionuclide in process, injection and extraction spills is radium (^{226}Ra), which is a strong gamma and alpha radiation emitter and decays to radon.

- ***Chemical spills/risks*** (eg. Beverley, March 16, 2002), which could include ***acids***, ***oxidants*** or other other chemicals. During 2001 alone some 70,000 litres of diesel was spilt at the remote water supply borefields for Olympic Dam, as well as a major industrial fire in the solvent extraction section of the complex in October 2001 - which apparently led to the release of radionuclides into the atmosphere.

The hazards of and potential consequences of environmental and occupational exposure to chemical, physical and/or radiological failures all need to taken seriously. As demonstrated in this submission and the appendices, strong precedents exist for every conceivable type of accident or failure, either human or technology induced. If such occurrences are to be prevented and the long-term pollution caused by Beverley, Honeymoon and Olympic Dam is to be minimised, this can only be truly done with proper public accountability for the companies involved as well as statutory government bureaucracies.

Principles

The main principle used for reporting 'incidents' at the Ranger uranium mine and Jabiluka project in Kakadu National Park, Northern Territory, is set out in the "Environmental Requirements" attached to approval conditions for each mine (legally the actual application is complex, but the end goal and principle is the same). It is listed below :

> ***"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."*

Thus, the important distinction is not only whether an incident *has* caused harm or creates significant risk, but whether it "*… is of or could cause concern*". It is important that the SA Government and the various companies (WMC, General Atomics, Southern Cross Resources) understand that this is the minimum standard expected by the public and traditional owners.

This clear ***'Best Practice'*** principle should be the same adopted for all uranium mines / projects in South Australia. If this requires amendments to various acts, legislation, agreements or even additional operating conditions as part of mineral lease conditions, then this should be a major recommendation and outcome. Such a development would increase Transparency and Public Accountability of the respective operations as well as statutory regulators.

As a minimum for any spills reporting procedure, the following must be clearly distinguished for all sites :

- Clear and consistent naming of the source (eg. extraction / injection / holding pond / acid / process solution / liquid wastes, etc.);
- Clear quantification, such as volume (soil and water), time of day, bunds involved (or not);
- Complete list of chemical and radiological concentrations in incident (as per hazard list). If a soil or water sample cannot be obtained and analysed promptly, then at a minimum the most recent analysis for the particular source of the spill should be provided, with analysis of the actual incident material involved ;

Improved Mechanisms

The approvals for the Beverley and Honeymoon projects clearly stated that stakeholders, such as environment groups (eg. CCSA, FoE and ACF), should be involved in a 'Community Consultative Forum' or like-named group. A similar group already operates for Olympic Dam (see comments below) as well as for the Ranger and Jabiluka projects in Kakadu National Park (the 'Alligator Rivers Region Advisory Committee' or ARRAC).

Unfortunately, it is often the case that such forums or committees merely become a one-way dialogue, with no real demonstrable reporting of 'incidences' or proper accountability for ongoing operations. This was the case with the Olympic Dam Environmental Consultative Committee and why the Conservation Council of South Australia refused to participate.

The Commonwealth is already on the 'Beverley Environment Committee' (BEC), although, based on performance to date, the public accountability of BEC is effectively zero. It has not publicly reported any ongoing environmental monitoring results from Beverley to date, nor has it appeared to be pro-active in holding Gereral Atomics to account over claims concerning recent incidents. The environment movement had heard of developing issues during 2000 and 2001 with regards to incidents and problems at Beverley but could not bring this to the attention of regulators or BEC due to the all-encompassing secrecy which the project operates within.

It is proposed that South Australian government lobby the Commonwealth to fund 2 permanent positions on the Beverley, Honeymoon and Olympic Dam, as with ARRAC in the NT, but that these committees or forums be reconstituted to ensure they have the legal power to release ongoing data about spills, leaks and incident data ***publicly***, as well as on-going operational data which can be used to enhance understanding of such occurences.

A feature of 'best practice' in Wyoming, USA, for ISL mines was an ***Online Database*** [1] of spills, leaks and incidents. Although the Wyoming Department of Environmental Quality (WDEQ) is currently redesigning their website, the database provided for enhanced information transfer between and across levels of government as well as better public scrutiny and corporate accountability.

Recommendations

Friends of the Earth therefore recommend the following :

- All spills / leaks / accidents / incidents be thoroughly investigated and publicly reported;
- A protocol be established which clearly defines the different streams at each operation (Olympic Dam versus in situ leach) , available on each company's website as well as the SA Environment Protection Authority (SA-EPA);
- A reporting procedure which includes all chemical and radiological constituents of potential health and/or environmental concern (eg. list above);
- If spill samples are not available, then the most recent relevant monitoring data should be used in conjunction with initial reporting on the occurrence until more detailed soil and/or water analyses are available;
- An 'Online Database' be established for incidents at each site, to be administered and made available through the SA-EPA;
- Community Consultative Forums or Committees be reconstituted to ensure political and corporate independence, and play a pro-active role in operations and incident investigation and reporting at all sites;
- The Commonwealth be approached for proper funding (time and costs) of two positions on the forum / committee for each site.

[1] Link : deq.state.wy.us/database/dataacces.htm (from WISE Uranium Project). An electronic extract of the WDEQ ISL spills / leaks database can easily be provided.

References & Further Reading

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WISE-UP, 2002, *WISE Uranium Project*. Researched by Peter Diehl, Arnesdorf, Germany. www.antenna.nl/wise/uranium/

Note : All WMC reports listed are available through www.wmc.com.au.

Appendix 1 : Spills, Leaks & Excursions in South Australia

Beverley

Adapted from PIRSA Public notice below and recent media.
(www.pir.sa.gov.au/pages/minerals/uranium/bev_incident_report.pdf)

Surface Spills :

2002

May 5	14,900 litres of water containing 0.0018% U (18,000 ppb).
May 1	6,600 litres of ***Evaporation Pond*** ('brine solution') containing some U due to over-filling of tank.
March 16	20-50 litres of acid water which came into contact with hydrogen peroxide resulting in a small ignition.
March 12	400 litres of ***Extraction*** fluid.
March 3	900 litres of ***Extraction*** fluid.
February 21	400 litres of ***Extraction*** fluid.
February 2	200 litres of ***Extraction*** fluid.
January 19	500 litres of ***Extraction*** fluid.
January 11	61,000 litres of ***Groundwater*** (***Extraction ?***) containing acid and U, after pipe rupture.

2001

July-Sept. #	1,000 litres of ***Evaporation Pond*** water (41,000 ppb U) from an overhead pipe failure.
July-Sept. #	880 litres of ***Injection*** fluid from a loose bolt in a gasket on an injection flange.
July-Sept. #	600 litres of ***Injection*** fluid from a filter skid overflow.
July-Sept. #	600 litres of ***Injection*** fluid from a vent valve failure.
July-Sept. #	759 litres of ***Extraction*** fluid from a poly weld failure.
July-Sept. #	400 litres of ***Injection*** fluid from a well head filter lid failure.
July-Sept. #	1,300 litres of ***Injection*** fluid from a well head filter lid failure.
July-Sept. #	200 litres waste water from laboratory due to sump pump failure.
July-Sept. #	Trace quantity of ***Process*** fluid due to bund leak.
July-Sept. #	1,900 litres of ***Extraction*** fluid at the well house.
Nov. 27	3,500 litres of ***Process*** fluid contained in bund and returned to circuit.
Nov. 13	5,000 litres of ***Process*** fluid contained in bund and returned to circuit.
Sept. 9	5,000 litres of ***Extraction*** fluid contained in bund & released to sump.
July 30	5,800 litres of ***Injection*** fluid due to oxygen fitting failing on injection well.
July 6	5,700 litres of ***Injection*** fluid as well-head tagged incorrectly.
June 22	1,500-2,500 litres ***Injection*** fluid spill due to blown gasket on inlet flange.
June 1 (1)	600-800 litres of ***Extraction*** fluid from injection well due to joint leak.
April-June	50 litres to 2,000 litres of ***Injection*** fluid spills due to butt joints & vent valve leaks. 11 minor spills in total.
February 9	1,200 litres of ***Groundwater*** due to joint failure at pipe in wellhouse.

No date given, only date reported (December 7, 2001).

2000

May 4	6,000 litres of ***Groundwater*** during bore well construction.

1999

May 21 (1)	Trace moisture detected under storage pond.

(1) No date given, only date reported.

1998

March 12	500 litres of ***Extraction*** fluid from split return line.

Honeymoon

Adapted from PIRSA Public notice below and recent media.
(www.pir.sa.gov.au/pages/minerals/uranium/hon_incident_report.pdf)

Surface Spills :

2001

May 22 — 30,000 litres of ***Groundwater*** (Basal aquifer) containing ~1,000 ppb U.

2000

July 4 — 2,000 litres of ***Injection*** solution at wellfield containing 30,000 ppb U_3O_8.

1999

October 3 — 9,600 litres of Process fluid within pilot plant (presumably 20,000,000 ppb U).
May 7 — 360 litres of ***Injection*** solution at wellfield containing 17,000 ppb U.
February 19 — 200 litres of ***Injection*** solution at wellfield.
February 19 — 1,000 litres of Barren processing solution in pilot plant.

Groundwater Excursions or 'Leaks' :

1999

November — On December 5, 2001, only one week after receiving final government approval for the mine, Southern Cross Resources confirmed an acid excursion that occurred in 1999. The leach acid solution, which is injected into a bottom aquifer at the mine site to dissolve uranium ore, escaped into an overlying middle aquifer.

Olympic Dam

Adapted from recent media, links below and WMC (1996, 2002).
(www.sea-us.org.au/roxby/roxby.html)

2001

Summary — Spills totalled ***4,216,000*** litres, no location or other data provided (except detail below).

Undated — Total of ***NINE Process*** spills (including December incident below), no location or other data provided.
Undated — ***TWO 'Pond'*** spills, no location or other data provided.
Undated — 'Undefined' spill at the Port Adelaide sulfur yard.
Undated — 'Undefined' ***Diesel*** 'leak' from a bulk storage tank at Olympic Dam, no location or other data provided.

'Late' — ~30,000 litres of ***Diesel*** spill at a Pump Station for Borefield B, no data provided.

Dec. 12 — 427,000 litres of ***Process*** leaching slurry containing 0.1% U (1,000,000 ppb) accidentally spilled from a holding tank.
October 21 — Large scale ***FIRE*** in the Solvent Extraction section of the Olympic Dam processing complex. Exact details still remain unclear, though it ***did*** apparently involve the release of radionuclides into the environment (mainly the atmosphere for wide dispersion).
May — ~40,000 litres of ***Diesel*** spilt from underground fuel lines at Pump Station 1, Borefield A, and spread some 200 m from the source. The lines had corroded, since they were more than 15 years old. The residual contamination left in groundwater as there was perceived to be "no significant environmental risk" (pp 17).

2000

Summary — 106 spills totalled ***2,021,000*** litres, no location or other data provided.

January 20 — Three workers were in the underground mine when explosives detonated. Although not injured, it represents a major breach in blasting safety procedures.

1999

Dec. 23 Large scale ***FIRE*** in the solvent extraction section of the processing complex. Exact details still remain unclear, though it did not apparently involve the release of radionuclides into the environment.

Dec. ?? Two workers seriously injured in a sulphuric acid spill.

October 12 Radioactive scrap metal detected at WMC's scrap metal merchant in Adelaide. Load returned to Roxby.

March 31 ***Explosion*** in the new acid plant connected to the expansion.

1998

March 6 Man is crushed to death in the underground mine at Roxby.

1997

Nov. 30 Union strike over the leak and spillage of sulphuric acid. 70 employees walked off the job after 23 workers had been overcome by fumes in the smelter area.

1994

February 14 WMC reveal that up to ***5 BILLION LITRES*** of tailings liquid has leaked from its tailings retention system at Roxby Downs. According to WMC the **leak had been happening for at least two years** but only became fully understood in January 1994.

Appendix 2 :
Spills, Leaks & Excursions at In Situ Leach Uranium Mines in the United States of America

1) Operational ISL Facilities

Adapted from : "Issues at Operating Uranium Mines and Mills – USA" (last updated 19 June 2002)
(http://www.antenna.nl/wise/uranium/umopusa.html)

Smith Ranch, Wyoming (Rio Algom Ltd)

2001

April 25	13,250 litres of ***Injection*** fluid.
April 24	68,150 litres of ***Injection*** fluid.
January 4	6,820 litres of ***Extraction*** fluid containing about 18,000 ppb U_3O_8.

2001

December 5	13,630 litres of ***Injection*** fluid.
October 22	236,200 litres of ***Injection*** fluid.
June 18	4,160 litres of Liquid Wastes (for deep well management).

2000

November 22	7,080 litres of ***Injection*** fluid.
October 22	42,020 litres of ***Injection*** fluid.
August 7	2,950 litres of ***Extraction*** fluid.
February 26	14,310 litres of ***Extraction*** fluid.
January 17	26,120 litres of ***Extraction*** fluid.

1999

December 31	11,360 litres of ***Injection*** fluid.

Kingsville Dome, Texas (Uranium Resources Inc. or 'URI')

2000

January 24	7,570 litres of ***'Bleed'*** fluid, covering 446 m^2.

1999

June 1	34,000 litres of ***Restoration*** fluid, containing about 2,700 ppb U.

1998

January 22	56,800 litres of ***Extraction*** fluid, containing about 35,000 ppb U.

1997

September 29	18,930 litres of ***Extraction*** fluid, containing about 81,000 ppb U.
September 16	11,360 litres of ***Injection*** fluid, containing about 6,700 ppb U.

Rosita, Texas (Uranium Resources Inc. or 'URI')

1997

December 17	26,500 litres of ***Extraction*** fluid, only 9,460 litres recovered to disposal pond.
December 4	26,500 litres of ***Extraction*** fluid, only 13,250 litres recovered to disposal pond.
October 13	25,000 litres of ***Extraction*** fluid.
September 30	18,930 litres of ***Extraction*** fluid, covering ~37 m^2.
September 1	113,560 litres of ***Injection*** fluid, containing about 1,500 ppb U, covering ~112 m^2.

Christensen Ranch / Irigaray, Wyoming (Cogema Mining Inc.)

According to Cogema's "Quarterly Progress Report of Monitor Wells on Excursion Status" of Oct. 2, 2000, 7 monitor wells at Irigaray remained on excursion status during the third quarter of 2000. The wells have been on excursion status for more than one year and up to 11 years. One other monitor well has been removed from excursion status.

2001

May 31	Monitor well placed on ***Excursion*** status.
January 23	13,392 Gallon spill of ***Restoration*** water.

2000

August 10	Monitor well placed on ***Excursion*** status.

1999

October 28	Monitor well placed on ***Excursion*** status.
October 5	Monitor well placed on ***Excursion*** status.
July 8	Monitor well placed on ***Excursion*** status.
May 8	56,780 litres Mining ***Injection*** Solution.
April 12	122,650 litres ***Injection*** Solution.
April 3	49,210 litres Spill of Restoration Water.
March 29	89,030 litres Mining ***Injection*** Solution.
March 26	227,120 litres Mining ***Injection*** Solution.
February 17	Monitor well placed on ***Excursion*** status.

1998

December 22	Monitor well placed on ***Excursion*** status.
November 19	Monitor well placed in ***Excursion*** status.
September 2	Shallow monitor well is in an ***Excursion*** status.
August 6	Ground water monitor well placed in ***Excursion*** status.
July 22	Minor leakage of byproduct solution from the Evaporation Pond.
July 8	105,990 litres of water containing 'low level' of U_3O_8 spilled onto ground.
March 5	Perimeter monitor well in ***Excursion*** status.

1997

October 3	Monitor well in ***Excursion*** status.
September 16	9,240 litres of 'waste water' containing 78,500 ppb U.
September 12	Well in ***Excursion***.
May 16	Two perimeter monitoring wells in ***Excursion*** status.
March 12	Perimeter well in ***Excursion*** status.

1996

December 31	Perimeter well in ***Excursion*** status.

Crow Butte, Nebraska (Cameco)

2002

April 4	Monitor well placed on ***Excursion*** status.

2001

December 4	Monitor well placed on ***Excursion*** status.
March 2	Monitor well placed on ***Excursion*** status.

2001

September 10	Monitor well placed on ***Excursion*** status.
May 26	Monitor well placed on ***Excursion*** status.
April 27	Monitor well placed on ***Excursion*** status.
March 6	Monitor well placed on ***Excursion*** status.

1999

July 2 Monitor well placed on ***Excursion*** status.

1998

August 7 10,260 gallons of ***Injection*** fluid.
March 21 Monitor well placed on ***Excursion*** status.

1997

August 12 Discovery of ***Pinhole Leaks*** in Upper Liner of Process Water ***Evaporation Pond***.

Highland, Wyoming (Cameco)

2002

March 21 Monitor well placed on ***Excursion*** status.

1999

July 7 11-19 litres of Water Containing LSA of Uranium Byproduct Material.
June 1 15,140 litres of 'waste' fluid.
February 5 Monitor well placed on ***Excursion*** status.

1998

February 5 Monitor well placed on ***Excursion*** status.

2) ISL Decommissioning Projects

Adapted from : "In-Situ Leaching Decommissioning Projects – USA" (last updated 1 June 2002)
(http://www.antenna.nl/wise/uranium/udusail.html)

Bruni, Texas

1998

May 26 30,280 litres of ***Restoration*** fluid, containing about 7,400 ppb U.
May 11 7,570 litres of ***'Impregnated' Restoration*** fluid, containing about 11,700 ppb U, covering ~167 m^2.
May 4 75,700 litres of ***Restoration*** fluid, containing about 8,600 ppb U.
February 5 9,460 litres of ***Liquid Wastes***, containing about 7,200 ppb U.

1997

December 13 11,360 litres ***Restoration*** fluid, containing about 5,000 ppb U, covering ~683 m^2.

Undermining Environment Protection

Honeymoon Uranium Project Assessment – An Independent Review

Friends of the Earth Australia

December 2002

Overview

The Honeymoon uranium project, located in north-east South Australia, is owned by Canadian company Southern Cross Resources. The company plans to use the controversial In-Situ Leach (ISL) method of mining to extract uranium from groundwater (aquifer) systems. In such systems uranium is naturally bound to sand formations below the surface. A sulphuric acid solution is used to dissolve the stabilised uranium into the groundwater under pressure. The groundwater is then pumped to the surface to be processed and the subsequent radioactive wastes and heavy metals pumped back into groundwater.

The Honeymoon assessment process has failed to address key issues of environmental impact and concern in a rigorous or transparent way. Information relating to the ISL process has been actively kept from the public during the process. Issues of long-term groundwater contamination were assessed by a pro-uranium PhD student with limited industry experience and whose academic study was facilitated by the company Southern Cross Resources. Despite ministerial and political assurances, key assessment information remains unavailable to the public.

The Commonwealth Government has given the project an unprecedented 5 year licence to export uranium in addition to controversial environmental approvals. An export licence is the primary mechanism where the Commonwealth can enforce approval conditions and try to regulate mine impacts. The 5 year licence divests the Commonwealth of responsibility is inconsistent with both the Government's duty of care and the clear community expectation of accountability.

The approval process of Honeymoon raises a series of questions about the concept of environmental protection. Uranium mining remains a significant political issue intimately intertwined with broader nuclear impacts. Beyond the failure to adequately assess the direct impacts of the project, the government has again failed to review Australia's role in an outdated, dirty industry.

Australia remains the only country in the OECD to allow commercial ISL uranium mining using sulfuric acid solution combined with discharge of radioactive waste to groundwater – this is not due to our unique geology, but rather an undermined approach to environment protection.

This review challenges the Environment Impact Assessment and of the Honeymoon Uranium Project in two key areas –

1. Technical Assessment – *Assumptions and inadequacies*
2. Due Process – *Failure of transparent, balanced assessment*

Background

Misconceptions –

'Groundwater is already saline and radioactive' –

While there are some levels of radioactivity in the aquifer set to be mined, the introduction of acid and pressure significantly increase the availability and mobility of uranium. Surrounding groundwater is currently used for stock and treated for use as drinking water at the mine site.

> . ……..However, pastoralists in the region do make use of groundwater from the Upper Sands for the watering of sheep under drought conditions. Southern Cross Resources does not provide chemical data for the locations where this occurs. There are no known wells completed in the basement in the region relevant to the project.
>
> The locations that Southern Cross Resources has sampled for groundwater quality are extremely limited, as indicated in the Response Supplement (Figure 6.6). Southern Cross Resources does not provide any discussion regarding past sampling. The groundwater quality external to Honeymoon is unknown except for that at the Yarramba homestead.
>
> *Assessment Report for the Environmental Impact Statement, Honeymoon Uranium Project, Planning SA November 2001, page. 57*

Uranium deposits are quite localised in the region with material naturally bound to sand formations where it occurs. It is when sulphuric acid and pressure is introduced that materials are dissolved into groundwater and hence available to both mining and migration.

'The groundwater is a closed system' –

The Honeymoon system is not closed, company technical reports clearly identify that the aquifer being mined is open horizontally. In addition a recently confirmed significant mine leak was vertical – contaminating a groundwater system above that where mining operations are taking place.

> ……PIRSA believes that the proponent has not provided adequate hydrogeological information in the Response Document to demonstrate confinement of the aquifers across and along the channel, or how the wastes might be effectively managed within what may be an essentially unconfined system.
>
> *Correspondence from Dennis Mutton, Chief Executive, PIRSA(Primary industry and Reousrces, SA) to Planning SA, 3/1/01*

'Groundwater will return to original state' –

The introduction of acid into groundwater significantly changes the chemistry of the system. The acid solution increases the mobility of heavy metals in addition to uranium. The company has made assumptions merely on the basis of computer modelling.

> Pirlo, pers com, (2000), has indicated that the aquifer could, with a 10:1 dilution of the waste water in the aquifer, be expected to return to normal background chemistry in about 15-20 years. Geochemical models of the type used by Pirlo, while establishing that natural restoration will occur and that heavy metals such as chromium and lead will not remain significantly mobile in the aqueous phase, cannot at this time give a more accurate time frame for a return to pre-mining conditions.
>
> *Assessment Report for the Environmental Impact Statement, Honeymoon Uranium Project, Planning SA November 2001, page 65.*

Despite additional work there remains a complete absence of laboratory and field evidence from the company to demonstrate, with any scientific certainty, that groundwater will return

to its natural state. Available evidence from overseas and in Australia suggests that even under favourable conditions attenuation fails.The company is not required to 'actively' rehabilitate the groundwater by adding chemicals that may assist attenuation.

'Sulfuric Acid is the same as wine or orange juice'-
The company has stated in the media that sulphuric acid used in the process is similar in strength to wine or orange juice, hence harmless (possibly implying that it's drinkable!). The strength of acids used in the mining process is much greater than that of orange juice wine or coca cola. Sulfuric acid used in the process is around pH 1.5 –2, orange juice is around pH 3.5- 4, (due to the logarithmic scale, a pH 2 is ten times as acidic as pH 3).

Further the type of acid defines its characteristics; wine and orange juice contain organic acids (eg. vinegar), soft drinks typically contain carbonic acid (carbon dioxide). Both of these have lower acid solubility coefficients compared to sulfuric acid, which is extremely soluble. This gives it higher acid strength (acidity) and explains why sulfuric acid is used in industrial processes.

Sulfuric acid is introduced in the mining process specifically to dissolve uranium into groundwater. It is an active ingredient and essential to the operation of the Honeymoon project, it is not a benign by-product.

1. Technical Assessment – *Assumptions and inadequacies*

Both the company and government have played on the misconception that the Honeymoon groundwater system is isolated, that it is not connected to other aquifer systems and that mining will not affect the natural state. The debate about risk to groundwater can be broken into two areas –

a. *Operational Impact* –
There is a serious and continuing concern that during any mining operations the significant pumping pressure combined with increased mobility of radioactive materials dissolved by sulfuric acid will cause an 'excursion'. In other words will radioactive water be forced into areas outside the control of the process? Given that pressure detection is ineffective, the ability to rapidly detect and remedy an 'excursion' is significantly reduced.

b. *Long Term Impact* –
There are serious and unresolved concerns over whether re-injected radioactive wastes and associated heavy metals will 'attenuate' or continue to 'migrate' after mining is completed. In other words whether the wastes will settle over time or gradually spread to other regional groundwater reserves. Given the unbounded nature of the deposit and uncertainty of its detailed form, the debate comes down to chemistry, computer modelling and assumptions.

Key issues of groundwater impact were only assessed as an 'addendum' to the process. Apart from the concern over due process, the technical assessment methodology was based on a series of inadequate assumptions. Groundwater systems in reality are complex underground structures with naturally formed imperfections which are visually undetectable. To attempt to 'map' the system both drill core sampling combined with hydraulic pump testing must be undertaken.

The greater the number of core samples drilled the greater the system can be 'mapped'. However if samples are taken 500metres apart, uncertainty remains over what lies between the two points. Yet, apart from being commercially prohibitive, drilling 1 metre apart would

turn the system into a 'sieve' greatly increasing the risk of leakage. Given the high variability of lithology of groundwater sands there is little justification for confidence in company assurances on key groundwater issues.

a. Operational Impact

The introduction of pressure pumping and sulfuric acid as a dissolving agent greatly increases mobility and the consequent risk of regional groundwater contamination by radioactive material. The company was required to undertake additional pressure pump testing to assess potential excursions.

> During the field leach trial, Southern Cross Resources reported an excursion, evidenced by data from a monitoring well completed in the Middle Sands. Modification of mining operations resulted in a return to the baseline conditions. The development of this excursion is interesting from the perspective that it appears that there is a reasonable thickness of Middle Clay in the area where it occurred. This poses the question as to whether excursions may be more frequent than Southern Cross Resources expects. Southern Cross Resources must exercise caution during the mining operations.
>
> *Assessment Report for the Environmental Impact Statement, Honeymoon Uranium Project, Planning SA November 2001, page. 62*

The leak occurred in the thickest section of clay layer between the aquifers.

Additional pump testing was conducted in several sequences at the trial mine site during 2001. The sensitivity of pressure testing had already been dismissed by the company as being unable to effectively detect excursions (refer to Honeymoon draft EIS). In addition the methodology involves pressurising the system for only very short periods of time to detect leakage. Leakage in such a natural formation may only occur after pressure is applied over a longer period of time – as would occur during the mining process. The combination of insensitivity and length of time used in the methodology undermine the credence of any assumption that excursions will either not occur or be detected and remedied.

Clay layers (often relatively thin between aquifers) and bore casings are susceptible to leakage due to increased pressure introduced by the mining process. Any leakage that does occur may remain hard to detect, and difficult to remediate.

b. Long Term Impact

The company has proposed to re-inject all resultant radioactive wastes and other heavy metals in solution directly into the groundwater reserve known as the Basal Sands aquifer. The company argued that conditions present in the groundwater would assist the precipitation of materials hence 'attenuating' or returning to a natural state over time. The assumption is based on computer modelling and remedial chemical analysis undertaken.

To assess this aspect of the project, Environment Australia employed Mark Pirlo, a PhD student to model the proposal. Mr Pirlo is on public record as strong supporter of ISL uranium mining. The company, Southern Cross Resources, had previously facilitated Mr Pirlo's academic work for his postgraduate studies. There are serious issues over the independence of his work.
There appears to be no international scientific peer review of Pirlo's work, ie he has no published work.

Pirlo only examined the mixing of contaminated and natural groundwater such as flow away from the mine site. This approach failed to address those time based chemical reactions pivotal in determining whether attenuation can occur and, if so, at what rate.

Pirlo's research immediately assumes certain chemical reactions will occur. This assumption forms the basis for computer modelling purposes. When the results deliver attenuation, Pirlo concludes the attenuation mechanisms he assumed are valid. There is no substantive field evidence produced by Pirlo demonstrating his modelling is accurate and occurring in the field. This is certainly not suitable for assessing controversial proposal that proposes using a technique unfamiliar to the Australian uranium mining industry and its regulatory agencies.

The company and government have refused to release key existing data that could possibly corroborate the time scales that are claimed for attenuation. The monitoring data from field trials at the site in both 1982 and 1999-2001 has never been released due to commercial 'in-confidence' claims. Despite additional work there remains a complete absence of laboratory and field evidence from the company and government to demonstrate, with adequate scientific certainty that their claims are valid and will prove reasonable in the long term.

The available evidence from overseas and elsewhere in Australia suggests that such attenuation mechanisms, even where local geologic conditions are theoretically suitable to promote attenuation either fail to work entirely or cannot overcome the strength of the chemical solutions used to mine.

Once mined, the groundwater system will be unstable for some time and there is no real evidence to suggest the level of instability will reduce or 'attenuate'. Unlike at comparable operations in North America the company is not required to 'actively' rehabilitate the groundwater by adding chemicals that may assist attenuation.

2. Due Process – *Failure of transparent, balanced assessment*

General Comments
Government assessment of the project fails to actively question the accuracy and assumptions made by the company. Large sections of the assessment report are direct transcriptions of the company written Environment Impact Statement without critique. The report fails to address project 'need' and 'no project' options, while denying any public submission on the broader issues of uranium and the nuclear industry.

Due Process
The Honeymoon Uranium Project Environment Impact Assessment (EIA) process fundamentally failed to openly assess one of the key environmental issues – groundwater impact. The company failed to provide any detailed information on groundwater impacts caused by the ISL process or re-injection of radioactive wastes in the Environment Impact Statement (EIS) or supplement. This move prevents adequate genuine public examination, testing or discourse in relation to these impacts through the formal EIA process.

i. Draft EIS – The company is required to present all information on key environmental impacts. The process involves an 8 week period for public submissions.
   NO GROUNDWATER DATA PRESENTED
ii. Supplement EIS – The company is required to address inadequacies in the draft as noted by government and public submissions.
   NO GROUNDWATER DATA PRESENTED
iii. Further Studies – The company was required to prepare further field trials and modelling and present information on groundwater impacts

NO PUBLIC COMMENT ALLOWED, GROUNDWATER DATA ACTIVELY WITHHELD

Key information was either not assessed or kept from the public –

The company, Southern Cross Resources, has actively blocked environment group access to trial mine information during the assessment period. The Australian Conservation Foundation formally applied for access to key information thought the South Australian Ombudsman's Office. The company sought legal action arguing 'commercial in confidence' over public interest. Despite public Ministerial assurances, key project data and documents remain unavailable.

Key information on potential groundwater contamination has never been publicly available. The government assessment process has facilitated approval of the company's project without adequate and reasonable independent assessment.

Conclusion

On the basis of both technical and procedural deficiencies the Environment Impact Assessment of the Honeymoon Uranium Project has comprehensively failed. The central aim of EIA is to safeguard the environment by determining and mitigating adverse impacts of major developments. The presentation of information by the proponent, Southern Cross Resources and its assessment by both SA and Federal Government fails to resolve key issues of radioactive waste management and groundwater impacts.

Friends of the Earth therefore recommends the following:

- A stay be placed on giving effect to any existing mine approvals
- All information pertaining to groundwater impacts and trial mine operations be placed on the public record
- A comprehensive and adequately resourced independent review of the operations and impacts of the Honeymoon project be undertaken
- That no mine process wastes be permitted to be disposed into groundwater
- The company be required to actively rehabilitate groundwater to at least pre-mining standard, as is required internationally.

Further Technical References

Mudd, G M, 2001, *Critical Review of Acidic In-Situ Leach Uranium Mining: 2 Soviet Block and Asia*. Environmental Geology

Mudd, G M, 2001, *Critical Review of Acidic In-Situ Leach Uranium Mining: 1 USA and Australia*. Environmental Geology