

Office of the Environmental Protection Authority
The Atrium
168 St Georges Terrace
Perth, Western Australia 6000

8th February 2016

To the Office of the Environmental Protection Authority,

Re: Assessment No: 2002 (CMS14025)

Please accept this submission on behalf of the Conservation Council of WA, the Australian Conservation Foundation, Friends of the Earth Australia, The Wilderness Society, the Anti Nuclear Alliance of WA and the West Australia Nuclear Free Alliance.

We have major concerns about the capacity of Toro Energy and the feasibility of the Wiluna proposal as a whole and the additional risk this application poses to the environment. Toro Energy's initial proposal for the Centipede and Lake Way deposits was not feasible (Appendix 1) as a single project so the company has sought to expand their proposal. Adding two additional deposits of low grade uranium has extended the life and impact of the proposal but not necessarily increased the economic viability.

The worst-case scenario is that Toro Energy, a small inexperienced company, begins operations but due to economic conditions closes prematurely without adequate rehabilitation. Though the EPA does not consider detailed project economics they can and should consider the capacity of a company to meet their environment commitments. The scenario that Toro will struggle economically into the future, jeopardising the companies' ability to safely manage a project which threatens two lake systems with radioactive pollution must be seriously considered and actively addressed. A company of the size and stature of Toro Energy is particularly vulnerable to external economic factors in this economic climate and in this particular industry¹.

We welcome the inclusion of peer reviewed studies in the PER as a valuable aid in providing expert analysis on the credibility of technical studies. We urge the EPA to consider how peer review studies could be incorporated into all assessments in the future. Peer reviewed studies in assessment documents save the public and the EPA time and resources in analysing every technical report. It is also appropriate that peer reviewed studies come at a cost to the proponent not the tax payer or the public.

From the earliest time we have called for uranium mining in WA to be assessed by way of a Public Inquiry. Never has this been more important or relevant than with the Toro Wiluna expansion. The piecemeal assessment of this proposal leads to a dangerous precedent that the EPA itself has previously cautioned against. The following organisations all signed a letter calling for the Wiluna extension proposal to be assessed by a public inquiry under section 40 (2) (a) of the EP Act 1968.

¹ M.Schneider - World Nuclear Industry Status Report 2015 <http://www.worldnuclearreport.org/-2015-.html>

Australian Conservation Foundation
Australian Manufactures Workers Union WA
Australia Nuclear Free Alliance
Anti-Nuclear Alliance WA
Beyond Nuclear Initiative
Conservation Council of WA
Electrical Trade Union
Friends of the Earth Australia
Greenpeace
Maritime Union Australia

Medical Association for the Prevention of War
Mineral Policy Institute
Public Health Association of Australia
Social Justice Board Uniting Church of WA
Sustainable Energy Now
The Wilderness Society
UnionsWA
United Voice
WA Nuclear Free Alliance

A Public Inquiry would be able to address more strategic questions about the proposal address questions about the company's future plans in the region and address the questions of regional impact should Toro seek to pursue future mining at Dawson Hinkler, Nowthana and Firestrike. This current application and the prospect of future applications at these additional deposits raise serious questions about transport and handling of ore and wastes as well as water requirements.

Signed;

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- Appendix 3: Federal Government Conditional Approval
- Appendix 4: CCWA Report to the Commonwealth Environment Minister: Wiluna Uranium Project
- Appendix 5: Questions on Notice – 26th March 2015
- Appendix 6: Questions on Notice – 5th May 2015
- Appendix 7: Water Corporation – Wiluna Water Reserve Drinking Water Source Protection Assessment
- Appendix 8: FOI – DOW advice to the EPA
- Appendix 9: Medical Statement warning against Toro’s promotion of radiation junk science
- Appendix 10: Photo of Centipede during a wet period

Note: References to Appendix to our submission are presented in text like this (Appendix 1).
References to Appendix to Toro’s PER are presented in text like this – Appendix 1 - .

Toro Energy’s long term plans:

Toro Energy has tenements at seven uranium deposits in the East Murchison and Northern Goldfields. These include Lake Way, Lake Maitland, Centipede, Millipede, Firestrike, Dawson Hinkler and Nowthanna. All of these deposits are described by Toro Energy as the “Wiluna Project”. Toro routinely overstate the level of approval they have obtained for the “Wiluna Project”. Toro further promotes Firestrike as a future prospect and describes Nowthanna and Dawson Hinkler as part of the “Wiluna Project”. A quick look at the company’s website gives a very clear indication of their overall ambition to mine several other deposits in the region.

*Toro state that: “The 76.5M lb project consists **of six deposits**, the approved deposits of Centipede and Lake Way 15 and 30 kilometres south of the township of Wiluna, and the Millipede, Lake Maitland, Dawson-Hinkler and Nowthanna deposits. Further exploration opportunities exist on the extensive Wiluna land package with the Firestrike prospect the most attractive drill ready property.”²*

In this context of incremental project creep, the current segmented and modular assessment approach is inadequate and unlikely to lead to the best environmental outcomes. We have concerns about the company’s long term ambitions for six to ten (three at Lake Maitland) individual mine pits involving multiple deposits over a 200km area that encompasses two lake systems. We are concerned about the impact this kind of project would have on the environment and public health in the affected region. The key factor to consider is that the proponent is likely to favour a single processing site to reduce infrastructure costs. This would mean the carting of ore to a central facility and possibly

² <http://www.toroenergy.com.au/projects/wiluna-mine/>

transporting tailings away from the processing site, or finding additional storage in close proximity to a lake system that periodically floods.

The current proposals to mine Lake Way, Lake Maitland, Millipede and Centipede would result in the generation of about 50 million tonnes of tailings (containing about 85% of the total radioactivity of the ore) to be stored on the edge of Lake Way, in some areas intersecting directly with the lake bed.

If we take the Dawson Hinkler, Nowthanna and Firestrike deposits into consideration when assessing the proposal for tailings management – then these figures are likely to change significantly – as would the capacity of the two mined out pits and Centipede and Millipede to hold that volume of waste.

We are particularly concerned that the company plans to pursue individual ‘salami-slice’ PER processes which would avoid full, integrated and proper examination of a range of significant issues associated with a uranium precinct. We are currently witnessing this approach by the separation of assessment between the Lake Way and Centipede deposits and the Millipede and Lake Maitland deposits and expect this to continue with a later assessment of additional deposits. These concerns are compounded by the failure by the company to adequately describe the project as a whole in the PER documents.

We are aware that this approach of piecemeal assessments places serious limitations on the information provided to the EPA and the EPA’s ability to assess the total impacts of these mines. This approach also denies the public opportunity to view and comment on a fundamentally different proposal. Our concerns extend to the lack of strategic planning in this approach. There is no evidence that the proponent has considered least-impact scenarios for a uranium mining province.

We understand that the EPA can only assess projects that are referred; and so on a case by case basis the EPA must assess these proposals as they are referred. However we note that the EPA has authority to make advice and recommendations under

section 16(e) of the EP Act 1986 to advise the Minister on environmental matters generally and on any matter which he may refer to it for advice, including the environmental protection aspects of any proposal or scheme, and on the evaluation of the information relating thereto, and section 16(j) to publish report on environmental matters generally.

We note that the EPA has, under section 16, on occasion made important public comment on serious environmental issues where there has been an important conservation area or alternatively a proposal with a high risk. This has taken the form of formal advice to Ministers, the publishing of bulletins, media comment and statements in the EPA annual report.

For example the EPA gave the following advice by bulletin in relation to the banded iron stone at Mt Manning Nature reserve: ***“proponents be advised that proposals for further mining in areas of the highest conservation value are unlikely to be found environmentally acceptable;”***

In March 2010 the ABC wrote about the EPA response to the BRL piecemeal assessments – similar to that of Toro Energy at Wiluna:

However Dr Paul Vogel, chair of the EPA says the level of review is justified, and he's critical of what he calls the propensity of some companies to 'salami slice' projects into smaller pieces to avoid public scrutiny.

"We have taken into account in the decision that we can look into the cumulative impacts of the large proposal in setting the level of assessment because it is in the public domain but we would assess this project on its own merits."

In the EPA's 2013 annual report there was an entire section on uranium and public health, where the EPA took on a leadership role by acknowledging the high level of risk to the public and equally the high level of public concern. In the same annual report the EPA also clearly described one of the greatest threats to the WA environment as the cumulative impacts. The EPA declared that while projects may be assessed separately they will not be considered in isolation.

"There is growing need for increased focus on the cumulative impacts of human activities across the State. Whilst proposals referred to the EPA are assessed at an individual level they are not seen in isolation."

Under section 16 of the EP Act we urge the EPA to recommend to the Environment Minister that the whole proposal be re-assessed – including Lake Way, Centipede, Millipede and Lake Maitland and taking into consideration the Nowthanna and Dawson Hinkler deposits which Toro intend to further develop.

Cumulative Impact:

While the proponent has included a section on cumulative impact Toro has not been thorough in this assessment. Toro has not:

- described the impacts on the downstream environment
- given detail on the impacts on receiving environments external to the development envelope
- identified the risk to the environment external to the "disturbance footprint" or "development envelope" in case there is an accident – a spill or a leak that results in offsite impacts
- considered the regional environmental impacts of the existing mine projects in the area, though they note the other mines in their social impact section to describe the regional setting

The mines in close proximity that are described by Toro in reference to social background include:

- Jundee Gold - 45km North East of Wiluna
- Rosslyn Hill Mining - 30km West of Wiluna
- Mount Keith Nickel Mine – 85km South East of Wiluna
- Bronzewing Gold Mine – 165 km South of Wiluna
- Yeelirrie Uranium mine proposal – 70km South of Wiluna
- Wiluna West Iron Ore Project 40km West of Wiluna
- Matilda Gold Project – 5km East of Wiluna.

The proponent does not mention the legacy or abandoned mines or mines on care and

maintenance in the area, including the Magellan lead and Gidgee gold mines and potentially many others.

While Toro has identified some cumulative impact risk areas of the Lake Maitland and Millipede deposits in conjunction with their plans to mine Centipede and Lake Way, there is a broader regional context that has not been considered and, as mentioned, there is no consideration on the proponents' ambitions to further extend the Wiluna project.

A study conducted by the Mid West Development Commission raised a number of regional issues from this level of mining activity (Appendix 2). The two major concerns include transport and the risk of transport accidents (see section below on transport), and water. The study was not able to identify accurate figures for water consumption from each mine or the different aquifers that are being used in the region. We have heard reports that some of the bores on Albion Downs station have dried up and consider regional water consumption as a serious cumulative impact of mining. Toro's proposal could significantly impact on this environmental aspect. The EPA should use their powers to require a comprehensive impact audit of water consumption in the area and impacts to water quality.

The incremental assessment of accepting and assessing one project by one proponent in two separate instalments is part of what the EPA has described as "piecemeal assessments" that can lead to "death by a thousand cuts". Such modular assessment is inconsistent with a comprehensive whole of project impact analysis. We note that Toro Energy has conditional environmental approval for the original proposal to mine Lake Way and Centipede. The State approval is subject to 12 conditions and the Federal approval is subject to 36 conditions (Appendix 3) including the need for the production and assessment of additional environmental and technical studies and reports. We note that an appeal process followed the original EPA assessment of the Wiluna proposal. As a result of the appeal process the State Environment Minister amended five conditions recommended by the EPA and added a further four conditions. CCWA did substantial work identifying deficiencies in the State Environmental Assessment process (Appendix 4).

To our knowledge since obtaining conditional approval in 2012 the proponent has not made substantive headway in addressing any of these conditions. No further detail on compliance progress has been provided in the PER. Until the proponent demonstrates that the existing project conditions can be met, it is premature for the EPA to undertake further assessment based on an assumption that Toro has the capacity to actually meet the conditions already set. It would make more sense for the EPA to require a new assessment of all four of the proposed mines under one assessment and that requires compliance with addressing all conditions of the previous approval as a pre-condition to any new approval.

The current segmented approvals process drains resources from the EPA and other regulators and decision making authorities. Further, it reduces the public's confidence and ability to input, enables the proponent to further avoid scrutiny and paves the way for the gradual expansion of a project that poses a significant risk to the regional environment.

The lack of environmental consideration in strategic planning for the development of these resources is a significant oversight. We strongly urge the EPA to reject the current PER and require the reassessment of the whole project including comprehensive, technical and peer reviewed cumulative impact of Lake Way, Centipede, Millipede and Lake Maitland and alternative scenarios for mining to be discussed.

The Project:

A key component of the project is the processing and storage of tailings at Centipede and Millipede. In some sections Toro discuss the two together in detail while in other areas they are discussed entirely separately. It becomes problematic and confusing when a proponent decides when it is convenient to talk about parts of the project in whole or separately. In one section Toro state that “Ultimately, the Centipede and Millipede pits will join.” PER 5-8. Page 6-5 shows a diagram of the two proposed pits – each pit is half in the Millipede proposal and half in the Centipede proposal. This makes the assessment of these two pits in this piecemeal process even more bizarre. It is bizarre to consider that Toro may mine half a pit and another half a pit simply because the assessment process occurred in this way. It makes no sense that half of a pit has been assessed in a different process and that it is possible that the two assessments may have two different sets of conditions.

This is highly significant because we are talking about the storage of 50 million tonnes of low level radioactive waste – aka uranium mine tailings in these two pits – that intersect/join. There is no schedule or audit of the combined capacity to store tailings (see section on tailings for more on this).

The description of infrastructure for the project describes the haulage road and pipeline for water and ore. *“Due to the location of the Millipede deposit and its proximity to the Centipede deposit no other supporting infrastructure would be required at Millipede”*. There is no clear information about how the tailings would get from the processing plant to the mined out pits. The original ERMP for Centipede simply states that tailings will be pumped from the processing site to the pits – assuming this is through a pipe. There is no description of this infrastructure in either the original ERMP or this PER.

The project description does not offer a comprehensive vision of how the project as a whole will operate, making it difficult to consider all of the risks and potential impacts. The information deficiencies in the current application are significant and should require the EPA to seek clarification from the proponent.

Fauna:

Three species of conservation significance were recorded within the study area:

- Peregrine Falcon (*Falco peregrinus*): WC Act Schedule 4 (Other);
- Brush-tailed Mulgara (*Dasyercus blythi*): DPaW Priority 4; and
- Australian Bustard (*Ardeotis australis*): DPaW Priority 4.

There was a peer review study of three vertebrate fauna assessments of Lake Maitland included in the PER. The three studies considered include: *Lake Maitland Baseline Terrestrial Fauna Survey* (Outback Ecology 2009), *Lake Maitland Infrastructure Areas Baseline Terrestrial Fauna Surveys* (Outback Ecology 2010) and *Terrestrial Fauna Habitat Assessment – Borefield, Accommodation Camp and Access Route* (Outback Ecology 2011). The peer review study was conducted by Ecologia in 2014 - Appendix 10.40 to the PER. In this report Ecologia identify three major inadequacies.

• *“Survey adequacy for the Level 2 survey consisted of four trap nights only at each systematic trapping site for each phase. Current guidelines (EPA and DEC 2010) recommend a minimum of seven nights trapping for each phase;(Pg.vi)*

· *“Systematic sampling was only completed in five of the nine identified fauna habitats, sampling was not completed in the samphire flats habitat despite this habitat being most likely to be impacted upon; (Pg.vi)”*

· *“The likelihood of occurrence for the conservation significant species Night Parrot was incorrectly assessed as low based on recent previous records despite the presence of suitable habitat within the study area. This has resulted in this species not being suitably assessed (Pg.vi).”*

Ecologia’s overall assessment was that the surveying for Lake Maitland is not compliant given that *“The level 2 field assessment does not meet the guidelines within the EPA Technical Guide, Terrestrial Vertebrate Fauna Surveys Environmental Impact Assessment (EPA and DEC 2010), which states a minimum of seven nights trapping should be completed (four nights for both phases completed).(Pg.7)”*

Some of these issues were addressed following the peer review in the further 2015 study - Appendix 10.8 and Appendix 10.36. It is unfortunate that these two additional studies were not then peer reviewed, as per the previous studies.

Despite Toro’s additional studies we have continuing concerns about their overall adequacy. We maintain that they do not go far enough in investigating the development as interrupting an ecosystem subject to significant weather patterns and variance. Appendix 10.8, the Additional Fauna and Vertebrate study, identifies the weather conditions and dates of surveys that were conducted, in a bid to fill the gaps on the quality of previous studies. It is important to note that these additional surveys were only conducted in March of one year. There was little to no rain. The surveys show no seasonal variation and so cannot be considered conclusive. Further surveys should be conducted, and especially during different seasons and under different conditions – e.g after rain, in order to better understand the landscape. This was a criticism of the original studies and one that has not been addressed by the further studies.

We are still unclear on the overall adequacy of the Night Parrot surveys. The likelihood of Night parrots being in the area is slim but cannot be ruled out. Ecologia described the importance of complete studies at the Wiluna proposed mine sites given a number of factors that suggest there is a possibility, however slim, that the Night Parrot could occur here. One of the reasons that Ecologia thought further testing on the Night Parrots should be conducted is because *“the type specimen for species description was collected from Lake Austin near Cue, on approximately the same latitude as the study area (DPaW 2014). The Night Parrot Interim Recovery Plan for Western Australia identifies “the salt lakes of inland Western Australia” as one of five key distribution areas and also noted recent potential sightings south of the study area amongst salt lake systems in the southern wheatbelt region (Blyth 1996). Furthermore, a number of potential sightings have recently been made (2012) within the DPaW managed estate Lorna Glen, which is approximately 100 km north of the study area (pers. com. Neil Hamilton)” and because “the Night Parrot has recently been re-discovered in south-west Queensland by Australian naturalist John Young.”*

As mentioned above - there were some efforts to address the shortfall in studies – and would like to flag the possibility of the Night Parrot occurring in this area, no matter how slim.

Short Range Endemic Invertebrate:

Ecologia conducted a peer review of the studies on Short Range Endemic species at Lake Maitland - Appendix 10.38. Their major criticism was that: *“The assessment includes identification of SRE habitat results. Caution should be applied when assigning SRE species to broad scale habitat preferences, and quantifying the area of potential habitat per species based on this, as has been done in this assessment. The level of assessment completed is not at sufficient scale or intensity to provide detailed habitat preference information per species.”*

Subterranean Fauna:

In this section we go through the various studies of each area – Centipede, Millipede, Lake Way, West Creek Bore and Lake Maitland and then make some overarching comments about assumptions on habitat and the possible range of species.

Centipede:

In the review of impacts to stygofauna and troglifauna conducted by MWH in 2015 - Appendix 10.35 - MWH note the following species at Centipede that could be impacted):

- *“three (9%) species are not known to have distribution ranges that extend beyond the proposed mining area;” – “Brevisomabathynella sp. SAM2 (Bathynellacea); Schizopera sp. TK4 (Copepoda); and Schizopera sp. TK7 (Copepoda).”*
- *“one (3%) species, is not known to have a distribution range that extends beyond the modelled 0.5 m drawdown contour - Schizopera sp. TK10 (Copepoda).”*
- *“The removal of habitat through the lowering of the groundwater table through mine pit dewatering poses a risk to one species Schizopera sp. TK10 whose distribution was not recorded from beyond the 0.5 m modelled drawdown zone.”*

MWH say it is possible for these species to exist outside the impact area because of suitable habitat. There is no description of what constitutes as suitable habitat or what the habitat requirements are for the four species mentioned above. MWH also discussed the usefulness of surrogates to assess likely distributions – we are of the view that the use of surrogates is not sufficient in providing evidence of distribution particularly given the high diversity and levels of endemism of subterranean fauna.

Millipede:

MWH note the amphipod *Chiltoniidae-SAM6* at Millipede could be impacted:

- *“The amphipod Chiltoniidae-SAM6 that had not been recorded previously was the only stygofauna species not found from beyond the proposed Millipede pit boundary.... The amphipod species, Chiltoniidae-SAM6, has been collected from two bores within the proposed Millipede pit area only. Additional Chiltoniidae specimens were collected from Millipede but DNA sequencing was unsuccessful so these species remain indeterminate. The seemingly restricted distribution of Chiltoniidae-SAM6 to within the proposed mine pit impact means this species is of potential conservation concern....The proposed Millipede pit excavation poses a risk to the conservation of one stygofauna species, the amphipod Chiltoniidae-SAM6 that had not been recorded previously, and was the only stygofauna species not to have been found*

from beyond the proposed Millipede pit boundary..... The amphipod, Chiltoniidae-SAM6, was recorded from two Millipede bores only, Gt12 and Gt1-A. It is not possible to reliably assess the distribution range of stygofauna species that are known from only one or two bores. The seemingly restricted distribution of a species to a single bore is likely to be an artefact of that species occurring at low population densities and/or possessing an irregular distribution in response to varying habitat factors, biological interactions and availability of energy resources (Boulton 2000, Boulton et al. 1998, Humphreys 2009). “

The diversity of the habitat features within the Hinkler Well calcrete delta has not been described. The habitat requirements and range of each of these species have not been described. The rate of change to habitat has not been described. Assumptions about the ability of these species to survive in other parts of the Hinkler Well calcrete delta have not been supported with evidence.

Lake Way:

MWH note the following conservation significant species at Lake Way that could be impacted by the removal of habitat and the lowering of the groundwater table as none of these species were recorded below the 0.5m modelled drawdown zone:

- *Paramelitidae sp. SAM2 (Amphipoda);*
- *Brevisomabathynella sp. OES6 (Bathynellacea); and*
- *Parapseudoleptomesochra sp. ?TK2 (Copepoda).”*

MWH suggest that these three species could occur outside the impact area of the mine and drawdown area because there are parts of the Uramurdah calcrete system that will not be affected and has suitable habitat. There is no further description about what constitutes as suitable habitat and no identification of the specific habitat requirements of each of the three species. There is no description of diversity of habitat in the Uramurdah calcrete system.

West Creek Bore:

MWH note the following species at West Creek Bore could be impacted as none of these species have been identified outside the 0.5m drawdown zone:

- *Chiltoniidae sp. SAM2 (Amphipoda);*
- *Brevisomabathynella sp. SAM3 (Bathynellacea);*
- *Brevisomabathynella sp. SAM4 (Bathynellacea);*
- *Parabathynellidae sp. OES13 (Bathynellacea); and*
- *Parapseudoleptomesochra sp. TK2 (Copepoda).*

MWH refer to previous use of the bore and ability for the population to re-establish itself. There are a number of unknown quantities here that should be considered and further explained – how long was the bore used for previously and what was the maximum drawdown from using the bore – how does the previous use compare to the proposed use? What were the species found before the bore was in use and what were the species found after the level or water in the bore recovered? Was there a change in the population and diversity? MWH again suggest that these five species could occur outside the impact area of the mine and drawdown area because of other connected suitable habitat. Again there is no

description of what constitutes as suitable habitat, there is no description of the diversity of habitat within the aquifer, or the specific habitat requirements of the five species.

Lake Maitland:

MWH note the following species at Lake Maitland that could be impacted:

- *“The removal of habitat through mining excavation poses a risk to two of the three species that are of conservation concern. These are **Chiltoniidae sp. SAM4** and **Schizopera sp. TK1.**”*
- *“The removal of habitat through the lowering of the groundwater table through mine pit dewatering poses a risk to **Haloniscus sp. OES1**, one of the three species that are of conservation concern.”*

MWH again suggest that these five species could occur outside the impact area of the mine and drawdown area because of other connected suitable habitat. There is no description of what constitutes as suitable habitat, there is no description of diversity of habitat within the Lake Maitland delta and no description of the habitat requirements of the three species listed above.

MWH note that the current proposal of reinjecting hypersaline water into fresh or brackish water has not been assessed for impacts on subterranean fauna and groundwater dependent ecosystems and poses a serious threat to the quality of water and the habitat for subterranean fauna.

Reinjecting hypersaline water into stygofauna habitat will drastically change the salinity and habitat – it is unlikely stygofauna will survive such rapid change in salinity. Though stygofauna are known to live in hypersaline environments, they can adapt to gradual change to salinity, during periods of low rainfall as levels of salinity slowly increases or during rain when fresh water slowly infiltrates the calcrete. Re-injecting hypersaline water will almost certainly cause a large number of species to die.

Aspects of habitat for further consideration:

The impacts to water quality and habitat from tailings seepage has not been effectively considered as an impact to stygofauna. In the Environmental Management Plan – Appendix 4 – Toro suggest tailings will not have an impact on stygofauna. They include a link to the CSIRO study – Appendix 10.29 – as if to suggest this report considers impacts to stygofauna - in this study there is not a single mention of stygofauna. The reduction of habitat in addition to the impacts of pollution in habitat and water quality should be considered in detail and presented.

Consultants have suggested there is ample habitat and habitat connectivity but have not described the features of suitable habitat. Calcrete is just one overarching feature of the habitat within calcrete there are many be many features. Impacts to those habitat features have not been adequately addressed and so assumptions on the ability for stygofauna to relocate to other parts of the calcrete are unfounded.

Some habitat features and issues are listed below:

1. Habitat is three dimensional – often there are gradients for example there might be fresh water on top and saline or hypersaline water underneath. There may be some

movement of species between gradients but only within certain ranges and would occur gradually.

2. The drawdown of water could impact on the gradients by concentrating salinity in lower gradients making that habitat prohibitive for some species.
3. Rapid change to habitat could – increasing salinity – is likely to lead to a high mortality rate
4. Re-injection of hypersaline water into brackish or saline water will drastically change the habitat and will almost certainly result in a high mortality rate.
5. Habitat features include - water quality, suitability, pH variability, salinity, dissolved oxygen, and calcrete physical structure – transmissivity of alluvial or transitional calcrete. Without understanding the specific habitat features that support individual species and without understanding the specific impacts to habitat no conclusions can be made about impacts to stygofauna.

There is a tendency to use surrogates to suggest a species is more widespread than what is demonstrated with evidence. We note that the new EPA guidelines have weakened the need for evidence in this area. The high levels of diversity and endemism in subterranean fauna and particularly stygofauna amplify the threats to individual species survival, hence our concern in this area.

We urge the EPA to recommend additional studies on water quality, pH variability, salinity, dissolved oxygen, and transmissivity of alluvial or transitional calcrete feature within each of the aquifers and deltas to determine the ability for species to migrate into suitable habitat.

We recommend further studies are conducted to provide evidence on the habitat range of the following species that are currently only found in the impact area of mining and dewatering:

- **Centipede:** *Schizopera* sp. TK10
- **Millipede:** amphipod Chiltoniidae-SAM6, *Schizopera* sp. TK10 (Copepoda) *Brevisomabathynella* sp. SAM2 (Bathynellacea); *Schizopera* sp. TK4 (Copepoda); and *Schizopera* sp. TK7 (Copepoda)
- **Lake Way:** Paramelitidae sp. SAM2 (Amphipoda); *Brevisomabathynella* sp. OES6 (Bathynellacea); and *Parapseudoleptomesochra* sp. ?TK2 (Copepoda)."
- **West Creek Bore:** Chiltoniidae sp. SAM2 (Amphipoda); *Brevisomabathynella* sp. SAM3 (Bathynellacea); *Brevisomabathynella* sp. SAM4 (Bathynellacea); Parabathynellidae sp. OES13 (Bathynellacea); and *Parapseudoleptomesochra* sp. TK2 (Copepoda).
- **Lake Maitland:** *Haloniscus* sp. OES1; Chiltoniidae sp. SAM4 and *Schizopera* sp. TK1.

Flora and Vegetation:

Ecologia conducted a peer review report into the *Lake Maitland Baseline Flora and Vegetation Surveys – May and November 2007 and May 2009* (Outback Ecology 2009) and *Level 1 Vegetation and Flora Survey – Borefield, Accommodation Camp and Access Route* (Outback Ecology 2011) reports.

The Ecologia report described the limitations on the ability to assess impacts to ground water dependent ecosystems: “*Groundwater dependent ecosystems Vegetation communities 2 and 3 within the Level 2 survey of the Lake Maitland Project area were identified to be Groundwater Dependent Ecosystems (GDEs), occurring within 1 km of the impact areas. Potential impacts to this vegetation could not be assessed at the time of the*

report production with further detail of proposed drawdown required to assess potential impact.”

It is important to note that the company could not provide enough detail about the project for the consultants to make a proper assessment. Clearly there are technical aspects of this project that require further detail and definition before any comprehensive analysis of environmental impact can be made by the EPA.

Dust & Air Quality:

We note the peer review study - Appendix 10.43 - conducted by Emissions Assessments on the Golder Associates report on *Background Ambient Air Quality Monitoring (Air Quality Monitoring Plan)*.

There are a number of areas of particular concern that were raised by Emissions Assessments in reference to the Ambient Air Quality Study done for Lake Maitland. These include:

- *“The data set which was developed from the monitoring conducted, may be considered representative of the conditions at the time of sampling. It is noted by the reviewer that that no supporting technical information was supplied with this report (no laboratory results or field notes supplied). Therefore all result data presented has not been interrogated for technical accuracy.”*
- *“Deposition samples were deficient in terms of number of tests. The Dust Deposition samples should be revisited and further sampling conducted. The sampling should be considered in both wet and dry season where possible.”*
- *“The background metals data presented was considered by the reviewer as a point of interest. The series of non-detects for ubiquitous metals (commonly occurring background) requires further investigation, this is especially so for Strontium, Aluminium and Iron. It was also noted that sample TSP sample 10-2748, subsequently analysed for metals concentrations, had no supporting total dust results tabled.”*
- *“The reviewer acknowledges that the Peer Review undertaken is based on a single report provided, and there has been no opportunity to interrogate raw field data in order to verify actual values used in the formulation of the final outputs.”*
- *“The metals results (obtained from the preparation of TSP filters) seem very low in concentration. The reviewer would have expected to see a few common metal compounds above detection limit, at background level. This may impact interpretation of further data generated.”*
- *“The level or intensity of the survey does vary with the individual species reported. For example:*
 - *1. The PM10 and PM2.5 data set would be considered adequate in terms of program duration and spatial intensity.*
 - *2. The TSP data set was collected over March and April, this may be extended in future studies.*
 - *3. The metals data was all reported below detection limit. There were only four filters samples submitted. 4. The Deposited Dust (Insoluble Solids) data was based on 5 samples conducted between December 2010 and February 2011**Overall the data would be sufficient with TSP being considered moderate and Dust Deposition be considered inadequate.”*

- *“It is noted that TSP (multi-day) filter 10-2246 subsequently used for metals analysis is not listed in the TSP results table, and does not have an associated TSP value assigned to it.”*
- *“The Deposited Dust (insoluble solids) sampling would be considered deficient in terms of duration and the number of data points generated throughout the study period. There is a real potential for future results to vary significantly, based on relative meteorological conditions.”*
- *“It would be recommended that further baseline sampling be conducted for Dust Deposition in order to better understand dust deposition impact as a baseline.”*
- *“The findings lack any technical supporting data in terms of instrument calibrations, methodology and personnel training. It is assumed that the NATA accreditation for the results presented provides traceable technical data.”*

EA make a number of comments saying the report is sufficient – however the detail of their report suggests that due to the flawed methodology and lack of data there is a high level of uncertainty. We consider this level of uncertainty to be unacceptable and inconsistent with the EPA’s obligation to apply the precautionary principle.

In the review on the Air Quality Impact Lake Maitland conducted by Golder Associates, the reviewer Emissions Assessments gave emphasis to the recommendation made by Golder Associates for the need to do real time air quality data collection in the first few years of operation.

“The reviewer agrees with all recommendations provided, and would place an emphasis on collection of further real time air quality data, throughout the construction and initial year operation... It is important to note that should the mine layout, extraction profile, processing technology or transportation methods change, this model should be revisited.”

The Golder Associate report recommends that dust can be reduced by 50% to 75% in different areas by applying 2 litres per square meter every hour - Appendix 10.66 Pg 53. We have not been able to complete a water balance to see if this recommendation has been picked up by Toro and what would be the further impacts of applying this volume of water. Questions also remain about the quality of that water and potential impacts of the surface application of that much water of a particular quality.

EA also suggest *“Further investigation of Deposited Dust / Air-Dust background and during mine site development would be considered important with respect to impact.”*

Toro have indicated there will be dust monitoring and the results will determine if more or less monitors will be deployed - Appendix 4 Environmental Management Plan pg 10-8. However Toro have not committed to real time air quality data collection in the initial years. Such data is needed to identify base line conditions and any future impacts on air quality.

Serious questions remain about the integrity of the studies provided as a baseline study with which to measure future changes. It is unclear how these reports consider or relate to Toro’s plans for dust management. This is most concerning considering the lack of detail provided in the PER about ore stockpiling which represents one of the most significant dust and emissions risks.

We note in the PER that there is mention of the risk, there is mention that stockpiles would be on ROM pads – but there is no information on the ore content of stockpiles, the volume

of stockpiles, the period of time ore will be stockpiled for, or how dust and water would be managed from those stockpiles.

These assessments have not adequately addressed these issues. We have no confidence the proponent has provided sufficient information in this regard and are not confident that the consultants could adequately consider this risk factor on the basis of the material provided by the proponent.

We highlight here concluding remarks from EA that must not go unaddressed: *“The Deposited Dust (insoluble solids) sampling would be considered **deficient in terms of duration and the number of data points generated throughout the study period**. There is a real potential for **future results to vary significantly, based on relative meteorological conditions**. It would be recommended that further baseline sampling be conducted for **Dust Deposition** in order to better understand dust deposition impact as a baseline.”*

*“The development of the scope and approach with the technical methodology overall was reasonably developed and executed. **The findings lack any technical supporting data in terms of instrument calibrations, methodology and personnel training**. It is assumed that the NATA accreditation for the results presented provides traceable technical data.”*

Based on these comments and others outlined above we urge that the PER be rejected and the proponent be required to resubmit the PER with more complete and credible studies. Dust deposition is a significant issue and one with public health implications, particularly in regards to uranium ore that has radioactive chemical content as well as heavy metal content and the close proximity to the town of Wiluna, Bondinis and Kookabubba.

Erosion and Sediment:

We note the findings of the Landloch 2015 peer review study of the Golder Associates MIKE21C Sediment Transport Modelling report. The peer review made the following statements of significance:

- *“Landloch could not support the specific recommendations made in this report. Landloch’s concerns are based on the model and methodologies used, and the magnitude of event modelled.”*
- *“The survey undertaken was performed by driving through Lake Maitland and the upstream contributing catchment to observe the condition and variability of these two areas. **As such, a strict definitional survey (e.g., grid based) was not conducted for this study**, but rather a reconnaissance/impression survey. A traditional survey based study will use discrete sampling to characterise the element(s) within the area of interest, and then extrapolate to the study area as a whole. For example, soil pits are used to produce an area soil map. In this study, the Project area and contributing catchment were characterised by discrete sampling (Section 2.2.2 below) that was used to parameterise the model, and the model was used to account for the character of the entire study area. Therefore no survey level can be attributed.”*
- *“However, it is questionable whether erodibility can or should be described on the basis of critical shear values alone. **For flood flows, sediment properties could strongly impact on erosion rates, but no sediment data were obtained or considered**. Clay-rich sediments are commonly aggregated (Nanson and Maroulis, 2006), so that estimation of sediment properties on the basis of dispersed particle size is unlikely to yield accurate information.”*

- *“The contributing catchment area was not sampled due to technical problems with the rainfall simulator whilst in the field. **The contributing area sediment load was therefore estimated without any field-based data.** In terms of estimating detachment by flood flows, it is questionable whether a measure of rates of detachment by drop impacts and shallow surface flows under a small rainfall simulator (3 m² plot area) would have any relevance, but the point is moot given the simulator was not used.”*
- *“An important element in the MIKE21 model is grid size, and this was not presented in the report. Typical approaches use a 20x20m cell size, but it is unclear whether the resolution was finer or coarser for this study. For example, small resolution size is better able to pick up low relief arid zone drainage patterns which can be broad through going braided patterns as distinct from a single well confined channel.”*
- *“The operational and post-disturbance scenarios use the erodibility characteristics of field sample LMO16 for the disturbed area material. The justification for using this value was not clearly detailed in the report.”*
- *“The report methodology, being based on such a large flood event, **does not provide any information that may inform sediment and erosion control plans such as the size of events that cause runoff, range of runoff events, storm size and sediment concentration correlation, sediment properties, and surface hydrology and flow routing to calculate sediment basin/drain size and location.**”*

Landloch has condensed their overall assessment of this area through recommendations and a gap analysis – below are some of those key statements, recommendations and key deficiencies:

- *“Landloch could not support the specific recommendations made in the Golder (2011a) report, and has concern with the approach taken in general.”*
- *“The model used MIKE21 is a powerful hydrodynamic model that was developed in Denmark to model water flows and sediment transport in coastal and estuarine environments.”*
- *“Landloch however finds that the use of the MIKE21 to model a 1,000 year flood event does not take into account more typical conditions that cause erosion and sedimentation in a WA arid environment, and that have been shown to cause landform failure via erosion.”*
- *“Landloch would be extremely cautious in using the report’s recommendation of a 100mm medium sand capping of disturbed areas as a long term option for closure planning.”*
- *“The modelled event does not yield information that could be used to design sediment and erosion control plans for the operational phase, nor for the development of robust mine closure plans, except to highlight the areas of highest risk.”*

We could not identify any further studies following this report nor could we see any acknowledgment of this critique or proposed future studies by the proponent. If that is the case we again urge that the EPA to reject the proposal on the ground that there is not sufficient data on sediments, erosion and the potential impact on tailings and mine closure and rehabilitation. This crucial information deficiency also applies to the stability and security of bunds and other landforms including ore stockpiles (which are not well defined or described in the PER).

Water:

Hydrogeological Studies:

In the hydrogeological and hydrological report review conducted by Klohn Crippen Berger (KCB) - Appendix 10.45 - a number of deficiencies are identified in the study of Supply Groundwater Modelling conducted by Aquaterra in 2010.

To start with the Numerical Groundwater Model – from the West Creek Water Supply Groundwater Modelling had an unacceptable SRMS error and on occasion the SRMS error was not provided at all. In section 4.1 of - Appendix 10.45 - KCB indicate the computer modelling of groundwater is not conclusive, KCB state:

- *“Initial calibration results provided a scaled root mean squared **error of 13.6%, higher than the accepted 10% error for undeveloped catchments and 5% for developed catchments.**”*
- *“Calibration hydrographs for bores in the West Creek Borefield and the Apex Southern Borefield were presented, however, **SRMS error results were not presented.**”*
- *“Steady-state **calibration results exceed acceptable guideline values** when the entire monitoring data set was included as the calibration data set. **Removal of monitoring records was required to achieve acceptable model calibration.**”*
- *“Transient calibration results **did not include error statistics** for the comparison of observed and predicted groundwater levels. Although mass balance results indicated that flow in and out of the model was relatively balanced, **the lack of groundwater level calibration statistics indicate possible uncertainty in the calibration.**”*

In the KCB review of the Bore Completion Report – Millipede Uranium Project conducted by Pennington Scott in 2015 it is revealed that:

- *MPD_2P1 – hydraulic conductivity estimate of 5.0 m/d ($T = 105 \text{ m}^2/\text{d}$), based on analysis of constant-rate test recovery curve. However, **the constant-rate test drawdown curve displayed a boundary condition near the end of test which was not incorporated into analysis or discussed during the interpretation. RPS (2015) applied a different hydraulic conductivity value (35 m/d) in the groundwater model than the analysed result of this investigation.***
- *MPD_3P1 – hydraulic conductivity estimate of 10 m/d ($T = 148 \text{ m}^2/\text{d}$), based on analysis of the constant-rate test recovery curve. **Variations in drawdown curve near the end of the test duration were not included in the interpretation of the aquifer parameter values.** The hydraulic conductivity estimate (40 m/d) applied by RPS (2015) in the groundwater model differed from this investigation.*

KCB reviewed the Centipede – Millipede Groundwater Impact Assessment conducted by RPS in 2015 see section 4.3, again KCB found that modifications were made on a number of occasions to support calibration. The limitations to the study identified by KCB include:

- *“The developed numerical groundwater level was established for assessing a project at a level of a pre-feasibility study.”*
- *“Aquifer parameters associated with the infill tailings and waste rock materials were assumed.”*
- *“Transient calibration of the model domain was not conducted. This results in less confidence in the simulation results for seasonal conditions beyond the average conditions.”*

- *“A limitation not highlighted in the report was the lack of discussion associated with the hypersaline groundwater in the vicinity of the Centipede and Millipede deposits. The potential impacts associated with density dependent flow and migration of tailings infill seepage with more saline and dense groundwater was not discussed.”*
- *“Justification for the reinterpretation of the Pennington Scott (2015) aquifer parameters were not provided.”*

On the review undertaken by KCB of the Wiluna Uranium Project – Surface Hydrology Studies conducted by Aquaterra in 2015 KCB note that:

- *“under PM P conditions **all deposits are located within the floodplain of Lake Way and the local creek flooding, and could be impacted by flooding.***
- *Rainfall records are based on daily rainfall events. Therefore, the assessment of storm events shorter than 24 hours is unable to be undertaken.”*

The KCB review of the Groundwater Studies – Lake Maitland Uranium Project conducted by Golder in 2011 4.5. raise that there is some uncertainty : *“Uncertainty in the model results may arise when simulation of storm and/or seasonal events are undertaken, as comparison or predictive simulation results against the **actual groundwater conditions have not been completed.**”*

The KCB review of the Lake Maitland Uranium Project – Hydrologic Studies & Site Water Balance conducted by Golder, 2011, 4.6 identified some limitations in the data inputs and assumptions:

“100 years and, longer durations ARIs from 100 to 1000 years were undertaken. These calculated rainfall events were used to develop intensity-frequency-duration curves. Golder identified limitations to the calculated design rainfall events include:

- ***Rainfall records for periods shorter than 24 hours are not available, therefore, short term duration design events are not validated; and,***
- *For ARIs calculated for storm events less than 24 hours BoM assumes these represent more localised events <1000 km², while durations of 24 hours and longer represent the entire lower catchment of the project site catchment.”*

Some of the observations made by KCB are more significant than others. The question for the EPA and other decision makers is how much uncertainty is acceptable given the unique and long term risks associated with uranium mining.

Key studies presented in this PER contain deep uncertainty and flaws and several surveys were not conducted at all – in particular survey’s conducted during wet conditions. We have repeatedly presented the view to the EPA that computer modelling is limited. This peer review study shows just how limited these studies are and how open they are to error and manipulation. We submit that these hydrological studies were deficient in multiple areas leaving a high level of uncertainty and therefore are not acceptable and should not be approved. Given that this proposal is for six mine pits on two lakes mining a radioactive material, proposing to divert and re-divert a creek system and eventually seeking to store fifty million tonnes of radioactive mine tailings on drainage line at the edge of a lake these reviews are critical to getting the project right (or less worse). This report provides evidence that these studies are flawed and do not provided the certainty required in order to approve this application.

Computer models in preference to real data, particularly in reference to surface water and wet conditions, cannot deliver a range of important information about the aquatic environment – see more details below.

KCB provided a summary of deficiencies that paint a very serious picture of uncertainty and lack of detail and real data:

- Two data points were removed to achieve compliant calibration statistics
- Calibration statistics for transient calibration were not included
- Analytical assessment and interpretation of the test pumping results were not appropriately conducted incorrect sections of the drawdown curve were selected for the analytical assessment
- Aquifer hydraulic parameters calculated by Pennington Scott were not adopted by RPS (2015) in the Centipede-Millipede Deposits groundwater model. The drawdown curves were reinterpreted by RPS prior to inclusion in the groundwater model.
- Numerical model was developed for assessing a project at a pre-feasibility level.
- Aquifer properties of pit infill material were assumed
- Transient model calibration was not conducted; therefore, simulated seasonal variability was not validated
- The potential for density dependent flow as a result of the hypersaline groundwater, particularly the potential to contribute to contaminant migration from the infilled pit, was not discussed in the report.
- The potential for density dependent flow as a result of the hypersaline groundwater, particularly the potential to contribute to contaminant migration from the infilled pit, was not discussed in the report.
- Evaporation records were sourced from the Meekatharra weather station 200 km west of the project site, although Class A pan evaporation mapping for the project site indicate similar values.
- Calibration of the numerical models were conducted to steady-state conditions only. Therefore, confidence in the modelling results is based on the assumed average conditions of the groundwater system. Uncertainty in the simulation results may arise when the simulation of storm and/or seasonal variability rainfall scenarios is undertaken.
- Rainfall records were sourced from weather stations with a minimum frequency of daily records. Therefore, calculated storm durations less than 24 hours were unable to be validated.
- Evaporation records were sourced from the Meekatharra weather station 200 km west of the project site, although Class A pan evaporation mapping for the project site indicate similar values.

Again we recommend that the EPA reject the proposal on the grounds that there is not sufficient evidence to support the proponent's claim that the risks can be managed.

Surface Water and aquatic environment:

Toro Energy has been operating at Lake Way since 2007. There have been numerous occasions where there has been flooding and filling of the salina system at Lake Way and yet the company has relied on inconclusive conceptual computer models in preference to real data.

We wrote to Dr Paul Vogel on the 23rd of March 2011 alerting him to a significant rainfall event which filled the salina systems of Lake Way and Lake Maitland. We called on the EPA to recommend the proponents take the opportunity to measure their latent productivity

and to detect endemic aquatic macro-invertebrates. We suggested that this opportunity would give the proponents a chance to develop hydrodynamic and geochemical models for these salina systems and an accurate characterization of their biodiversity values. We wrote to Paul Vogel again on the 16th of March in 2015 alerting the EPA to another significant rainfall event and the opportunity to review the test pit at Centipede. This was also an opportunity for Toro to conduct surveys at Lake Maitland under wet conditions.

On the 26th March 2015 the Minister for Agriculture and Food representing the Minister for Mines and Petroleum provided answers to Questions on Notice asked in Parliament in reference to high rainfall and flooding at Lake Way. The questions were surrounding the opportunities presented by the rainfall to test. In response the Minister said this (Appendix 5 & 6):

“In the ESD, there is a requirement for Toro to complete the following environmental and hydrological studies:

- 1. surface water, hydrological and flood studies in relation to mining at Millipede, Centipede, Lake Maitland and Lake Way;*
- 2. hydrological studies and laboratory testing to estimate the frequency, magnitude and duration of flooding events which may affect the project area during or following the active life of the mine; and*
- 3. external review of all hydrological studies.*

We note that while there has been an external review of hydrological studies these studies have revealed serious deficiencies in the studies and laboratory testing – see sections above and below. There is a serious lack of data and surveys on surface water as noted by Ecologia Environment Peer Review study conducted by Ecologia Environment on Aquatic Baseline - Appendix 10.37.

Toro instead suggest in their Environmental Management Plan that *“Surface water monitoring in both lakes would commence during Project construction and continue throughout operations. The locations of this monitoring would be decided before the commencement of construction and reviewed before the commencement of mining and/or processing operations”* Pg 8-5 - Appendix 4. This lack lustre commitment to monitoring is inadequate. Given that Toro had multiple opportunities to monitor and collect data and failed to do so puts the proponent’s claims, capacity and commitments into question.

The peer review study conducted by Ecologia Environment on Aquatic Baseline - Appendix 10.37 - studies for Lake Maitland identify that there has been an absence of studies conducted during wet conditions. Ecologia note the importance of such studies to understand the biodiversity – residential species, migratory species, dormant species, ecological function, physio- chemical properties, flooding regimes, increased pollution and identifying risks.

“The assessment has an important knowledge gap related to the fact that all wetlands are best studied during wet conditions following a substantial flood event. While such requirement was completely beyond the control of those conducting the aquatic assessment (Outback Ecology) due to no flood event taking place during the fieldwork period, the gap is still a significant one. The report recognises this fact, too, and makes recommendations towards it.

While sampling during dry conditions allows for mapping of the lake geomorphology, sediment chemistry and some taxa that inhabit it, it does not allow for:

- *a comprehensive list of resident taxa,*
- *characterisation of biological assemblages and their succession in time, and*
- *an accurate evaluation of a broader ecological function of the lake (e.g. use by migratory birds)*

This is mainly because sampling during dry conditions limits data collection to a fraction of a real diversity and abundance, while collection methods themselves may influence the outcomes of sampling (Brandão et al. 2014). In addition, subsequent re-hydration of samples under laboratory conditions may provide different environmental cues for hatching than those in nature (Caê Ceres and Schwalbach 2001). Therefore, some species that are very abundant under natural conditions may not hatch at all under laboratory conditions, while those relatively rare in nature, may be present, adding to a skewed view of species composition and function (Caê Ceres and Schwalbach 2001). This is especially valid when evaluating the resilience of the ecosystem based on the species that inhabit it and their potential response to changes. Such changes include:

- *flooding regimes, which can result in inability of resting stages to hatch and existing eggs/ spores being buried in the sediment and thus not able to contribute to re-colonisation (Stephens 1990);*
- *physico-chemical properties (e.g. changes in salinity or pH, leading to change of biota and/or destruction of resting propagules of original biota) (Stephens 1990; Faustová et al. 2004); or*
- *increased pollution, presenting potential risk to resident biota and other organisms that depend on the ecosystem (e.g. migratory birds) (Wurtsbaugh and Jones 2012)*

If such changes are likely due to the LMUP development, additional data collection during wet conditions will become essential to evaluate the lake's ecosystem stability, and to design a long-term monitoring and management plan."

Please note the advice from Ecologia is to collect more data during wet conditions to evaluate the lake's ecosystem – which would then provide the information to design a long-term monitoring and management plan. This is significant because it highlights that the current shortfall in data means there is not sufficient information to design a long term monitoring and management plan. This further supports our organisations view that Toro's commitment to monitoring is too little too late. The EPA should have required this higher level of data to be collected, especially given the number of times we have alerted the EPA to prime conditions for conducting such studies.

Toro have numerous statement through the PER seeking to excuse why they did not conduct these in-depth studies. These reasons are not valid, particularly considering that there have been numerous occasions to conduct studies and time to develop strategies to overcome barriers to conducting surveys during wet conditions. Toro have not conducted surveys in wet conditions at either Lake Way or Lake Maitland. Toro have had tenements at Lake Way for around nine years and access to Lake Maitland for over two years – including during the 2015 rainfall event. The challenges and opportunities for surveys should be understood and we expect that such important studies for understanding lake systems and wetlands be conducted before any EPA approvals are given. These rainfall events that were opportunities now present a risk, and a risk that is not well understood due to the lack of data.

There was ample opportunity to collect data and the proponent's failure to do so shows a lack of credibility and a lack of commitment to do what is necessary to ensure the protection of the environment in which they intend to operate a uranium mine.

Flooding and Surface Water:

In the Wiluna Uranium Project – Surface Hydrology Studies by Aquaterra in 2015 – Appendix 10 - the following aspects of the proposal are described which pose a serious risk to the environment in flood conditions. Not only are the pits at risk from flooding, so are the ore stockpiles all with radioactive chemicals and heavy metals. The bunding to protect mine infrastructure also has the potential to change water flows and cause erosion, the impacts of this are not well understood and have not been well defined or explored:

- *“Three deposits are located within the 100 year floodplain of Lake Way and will require bunding for protection; however, under PMP conditions all deposits are located within the floodplain of Lake Way and the local creek flooding, and could be impacted by flooding.”*
- *“Development of project infrastructure at Lake Maitland will significantly impact flood levels and flow velocities within the lake. An immediate increase in flood levels by 1 m to 1.3 m during a 100 year ARI, and 1.5 m to 2 m during a PMP, upstream of the bunded project area is simulated. Flow velocities are predicted to increase from ~0.6 m/s to 1.5 m/s as a result of the project development.”*

Aquaterra recommended that *“Project infrastructure location of the floodplains of contributing creeks, or crossing creeks, will require bunding”* and noted that *“Encroachment of bunding onto the floodplains or creeks will result in flow restrictions and increase water levels upstream, therefore, bunding within the vicinity of the main channel should be limited and diversion channels for the main channel (for short periods of time) should be considered.”*

The proposal however includes plans for bunding on the lake bed itself – Lake Maitland and in major drainage lines – like West Creek, and Centipede and Millipede. Diversion channels if considered would not be for short periods of time rather we expect they would be for the life of mine. The proposal also includes building haul roads through drainage lines.

Aquaterra noted that *“The selected southern haul road route crosses several ephemeral drainage lines. Due to the relatively flat topography across the project areas, the structures proposed at the creek crossings include floodways, floodways with culverts or full flow culverts.”*

Aquaterra also note the limitations to the study on rainfall noting that *“Rainfall records are based on daily rainfall events. Therefore, the assessment of storm events shorter than 24 hours is unable to be undertaken.”*

In the hydrological review by KCB - Appendix 10.45 - there were concerns raised about the impact on surface water flows during flooding – particularly at Lake Maitland where there are proposed pits in the central parts of the lake.

The proposals to bund and divert ephemeral creeks at Lake Way as well as bund Millipede, Centipede and the three pits at Lake Maitland when put together could have substantial impact on surface water flows during flooding. There is no clear picture of where water will

be diverted from and to at each individual structure. The unknown aspects of surface water hydrology pose a significant risk in that the proponent does not have the necessary real data to base their designs on and have not presented these designs or this level of detail.

We are concerned about how contaminated water would be managed in event of flooding. Toro has stated that *“In the event of large storms and the inability of Toro to contain all storm waters within the Project, Toro has reserved the right to discharge water onto the lake to enable operations to continue. In this case, surface water quality would be analysed for basic chemistry as well as for radionuclide contamination. Where the chemistry is at or below the guidelines for drinking water established in ANZECC 2000, approval would be sought to discharge water. Where the water exceeded a particular value it would be captured and used in the processing circuit or diverted to the evaporation ponds for disposal”* - Pg 8-3 - Appendix 4.

This water management strategy is not very detailed and prioritises commercial operations over environmental considerations. It does not identify the diverse number of situations that could arise that would undermine this particular strategy.

In the situation that water ‘exceeds a particular value’ there are a number of questions that are not raised or answered in any of the reports:

- where would this water be on site – in pits, on the surface, in diversion channels,
- how would this water be captured
- if evaporation ponds are already full and overflowing where would this water be put
- what if processing were not occurring at that time due to the flooding and inability to move ore (or any other myriad of problems) where would the water go
- If both options for using contaminated water - in processing or storage in evaporation ponds were not viable at the time - and no approval given to discharge water – what would occur in that situation and what would be the environmental impact of that situation.

Change in weather patterns:

In - Appendix 10.1 - Surface hydrology studies, the consultant RPS has given a very brief overview of rainfall in the Wiluna area. They have not included any analysis or discussion on the well documented changes rainfall patterns. For nearly ten years the Bureau of Meteorology in partnership with the CSIRO has produced a report called *“State of the Climate”* which offers insights and predictions about various climatic changes. Over the years they have consistently said that in inland parts of WA there is likely to be more intense rainfall.

The 2007 CSIRO and BOM report suggests that there is likely to be a combination of high rainfall events, increased rain but variable rain over summer and less rain over winter. They suggest that there will be increased intensity of extreme rainfall events.³

The 2010 State of the Environment report noted *“the geographic distribution of rainfall has changed significantly over the past 50 years.”*⁴

³ Commonwealth of Australia 2007, State of the Climate Report.

⁴ Commonwealth of Australia 2010, State of the Climate Report.

The 2012 CSIRO and BOM report noted that there is higher than normal rainfall across the Centre.⁵

Similar observations and predictions are made in the 2014 State of the Climate report produced by the Bureau of Meteorology and the CSIRO which state that *“the frequency and intensity of extreme daily rainfall is projected to increase”* and *“tropical cyclones are projected to decrease in number but increase in intensity.”*⁶

This combination could lead to unexpected rainfall that could impact on the integrity of the proposed mining infrastructure. When you combine the lack of real data on surface water hydrology, the lack of understanding about the diversion of water, the risk of erosion to bunds from increased water flow on top of the likelihood for rainfall to intensify in the region – it is clear that there are unquantified risks to the two Lake systems from this proposal and that more data and detail is required.

Cumulative Impacts from water extraction:

In our joint submission into the original Wiluna proposal we noted that there is no water allocation plan for the Northern Goldfields/ West Murchison. In fact there isn't a water allocation plan for the whole of the Goldfields and the Murchison.

In response to our submission the DoW and EPA referred to the Wiluna Water Reserve Drinking Water Source Protection Assessment conducted by the Water Corporation in 2004 (Appendix 7). In the 2004 assessment there was no consideration of mining as a land use or major consumer of water. There was a focus on the drinking water bores around Wiluna that did not consider regional water; there was no consideration on environmental allocations of water, mining allocations or allocations for other land users. Nor was there consideration of water recharge in the area.

Following the original assessment of the Wiluna uranium proposal we lodged an FoI application to determine what information had been considered in the assessment of the water allocation aspect of the proposal. We received the correspondence from the DoW to the EPA (Appendix 8) stating that their advice is based on *“a study of the Groundwater resources of the Northern Goldfields published in 1999 by the Water and Rivers Commission. The study mapped a continuous paleochannel aquifer system extending across the Northern Goldfields, including the Wiluna area.”* Also in the advice the recommended that the proponent find an alternative water source to the West Creek Bore.

We can see no evidence in previous assessments or this assessment that the DoW or the proponent has reviewed the current allocation in the region or the sustainable yield of the recharge rates of the aquifers. There does not appear to be any regional study on current water extraction rates or impacts. There are no clear indications on what the regions environmental water needs are.

The reliance on studies conducted in 1999 and 2004, 17 and 12 years ago, is concerning given the significant amount of mining activity in the region and significant water allocations for those mines over the last 17 years. The regional water yield should be considered in the context that there are also several mine projects in the region under assessment and others

⁵ Commonwealth of Australia 2012, State of the Climate Report.

⁶ Commonwealth of Australia 2014, State of the Climate Report.

in Care and Maintenance that are looking to re-open. There is still no clear picture of how much water is currently being taken from the region for mining.

Through the DoW processes there has been ongoing granting of licenses based on outdated studies without any evidence on water balance in the region following 12-17 years of water allocations to mining. The EPA continually defers water related issues to the DoW – in this case we are not convinced that the DoW has sufficient or current information about water consumption and impacts in the Northern Goldfields to base their assessment.

The proponent has suggested that *“Managing the cumulative impacts of water abstraction in the West Creek/ Wiluna South area is a matter that can be regulated by the Department of Water through its licensing powers under section 5C of the Rights in Water and Irrigation Act 1914.”* PER 12-45

The Department of Water does not assess or consider water quality outside drinking water. Their scope as a Government agency does not include cumulative impacts on water quality. While they may consider volumes of water and water use, we are not confident that the DoW can or will assess or consider cumulative impacts on the water quality. As mentioned above we are also not confident that the DoW has sufficient evidence about water yields in the region to base their assessment on water allocations. Clearly this is a matter of significant public interest and assessment decisions need to be based on comprehensive and contemporary data.

Tailings Management:

Following the initial approval of the Toro Wiluna uranium proposal, Toro wrote to the Hon. Tony Burke on the 4th February 2013 making a series of claims downplaying the risks of disposal of radioactive mine waste – tailings - in a lake bed. One particular claim raises alarm bells on the companies understanding and commitment to the proper management of radioactive mine wastes. Toro claims that the ***“existing in-situ uranium ore is more radioactive than the tailings would be as the processing extract 85% of the uranium and only 15% of the uranium remains in the tailings.”*** This comment deliberately confuses uranium and radiation in ore and waste rock and tailings. The comment by Toro alludes to the removal of 85% of the risk by stating that 85% of the uranium will be removed – removing 85% of the uranium does not mean removing 85% of the radioactivity of the ore. In any typical uranium ore body the uranium accounts for about 15% of the total radioactivity of the ore body – this is defined in a Federal Government technical report⁷. Consequently mining uranium leaves 85% of the radioactive material behind to be disposed of and managed. The ore once stable has now been mined and milled and become more mobile and bioavailable – thus posing a far greater risk to the environment⁸.

The elements that make up this waste include radioactive elements thorium-230 and radium-226 and some uranium is also left behind as waste. Tailings will also emanate radon 222 gas – a breakdown element of radium 226 - radon is the second leading cause of lung cancer globally according to the World Health Organisation (see section on health below).

⁷ Waggit, P. 1994. A Review of worldwide practices for disposal of uranium mill tailings. Technical Memorandum 48. Supervising Scientist for the Alligator Rivers Region.
<http://www.environment.gov.au/science/supervising-scientist/publications/technical-memoranda/review-worldwide-practices-disposal-uranium-mill-tailings>

⁸ *ibid*

The comment made by Toro suggests that uranium mining will significantly reduce the total radiation signature of the area. At best mining could reduce 15% of the total radioactivity and rather than reducing risk it will instead take an ore body that is relatively stable and make 85% of the radioactivity more bio-available - effectively increasing the risk of exposure to radiation. The selective presentation of information on radiation is typical of the behaviour and presentation of information about radiation that Toro disseminates. Toro Energy has in the past sponsored three speaking visits by the Canadian scientist Dr Doug Boreham who argues that low-level radiation is actually beneficial to human health. This fringe view has been discredited by leading international health organisations and directly attacked by domestic public health and radiation experts. We see the continued promotion of such fringe views on radiation as dangerously deceptive and - as some medical professionals have said – it may be time for Government intervention. Over 40 medical professionals produced a statement condemning the promotion of fringe scientific views and called for Government intervention, specifically naming Toro Energy for their involvement in this practice (Appendix 9).

In March 2015 the Hon. Robin Chapple flew over the proposed uranium mine site and trial mine pit at Centipede – some weeks after the actual rainfall event. In photographs of the site there is clear visibility of Toro’s trial pit at Centipede. The aerial photographs were taken by the Hon. Robin Chapple some weeks after the rainfall event. In the photographs you can see damp areas of the trial pit where the rain has infiltrated the trial pit (Appendix 10 - See right hand side of the photo about a third of the way up the page). This pit is where the proposed tailings would be stored. That the site of the proposed tailings retained so much water is of concern for the ongoing management of tailings and possibility of seepage. This issue has not been acknowledged or discussed by the proponent. This current assessment process needs to actively consider how the tailings would be secured under wet conditions.

Tailings and mine closure:

In pit tailings may be the least worst option for managing radioactive waste but the threat posed by such close proximity to the lake is a very poor option. There are significant risks associated with the management of low level but long lived radioactive waste such as uranium mine tailings - challenges made worse when there is a risk of water and seepage.

In Toro’s Tailings Risk matrix – Appendix 1 - we note that there is no clear consideration of time. For example there is no indication of a change in risk over time. In the Mine Closure Plan there is some consideration of tailings seepage over time – but this appears to only consider seepage under normal conditions. Time represents increasing risk as the infrastructure put in place to secure tailings diminishes, the intensity of storms/ increase of high rainfall events and slow erosion from normal weather takes its toll. These factors represent greater risk post mining when there is no active management of the site.

The risks that will increase over time include

1. Increased mobility of elements in waste rock as a result of mechanical disturbance
2. Loss of containment or contaminant behaviour not conforming to modelling
3. Erosion of tailings cap and site flooding due to extreme rainfall
4. Inappropriate design or construction of cover system – or cover system degradation over time
5. Insufficient depth of cover over the tailings

In - Appendix 10.46 - the peer review study on sediment and erosion clearly point out concerns about the capping of tailings using sand and the erosion over time through regular climatic events and winds:

“Landloch would be extremely cautious in using the report’s recommendation of a 100mm medium sand capping of disturbed areas as a long term option for closure planning.”

Landloch provides more details on why the 100m medium sand capping is not a sound recommendation:

“This recommendation ignores what may potentially occur to a 100mm sand capping layer at closure over a long period of time and for processes other than flood events. For example, wind erosion is an important erosion process in arid environments and could compromise the sand layer over time, as could concentrated flows from other parts of the site interacting with disturbed areas during storm events. Landloch has experience in examining the failure of cover systems where, even though rock was used, it was inappropriate due to its weathering characteristics. Also, there may be smaller, higher intensity storms that cause greater shear on the sand layer above the 6.5 Pa identified in the report.”

These design failures may not be obvious during operation or for the first few years post closure but may appear later. In the case that these problems emerge later the potential impacts would include:

1. Seepage of metals or radionuclides into groundwater – accumulation of contaminants in biota & contamination of groundwater.
2. Discharge of water and/or sediment from area of breached tailings cover – contamination outside the project footprint.
3. Upward migration of metals or radionuclides through the cover system – bioaccumulation of contaminants in soil and vegetation
4. Release of radioactivity in the atmosphere – localised radiation levels above background.

These scenarios have all been documented by the proponent in the tailings risk assessment but have not clearly incorporated the additional risk of time and design and infrastructure degradation over time or modelling flaws.

In Toro’s section on Radioactive Waste Management - Appendix 7 - and in the draft Environment Management Plan – Appendix 4 – there are two small paragraphs in each outlining Toro’s proposal for tailings storage. In - Appendix 7 - there is some description of capping and revegetation without discussion or acknowledgement of the risks of erosion or infiltration and any of the many impacts or outcomes of those two system failures.

In - Appendix 4 - Toro acknowledge that *“seepage could increase groundwater uranium concentrations significantly”*. They go onto say *“seepage from the TSF would not lead to significant impacts to local groundwaters and would therefore not impact local subterranean fauna populations”* citing the CSIRO review conducted on behalf of Toro (Prommer, et al. (2015). In this short and limited discussion on the environmental impacts of tailings Toro have singled out the lack of impact to subterranean fauna but avoided discussing any other potential impact – and given a reference for this CSIRO report - Appendix 10.29 - as if to give this assertion weight. On review of the CSIRO report - Appendix 10.29 – there is not a single mention of subterranean fauna.

On review of - Appendix 10.29 - we note that CSIRO made the following more substantial comments about the tailings *“The results of the supplementary modelling scenarios illustrate that under the currently made assumptions a number of factors may allow elevated uranium concentrations to migrate further than in the originally defined modelling scenarios. Increases in predicted uranium concentrations were found as a result of considering uranyl-calcium complexes in the simulations and also as a result of modifying source-term assumptions from a slug-type fluid release to a more continuous source release.”*

CSIRO suggest the following studies should be conducted to remove the ‘geochemical uncertainties’ in this case uncertainty that represents risk: CSIRO report - Appendix 10.29

- *a refined hydrogeochemical field-site characterisation (upstream and downstream of the proposed TSF).*
- *a detailed mineralogical characterization that identifies the mineral inventory*
- *characterisation of potential TSF solutes*
- *batch sorption tests for uranium and vanadium with various sediment materials from the aquifers that are potentially affected by leakage from TSF facilities*
- *developing site-specific surface complexation models that capture the characteristic sorption behaviour of the sediments along the major transport pathways*
- *laboratory-scale column testing of uranium migration with sediments, groundwater and other aqueous solutions that most likely represent the composition of fluids egressing from the proposed TSF facilities. The tests would be aimed at using site-specific material to demonstrate and validate geochemical processes that cause U immobilisation*
- *controlled field-scale push-pull or forced gradient injection test that verify the attenuating role of Fe-sulfides and other attenuation processes*
- *assessment of suitable techniques to assist in engineered immobilization of contaminants in tailings solutes and/or in the surrounding aquifer*

Section 4 of the CSIRO report goes into more substantial detail on the further studies needed, and why. The advice for additional studies is significant, there are several uses of strong language to highlight just how important these additional studies are – for example:

*“A second objective of the present report was to suggest a series of future studies that will reduce the **substantial uncertainties contained in the current model predictions due to the current use of literature-derived rather than site specific model parameters**..... The results of the supplementary modelling scenarios illustrate that under the currently made assumptions a number of factors may allow elevated uranium concentrations to migrate further than in the originally defined modelling scenarios. Increases in predicted uranium concentrations were found as a result of considering uranyl-calcium complexes in the simulations and also as a result of modifying source-term assumptions from a slug-type fluid release to a more continuous source release.”*

We certainly agree with the comments by the CSIRO and many of the consultants involved in peer reviews who have all stated that computer modelling cannot substitute for real data and site studies. Given the lack of understanding on how tailings would interact with the environment we urge the EPA not to approve this proposal but rather, at a minimum, require the proponent to complete the recommended studies by the CSIRO listed above.

Tailings During Operation:

Toro have clearly identified that they need to have enough space in the mined out voids at Millipede and Centipede. The Mine Closure Plan states that *“At Millipede, sufficient pit void space needs to be left to take tailings generation from the processing of ore mine at Lake Maitland, and at Centipede the same is the case for Lake Way tailings.”* This is common sense, but common sense statements do not equate to an actual plan with a detailed management plan.

There is no actual tailings balance or accounting for the capacity of the mined out voids to take tailings, nor is there any clear indication what volume of tailings would be produced annually. There is discussion on the tonnage of tailings but no clear description of the volume. There is no clear identification of what the capacity of the mined out pits is for tailings storage. Tailings capacity and storage has been an issue at the Ranger uranium mine in the Northern Territory - granted that has been due to monsoonal rain, but none the less a problem that has and could occur.

There doesn't appear to be any discussion about any interim storage of tailings before disposal in pit. Given that two small pits are expected to host the tailings from operations at six pits there is some cause for concern about the capacity to hold that volume of tailings. This is more concerning given that the proponent has not documented this balance of material or explained the management strategy for tailings storage.

Serious questions remain unanswered - where will tailings be stored for the first year – or will ore be stockpiled for a year and processing will only begin when the first cell at Centipede is ready to receive tailings? See section below on ore stockpiling.

Our analysis of the PER and the 70 odd Appendix has not found a clear explanation of this aspect of the proposal and we remain concerned that there is a lack of both real data and a real plan. Without such data and planning this core part of the project that represents the greatest long term environmental risk should not be approved.

Ore Stockpiling:

In PER section 11 on the terrestrial environment there are a few mentions of ore stockpiling and environmental risk – but there is no clearly defined plan for stockpiles. It is interesting that Toro has acknowledged the risk of stockpiling mineralised ore, but fail to present a comprehensive plan for stockpiling ore. Rather than a plan there is a list of commitments:

- *As far as practicable all stockpiles would be located outside drainage lines and where this was not possible, diversions around the stockpiles would be created.*
- *All ore and waste stockpiles would be bunded to catch runoff and flow-through water and this water would be used to suppress dust on the stockpiles.*
- *Further engineering studies would investigate methods of dust mitigation or control, including stockpiles and the processing plant.*
- *Toro would undertake progressive rehabilitation and aim to return waste, overburden and soils as a matter of practice.*
- *Where soils need to be stockpiled, stockpile height would be capped at 2 m and regular monitoring and inspections would take place.*

It is unclear if there is a need to stockpile ore or just overburden or both and how much ore, overburden needs to be stockpiled and for how long. On the question of ore stockpiling it is not clear if there is some issue with stockpiling and capacity to store tailings – e.g. does ore need to be stockpiled until there is sufficient capacity in a mined out pit at Centipede or

Millipede to store the tailings? It is very hard to comment on the risks of stockpiling ore when there is no clear proposal for ore stockpiling. It is only in the Conceptual Mine Closure Plan that Toro suggest it will take two years until tailings will be stored in the mined out pit – there is no discussion here of the ore stockpiling for possibly two years.

There are obvious risks and Toro has touched on some of these, including risks with dust, particularly with mineralised ore and issues of leaching from the stockpiles and runoff during rain. Without having a clear proposal of how much ore would be stockpiled for how long and without identifying what is the chemical and heavy metal content of the ore we do not see how the proponent can credibly claim that they can manage this risk and we fail to see how the EPA could approve this aspect of the proposal.

Mine Closure:

Mine closure is one of our key concerns about uranium mining given the unique make up of uranium mine tailings which pose a risk to the environment for tens of thousands of years.

There are many generic concerns we have about the integrity of tailings, failure of rehabilitation, acid metalliferous drainage, erosion and salinity. In addition to these generic concerns we are particularly concerned about Toro's plans for the following reasons.

Toro has outlined two options for the disposal of the processing facility – *“At the end of its useful life, the processing plant would be decommissioned, dismantled and either buried in mined out voids or removed”*. Burying in mined out voids or being removed are two very different options with a range of implications particularly if the option of burying the processing plant is chosen. The option of burying the processing plant should be disqualified as an option as there has been no environmental assessment of that proposal. This is a serious issue when you consider that the processing plant will have radioactive content and that the proponent has not identified the capacity of the mined out pits at Centipede and Millipede to hold the tailings from six pits – let alone the processing plant. The option to transport and store the processing facility at Lake Way and Lake Maitland should be disqualified – as Lake Way will have an ephemeral creek running through it. The pits at Lake Maitland should be disqualified as they are in the middle of a Lake Bed.

We are still concerned about the proposal to store tailings at Centipede and Millipede, given its proximity to Lake Way, that it is in a floodplain, and that there is still so much uncertainty about the hydrology of the area and a significant lack of data (see above section on tailings and various sections on water).

Toro has made a case for leaving the water pipe from Lake Maitland to the processing facility, post closure, saying that there will be twenty years of recovery over the area originally disturbed when laying the pipe. There is however no discussion on the environmental impacts or risk of keeping the pipe line in place. There is no supporting evidence for the claim that *“the environmental benefits of leaving the pipeline in place outweigh any benefits of its removal”* - Appendix 3 MCP Pg 4-15.

Toro have come up with a theory that there is a hypersaline barrier that stops uranium moving into the lake – they attribute this to the CSIRO study and use this to make the suggestion that the tailings will not infiltrate the lake system because of the natural saline barrier. As mentioned above in the section on Tailings we note that the CSIRO report - Appendix 10.29 – actually identify that a number of studies to collect real data need to be

conducted to reduce what appears to be an unacceptable level on uncertainty about how tailings will interact:

- *a refined hydrogeochemical field-site characterisation (upstream and downstream of the proposed TSF).*
- *a detailed mineralogical characterization that identifies the mineral inventory*
- *characterisation of potential TSF solutes*
- *batch sorption tests for uranium and vanadium with various sediment materials from the aquifers that are potentially affected by leakage from TSF facilities*
- *developing site-specific surface complexation models that capture the characteristic sorption behaviour of the sediments along the major transport pathways*
- *laboratory-scale column testing of uranium migration with sediments, groundwater and other aqueous solutions that most likely represent the composition of fluids egressing from the proposed TSF facilities. The tests would be aimed at using site-specific material to demonstrate and validate geochemical processes that cause U immobilisation*
- *controlled field-scale push-pull or forced gradient injection test that verify the attenuating role of Fe-sulfides and other attenuation processes*
- *assessment of suitable techniques to assist in engineered immobilization of contaminants in tailings solutes and/or in the surrounding aquifer*

Given the lack of data and evidence to prove that tailings can be contained in the long term we urge the EPA to recommend the project not be approved until the studies listed here are complete and provide evidence that tailings can be contained for no less than 10,000 years (as stated in the 2012 motion passed by Liberal and Green MLCs in the WA Parliament).

Regulating uranium:

We take this opportunity to draw the EPA's attention to the findings of the Bureau d'audiences publiques sur l'environnement (BAPE) inquiry into the environmental and health impacts of uranium mining in Quebec, Canada. This Inquiry is the most recent and comprehensive review of uranium mining to occur globally. The BAPE panel found that there are *"significant gaps in scientific knowledge of the impacts of uranium mining on the environment and public health."*

BAPE recommended that a new regulatory system in Canada would be needed to regulate uranium mining. This view is at odds with the view and actions of the DMP and other WA Government agencies that have been making attempts to normalize and integrate uranium into risk based regulations.

WA's approach is not only at odds with the BAPE findings but is also at odds with advice given to the DMP from their own advisory group - the Uranium Advisory Group (UAG). UAG was established by the DMP to benchmark WA's regulations for uranium mining with 'World's Best Practice'. There were several areas where WA regulations fell short. The UAG made recommendations that the DMP amend the 1999 Tailings Guidelines. Inexplicably in the 2013 updated guidelines there is not a single mention of uranium.

Under current regulations there are serious, but untested, limitations in the DMP's ability to hold companies accountable for non-compliance with environmental conditions. In the Mining Act 1978⁹ there are no heads of power given to the Department of Mines and

⁹ WA Mining Act 1978 http://www.austlii.edu.au/au/legis/wa/consol_act/ma197881/

Petroleum to regulate or enforce conditions on environment or assess Environmental Management Plans. A DMP report on improving environmental regulations contains many recommendations to improve compliance with the environment.¹⁰ Despite this there are still no legislative powers for the DMP to enforce compliance with environmental obligations. Equally there are no powers for the EPA to enforce environmental conditions imposed by the DMP.

In light of the Canadian regulatory problems and lack of scientific evidence the BAPE recommended that uranium mining not be approved. It is irresponsible for WA agencies to press ahead with an industry that has failed to deliver on basic promises of compliance and rehabilitation across Australia and without serious reflection or uptake of advice from the Uranium Advisory Group. We urge the EPA to consider the BAPE findings and heed the warnings found in the panel's recommendations.

Annual Environmental Reporting:

In the section on Annual Environmental Reporting (AER) in the Environmental Management Plan - Appendix 4 – Toro make the claim that all aspects of the mine and all the results from monitoring programs will be released in the AER. They list some of the monitoring programs with the disclaimer that it's not limited to the list and Toro has clearly made many omissions in this list. At this point we expect that the proponent should be capable of syncing their environmental management plan and expected Annual Environmental Requirements into a complete and concise document. This section of the EMP is vague, lacks clarity and leaves potential room for the proponent to either self-define or dodge reporting requirements.

A quick review of the Department of Mines and Petroleum mine database – MINEDEX reveals that out of 3382 active mine projects in WA only 661 have active annual environmental reporting. Whether this is because of an issue with MINEDEX, an inability to apply annual environmental reporting on some mines or just a lack of compliance with regulations it is clear there are serious problems with the annual environmental reporting system. Many of those 661 active annual environmental reporting requirements are held by environmental consultants – not mining companies. On a quick search of those 661 projects with listed Annual Environmental Reporting requirements we note that many sites did not have an annual environmental report on MINEDEX and no indication that they are compliant with their requirements to lodge an AER.

Rehabilitation Securities/ bonds/ MRF:

There is no clarity, commitment or acknowledgement of any requirements to hold bonds or securities for the rehabilitation of the proposed Wiluna mine. Following the original assessment of the Lake Way and Centipede deposits there were clear requirements for a 100% bond for the Wiluna uranium mine proposal. The Premier Colin Barnett on the 23rd of September, 2012 stated *“the minister has made it very clear that since there is an issue in parts of the community, Toro uranium will operate under a 100 per cent performance bond,*

¹⁰ Department of Mines and Petroleum – Report – Reforming Environmental Regulation
[www.dmp.wa.gov.au/%2Fdocuments%2FReforming_Environmental_Regulation_in_the_WA_Resources_Industry_-_Final_Report_to_Minister\(1\).pdf&ei=CtjYUv6hNozckgWDv4HIAg&usg=AFQjCNF2CAXTOIMy7Aj0QdloZiRMMWFI Tg&sig2=rZAgQrD68R9j0Flx1millw&bvm=bv.59568121,d.dGl&cad=rja](http://www.dmp.wa.gov.au/%2Fdocuments%2FReforming_Environmental_Regulation_in_the_WA_Resources_Industry_-_Final_Report_to_Minister(1).pdf&ei=CtjYUv6hNozckgWDv4HIAg&usg=AFQjCNF2CAXTOIMy7Aj0QdloZiRMMWFI Tg&sig2=rZAgQrD68R9j0Flx1millw&bvm=bv.59568121,d.dGl&cad=rja)

*and may continue under that indefinitely.*¹¹” The requirement for a bond is also one of the 36 conditions on the mine imposed by the Federal Government on the original assessment.

Under the Mining Rehabilitation Fund and new Mine Closure Guidelines, the requirements for bonds are now only applied if there is a Ministerial decision. There is concern that the political desire of the Government to approve and establish a uranium mine may cause a Minister to be lenient on bonds to show support and good will to the company and the industry. The clear view of the Department of Mines and Petroleum is that bonds are a disincentive for mining companies and an economic barrier to developing mines. There is a clear economic barrier for uranium mining given the low uranium price and lack of investment. These economic factors should be a cause to apply further bonds to better protect the environment and the state from the closure liabilities. These economic factors should not be used as a reason to be lenient on the company in applying further bonds. This is particularly important given that the community concern identified by Premier Barnett in 2012 remains high in relation to WA’s proposed uranium sector.

What is best for environmental protection is an incentive to rehabilitate. That incentive to rehabilitate is best achieved through bonds. Without bonds mining companies can (and often do) leave mine sites un-rehabilitated or in preference to rehabilitating may put the mine in Care and Maintenance for an extended time. We note the arguments by the mining sector to closure costs are low when there is progressive rehabilitation - while we support progressive rehabilitation this does not equate to mine closure. Mine closure with progressive rehabilitation can still be expensive and costs should not be passed on to the taxpayer or compromise the MRF that has struggled to meet targets of generating funds.

Ministerial discretion may be influenced by industry advocacy or short term political considerations. Bonding for the proper and long-term management of uranium mine tailings should not be politicised. It should be enshrined in law to ensure rehabilitation, the ongoing protection of the environment and effective long-term management of tailings. Such an approach would also facilitate building the community confidence needed to sustain an industry’s social license.

We submit that Toro should not be exempt from the MRF but in addition to the 1% levy Toro should be required to provide a bond that equates to 100% of the expected cost of closure and that this bond be reviewed and adjusted annually. We recommend this for all mines but emphasise the need on this arrangement for uranium mining given the unique risks, complexity and costs associated with rehabilitating uranium mines.

There are clear reasons why mine securities for uranium mines should be applied:

1. The uranium market is particularly volatile and is dominated by low prices. The industry has presented overly optimistic forward projections that may be quite out of touch with reality. We have seen a number of uranium projects in Australia close, downsize and sell off assets indicating that optimism around long term projections is not warranted. This is clear in the recent decision by Rio Tinto to withdraw support for the extension to mining at the Ranger operation in Kakadu. In the case of any new proposals there is a real risk that they

¹¹ WA Parliament Hansard ASSEMBLY Legislative Assembly Wednesday, 26 September 2012] p6544b-6555a. Mining Rehabilitation Fund Bill 2012.

will open and then close prematurely without rehabilitation, leaving a burden on the taxpayer and the MRF to rehabilitate and secure the site.

2. There is no incentive for companies to rehabilitate. An article by the Charmian Barton from Norton Rose Fulbright LLP summarised the problem with removing bonds in this way *“The requirement for a performance bond creates the main incentive for meeting closure and rehabilitation obligations. Payment of an annual levy under the new Fund may not create the same incentive. In transitioning to the Fund, comparable incentives and enforceability will need to be provided through DMP’s environmental compliance regime. Failure to do so presents a significant risk to the state. It is currently unclear how DMP will treat performance bonds in the future or how the existing performance bond regime will transition to the Fund.”*¹² Again please note that under the Mining Act 1978 the DMP does not have powers to enforce environmental conditions.

3. There is no example in Australia of a uranium mine site that has been successfully rehabilitated. The world’s best practice for uranium rehabilitation was carried out at Wismut in Eastern Germany at a cost of US \$9.3 billion. Please note the West Australian Government made a promise to deliver world’s best practice uranium mining - and currently the world’s best practice uranium rehabilitation costs approximately \$9.3 billion.

4. Rehabilitation of uranium mines is disproportionately high, even below world’s best practice standard rehabilitation is likely to cost hundreds of millions. For example the projected costs of the rehabilitation of the Ranger uranium mine in the Northern Territory is upwards of AUD \$512 million¹³.

5. Uranium tailings are different to other mine wastes and pose a long term risk to the environment and public health. The unique problems of uranium mine tailings are noted in the Management of Radioactive Waste from the Mining and Milling of Ores (IAEA, 2002a). It states *“Of the different waste streams produced by mining and milling operations, tailings represent the greatest challenge, particularly in terms of long-term management, because of the large volumes produced and their content of very long lived radionuclides and heavy metals”*.

6. The Department of Mines and Petroleum engaged the Uranium Advisory Group to benchmark WA regulations for uranium. In the final report to the DMP in relation to bonds they said this *“Bonds should reflect the maximum, full third party costs of closure and rehabilitation. While this requirement may not be that onerous for true ISR operations, when applied to conventional mining operations (where TSFs and waste rock dumps have to be rehabilitated), the costs could be extremely high. Nevertheless, this requirement is entirely appropriate and should be retained.”*¹⁴

We urge the EPA to recommend a 100% bond, annually reviewed and adjusted, be applied to any approval for uranium mining at Wiluna.

Offsets:

¹² <http://www.lexology.com/library/detail.aspx?g=23ed12dc-57fd-441b-bb0d-5e50ee7c7e3b>

¹³ ERA 2014-2015 Annual Report <https://www.erawa.com.au/about-us/annual-report>

¹⁴ Uranium Advisory Group Final Report
http://www.dmp.wa.gov.au/documents/UAG000408v05_April_12-pmd_v2.pdf

Toro assert that the project has no requirement for offsets as all the impacts they have identified can be avoided, minimised or rehabilitated. In previous sections we have outlined many impacts and scenarios that have not been considered and no doubt there are more. If there is an incident that cannot be “avoided, minimised or rehabilitated”, measures should be in place so that Toro compensates for such an occurrence through pre-determined offsets.

Offsets are the fourth element in the mitigation hierarchy of first, do no harm; second, minimize; and third, mitigate any residual impacts. Offsets and other compensation are the last option if the other three cannot be accomplished. The term “offset” is often used interchangeably with “compensate.” “Compensation” has several meanings, including financial payment for impacts as in “impact-compensation contracts,” or it can mean measures designed to counteract harm or impacts¹⁵.

The goal of compensatory offsets is to achieve a clear net gain of ecosystem function. Toro merely aims to minimise the project’s impacts.

An example of an area where there is a possible impact but insufficient information to determine the impact is in the Outback Ecology 2009 study into GDEs which states *“Potential impacts to this vegetation could not be assessed at the time of the report production with further detail of proposed drawdown required to assess potential impact”* (Outback Ecology 2009). There has been a lack of data provided for consultants to conduct an assessment. It is premature for Toro to claim there will be no impact and therefore no need for offsets. The piecemeal approach to assessment creates this ongoing problem where consultants, the EPA, other agencies and the public are left to make some assessment on a proposal that has not been well defined. Uncertainty, particularly when it is due to the failure of the proponent to provide full studies and collect real data, should not be used to presume no impact. This is counter to the guiding precautionary principle that is supposed to underpin the ethos of the EPA.

With phrases such “as far as practicable”, “likely to”, “where possible” and “minimise” that are nebulous and littered throughout the PER, there are few clear standards or benchmarks.

Section 8 of the PER, Energy and Greenhouse Gases Toro state that they have “*undertaken an analysis of Project greenhouse emissions under two scenarios:*

- *The main fuel source for the Project is diesel; or*
- *Power generation using natural gas.*

They have not considered the Greenhouse gases that would be released from land clearing, or transport. There has been no consideration of alternative energy sources like solar wind which are much less carbon intensive. Toro claim to be concerned about the greenhouse gas emissions and climate change - often capitalising on climate change to promote their business. However they show a lack of understanding about carbon accounting and a lack of credibility on climate change as they show no interest of offsetting their carbon emissions from mining and transporting ore.

The Offset Table in the PER states that *“Annual surveys would commence one-year post rehabilitation to assess whether species are returning to disturbed areas. Surveys would assess diversity and abundance, the presence of weeds and evidence of grazing. Ongoing*

¹⁵ Goodland, R., 2012. Responsible mining: the key to profitable resource development. Sustainability, 4(9), pp.2099-2126.

monitoring would assess how the composition of the ecosystem is changing and analog sites in similar vegetation types and ecosystems would be used to gauge how rehabilitation was progressing.” It does not go on to say what will be done in the event of species decline and who would be responsible for any action that would need to be undertaken.

The Offset Table states that the survey and research plan is *“likely to be ongoing in some form throughout the life of the Proposal to provide information for continuous testing and refining until an effective rehabilitation method is developed”*. It does not detail under what circumstances the plan will discontinue.

Offsets should ensure that there will be gains of sufficient magnitude on the offset site to compensate for losses¹⁶. If Toro’s Wiluna expansion proposal goes ahead, the losses to the inherent value of the site should be compensated for so that there is a net gain to the environment and the community.

Section 17.3 Proponent Studies and Investigations states *“As a result of the assessment of Toro’s proposal for mining at Centipede and Lake Way, and on the recommendation of the EPA, the Minister for Environment applied an offset in his Ministerial Decision as a condition of approval of that proposal (EPA Report 1437; Ministerial Statement No. 913). This offset requires Toro to implement a survey and research plan with a minimum total monetary value of \$900,000 to conserve and improve scientific knowledge of Tecticornia species.”* The offset of a survey and research plan framed by monetary value rather than outcome shows that the process is more about economics than environmental objectives and outcomes. Toro *“does not believe any impacts have been identified that cannot be effectively mitigated through avoidance, minimisation and rehabilitation such that there would be no material residual impact on the environment from implementation and subsequent closure of the Proposal.”* However, Moring & Hutt (2001) argue that *“It is well to concede at this point that any mining or industrial activity will inevitably cause some environmental damage. The overall benefit to the country must be offset against this damage.”*¹⁷

It has been suggested that *“best-practice mining companies should agree to contribute at least 1% of profits (or revenues, or even better, of the value of the minerals extracted) to environmental conservation efforts in their area of operation, as proposed in IUCN’s World Conservation Congress Resolution 4.085 of 2008: establishing the 1% Earth Profits Fund. This contribution should be above and beyond any compensatory offsets, linked to inflation, and standard even if the project does not offset.”*¹⁸

At a minimum, Toro should ensure that there is a net gain to the environment and the community, not only their bottom line.

Transport:

In a recent study by the National Transport Insurance, Australia (NTI) on truck accidents there were some key findings that are relevant to WA. Some key findings are listed below:¹⁹

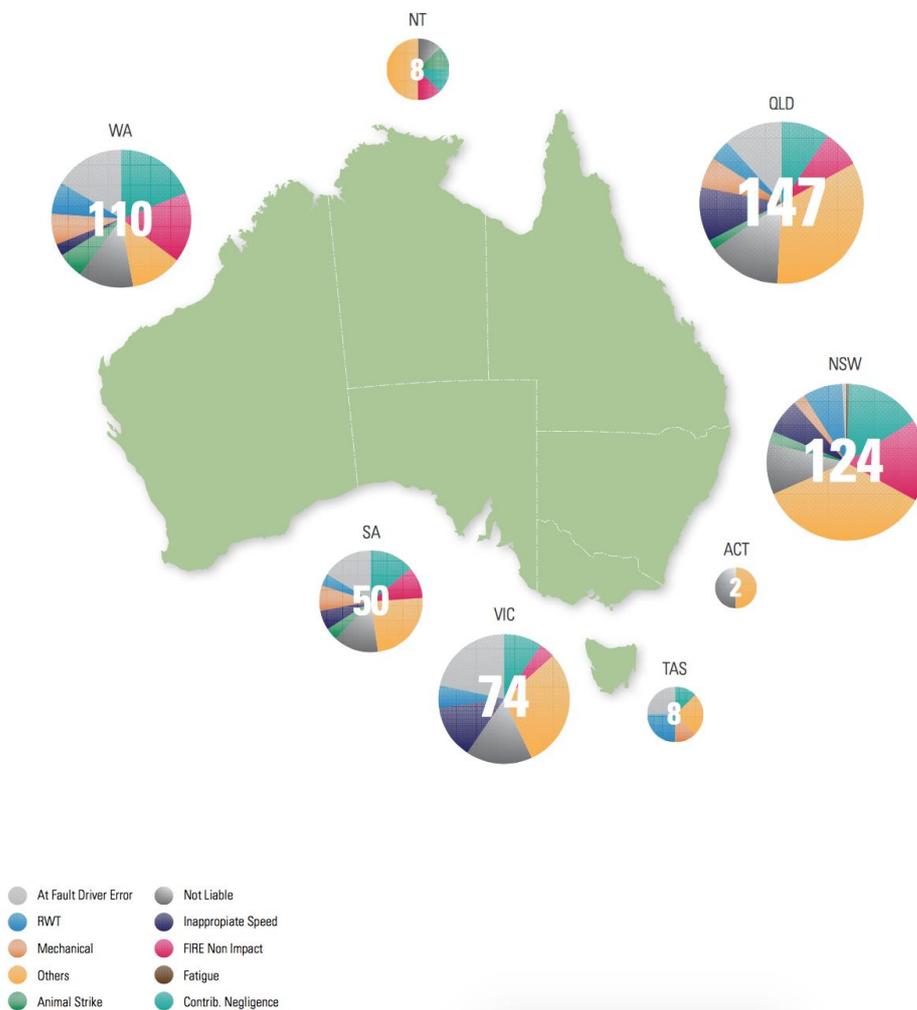
¹⁶ Gibbons, P. and Lindenmayer, D. B. (2007), Offsets for land clearing: No net loss or the tail wagging the dog?. Ecological Management & Restoration, 8: 26–31

¹⁷ Morin, K.A. and Hutt, N.M., 2001. Environmental geochemistry of minesite drainage: Practical theory and case studies, Digital Edition. MDAG Publishing (www.mdag.com), Surrey, British Columbia. ISBN: 0-9682039-1-4.

¹⁸ Goodland, R., 2012. Responsible mining: the key to profitable resource development. Sustainability, 4(9), pp.2099-2126.

¹⁹ http://www.nti.com.au/files/files/NTARC/2015_Major_Accident_Investigation_LR.pdf

- “Western Australia was noteworthy with the highest proportion (30%) of major crash incidents attributed to fatigue.”
- “Queensland and Western Australia continue to be over represented in large incidents when likened to their share of the freight task. We did comment in that report that this could in fact be attributed to the growth in the freight task servicing mining communities usually in remote areas. This again seems to be the case when we chart the actual location of incidents.”
- “As highlighted in the 2013 crash report, the worst performing State was Queensland followed by Western Australia.”
- “Most incidents occurred between the hours of 10.00 and 16.00 when the on-road population of commercial vehicles is at its highest.” This point highlights the increased risk factor with more trucks on the road. This is a cumulative risk that should be considered with increased trucks from other mines or proposed mines.
- “Truck fires continue to account for 10.7% of large loss incidents with electrical failure accounting for 68.5% of cabin / engine compartment fires.”



The Transport Management Plan – Appendix 9 – is written as a draft and makes promises to include things like an emergency plan for dealing with UOC at some later date. There are some areas of the preliminary response to an accident that lack any meaningful description, including

- Control and prevent any additional spread of radioactive contamination;
- Recover the radioactive material, packaging and transport equipment;
- Decontaminate equipment in preparation for rail and/or road transport; and
- Decontaminate and restore the surrounding environment to an acceptable standard.

In these broad objectives of managing a potential road or rail accident, there is no description on how Toro intend to fulfil these activities. What to do with decontaminated waste that may not at that point be suitable to go back in the UOC barrels. Or will everything go back in the barrels? There is no clear plan on whether they would continue with the shipment of the product or return it to the mine site. Restoring the surrounding environment to an acceptable standard is ambiguous - what is an acceptable standard? Normal background levels of radiation? Who decides?

Toro identify that police, fire and emergency services will be first on the scene. We note Toro are considering providing training to those services – it is unclear on which services between Wiluna, Port Adelaide and Darwin they will give training to. There is no clear indication that Toro has identified the services along the transport routes or understood not just their level of training but their capacity and willingness to respond to a radioactive incident.

Toro has suggested that they have consulted with communities and stakeholders along the transport route, but have not identified the dates or times of those consultations, or who the stakeholders are. Certainly communities we are in touch with in Ceduna – Kokatha Mula Munda and the Port Adelaide group NOWPA were not aware of consultations and were not invited. Any basic survey of those areas would have identified those groups as stakeholders.

The suggestion that protests or blockades pose the biggest threat to transport is absurd. That a protest or a blockade would be done in such a way to create an accident endangering transport workers, emergency services and the environment is counter to the objectives of groups opposed to an expanded Australian uranium sector.

Australia's Uranium Industry:

Uranium accounts for a tiny percentage of Australian export revenue. In the 2011/12 financial year²⁰:

- uranium accounted for 0.19% of national export revenue (the 2013/14 figure was also 0.19%²¹ and the figure for 2014/15 would be very similar);
- uranium revenue was 4.4 times lower than Australia's 20th biggest export earner, wool;
- uranium revenue was 8.7 times lower than Australia's 10th biggest export earner, aluminium; and
- uranium revenue was 103 times lower than the biggest earner, iron ore.

²⁰ ACF, 2013, 'Yellowcake Fever: exposing the uranium industry's economic myths', www.acfonline.org.au/resources/yellowcake-fever-exposing-uranium-industrys-economic-myths

²¹ Uranium exports in FY 2013/14: \$622m
www.world-nuclear.org/info/Country-Profiles/Countries-A-F/Australia/
 Total national export revenue (goods and services) in FY 2013/14: \$332 billion
www.trademinister.gov.au/releases/Pages/2014/ar_mr_140805.aspx?ministerid=3

In 2011, the total value of global uranium requirements was approximately US\$10 billion,²² and the current figure would be very similar (with recent contract prices typically around US\$50–55/lb U3O8). From 2011 to 2013, uranium was produced in 21 countries, and a 2014 UN report states that "*more than 20 countries around the globe produce uranium*".²³ Thus many countries are competing in a market that is modest in size.

Even using the most optimistic assumptions, uranium will remain a very small contributor to national export revenue. During the years 2002–2011, uranium's peak contribution to national export revenue was 0.45%.²⁴

There is no sound basis for concluding that there will be any significantly increased demand for uranium in the medium and long term. Plausible projections for the next 20 years range from a modest decline in demand to a modest increase.

Politicians, academics and uranium industry representatives have drawn comparisons between the potential of Australia's uranium industry and Saudi oil revenue. The comparisons do not stand up to scrutiny. Using 2011 data, Saudi oil exports were 466 times greater than revenue from Australian uranium exports; Australia would need to supply *entire global* uranium demand 31 times over to match Saudi oil revenue; and if all of Australia's Reasonably Assured plus Inferred uranium resources (to US\$130/kg U) were mined and sold at the price realised for 2011/12 uranium exports, the one-off economic windfall would fall short of annual Saudi oil revenue by \$128 billion.²⁵

From 2011 to 2013, uranium was produced in 21 countries, with Kazakhstan, Canada and Australia as the largest producers, accounting for approximately 63% of world production. Australia now accounts for approximately 11% of global production, compared to Australia's 2002–2011 average of 18.2%.²⁶

Australia's uranium production of 5,000 tonnes in 2014 was the lowest for 16 years.²⁷ The industry generates less than 0.2 per cent of national export revenue (0.19% in 2013/14²⁸) and accounts for less than 0.02 per cent of jobs in Australia.²⁹

²² ACF, 2013, 'Yellowcake Fever: exposing the uranium industry's economic myths', section 2, 'Australia's uranium export revenue in perspective', www.acfonline.org.au/resources/yellowcake-fever-exposing-uranium-industrys-economic-myths

²³ UN News Centre, 10 Sept 2014, 'Despite price dip, uranium demand, production continues to rise – UN atomic watchdog', www.un.org/apps/news/story.asp?NewsID=48678

²⁴ ACF, 2013, 'Yellowcake Fever: exposing the uranium industry's economic myths', www.acfonline.org.au/resources/yellowcake-fever-exposing-uranium-industrys-economic-myths

²⁵ See the discussion and calculations in section 5 of: ACF, 2013, 'Yellowcake Fever: exposing the uranium industry's economic myths', www.acfonline.org.au/resources/yellowcake-fever-exposing-uranium-industrys-economic-myths

²⁶ ACF, 2013, 'Yellowcake Fever: exposing the uranium industry's economic myths', www.acfonline.org.au/resources/yellowcake-fever-exposing-uranium-industrys-economic-myths

²⁷ World Nuclear Association, 23 Jan 2015, Weekly Digest, <http://us1.campaign-archive1.com/?u=140c559a3b34d23ff7c6b48b9&id=e08ac096b6&e=ae5ca458a0>

²⁸ Uranium exports in FY 2013/14: \$622m
www.world-nuclear.org/info/Country-Profiles/Countries-A-F/Australia/
Total national export revenue (goods and services) in FY 2013/14: \$332 billion
www.trademinister.gov.au/releases/Pages/2014/ar_mr_140805.aspx?ministerid=3

²⁹ See section 2 (export revenue) and section 3 (employment) in: ACF, 2013, 'Yellowcake Fever: exposing the uranium industry's economic myths', www.acfonline.org.au/resources/yellowcake-fever-exposing-uranium-industrys-economic-myths

Claims that Australia should aspire to a market share commensurate with our percentage of the world's known uranium reserves generally overlook the point that Olympic Dam accounts for a large majority (>70%) of Australia's uranium reserves.

According to a 2012 report³⁰ by the federal Bureau of Resources and Energy Economics, Australia's identified uranium resources have more than doubled in the past two decades and increased by 62% from 2006 to 2010. However a large majority of the increase comes from revised estimates of Olympic Dam (first discovered in 1975). New resource discoveries include Beverley Four Mile (SA – 2005), Samphire (SA – 2007), Lake Mackay (WA – 2011), and some other mostly small, technically challenging deposits – primarily in WA and Queensland (note: a long-standing state prohibition on uranium mining has been reinstated in Queensland).

Another point that is overlooked by the uranium industry is that a vast expansion of uranium mining in Australia would inevitably result in reduced global prices. The plan to mine and export 19,000 t U₃O₈ annually from Olympic Dam, as envisaged under the abandoned mega-expansion, would have resulted in Olympic Dam producing about one-quarter of global uranium requirements (with an estimated global requirement in 2015 of 66,883 tU or 78,855 tU₃O₈³¹). As Flinders University academic Richard Leaver said of an earlier period: *"In essence, the idea that world prices could remain high while Australian production skyrocketed required that the basic laws of supply and demand be suspended."*³²

Richard Leaver further notes³³:

"'Potential' is one of the most powerful chemicals available to the political alchemist. Any individual, firm or sector deemed to have potential is relieved of a massive and perpetual burden – the need to account for past and present achievements (or, more probably, the lack of them). ... The history of Australian involvement in the civil uranium industry offers an excellent example of this alchemy at work."

Industry and government have a long track record of providing implausible uranium industry growth estimates.

The Australian Uranium Association frequently and prominently promoted a consultant's estimate of 14,000 t U₃O₈ exports in 2014, earning \$1.7 billion. But production in 2014 was less than half that figure (5,001 tU³⁴ or 5,896 t U₃O₈).

The consultant's report was produced before the Fukushima disaster, but even post-Fukushima projections have proven to be inaccurate:

- In a 2012 paper³⁵, the Australian Uranium Association predicted production of 9,800 t U₃O₈ in 2014, but actual production in 2014 was 5,896 t U₃O₈ or just 60% of the estimate.
- In June 2011 (three months after the Fukushima disaster), the Australian Uranium Association claimed there were *"good prospects that four or five projects in WA will*

³⁰ www.bree.gov.au/documents/publications/energy-in-aust/energy-in-australia-2012.pdf

³¹ www.world-nuclear.org/info/Facts-and-Figures/World-Nuclear-Power-Reactors-and-Uranium-Requirements/

³² <http://books.google.com.au/books?id=QdOkh26w3McC&pg=PA92>

³³ <http://books.google.com.au/books?id=QdOkh26w3McC&pg=PA88>

³⁴ www.world-nuclear.org/info/Facts-and-Figures/Uranium-production-figures/

³⁵ <http://web.archive.org/web/20130425205831/http://www.aa.org.au/Content/AUASubDEWP.aspx>

begin operation in the next three to four years". No uranium mines are operating in WA as of February 2016.

The federal Bureau of Resources and Energy Economics (BREE) also has a track record of providing inaccurate and inflated estimates, even in the aftermath of the Fukushima disaster. For example a March 2012 BREE report³⁶:

- estimated that the spot price would average around US\$53/lb in 2012, but it fell to US\$43.50 (and the average was around US\$48).
- estimated export revenue of \$708 million in 2011/12, but the true figure was \$607 million.
- estimated 15 reactor restarts in Japan in 2012, but there have been only two restarts.
- estimated revenue of \$1.69 billion in 2016/17 – an estimate that stretches credulity in light of figures in recent years (\$610m in 2010/11; \$607m in 2011/12; \$823m in 2012/13; and \$622m in 2013/14³⁷).

Along with inflated, inaccurate estimates of nuclear power growth and demand for Australian uranium, predictions regarding the uranium price have also repeatedly proven to be inaccurate and inflated.³⁸

Export policy / customer countries:

The industry hopes that bilateral nuclear cooperation agreements concluded over the past decade with China, Russia the UAE – along with the nuclear cooperation agreement with India – will lead to export growth. Increased sales to China can be anticipated (although the points made earlier by Steve Kidd need to be kept in mind). Sales to Russia have been suspended – and in any case should they ever be resumed it is likely to be a small market given the slow pace of nuclear power growth in Russia and the country's domestic uranium resources. It is unclear whether significant growth will be achieved in India and current uranium demand is very low. The UAE is building its first reactors so will be at most a small market.

There is little prospect for growth in other current export markets for Australian uranium:

- Plans to expand nuclear power (or at least to maintain current capacity with new build) are in trouble in the UK, the USA and Canada.
- Germany and Belgium plan to abandon nuclear power.
- The restart of reactors in Japan promises to be a protracted, contentious affair and Japan has a very large uranium inventory.
- South Korea's nuclear industry has been hit by a series of scandals including bribery, corruption and cover-ups, and the proportion of South Koreans who consider nuclear power safe fell from 71% in 2010 to 35% in 2012.³⁹
- France plans to reduce its reliance on nuclear power.
- Taiwan, Finland, and Spain have fewer than 10 reactors each and will remain, at most, small markets.

³⁶ <http://web.archive.org/web/20130427033414/http://www.bree.gov.au/documents/publications/req/REQ-Mar-2012.pdf>

See also the discussion in ACF, 2013, 'Yellowcake Fever: exposing the uranium industry's economic myths', www.acfonline.org.au/resources/yellowcake-fever-exposing-uranium-industrys-economic-myths

³⁷ www.world-nuclear.org/info/Country-Profiles/Countries-A-F/Australia/

³⁸ See section 5 in ACF, 2013, 'Yellowcake Fever: exposing the uranium industry's economic myths', www.acfonline.org.au/resources/yellowcake-fever-exposing-uranium-industrys-economic-myths

³⁹ www.reuters.com/article/2013/01/08/us-nuclear-korea-idUSBRE90704D20130108

- Sweden has 10 reactors, with no scope for growth under existing government policy.

India is used by the industry and some politicians as the basis to produce inflated, asinine estimates of uranium export revenue growth. A September 8, 2015 media release by Wyatt Roy, Chair of federal Parliament's Joint Standing Committee on Treaties, makes the claim that selling uranium to India will double the size of the uranium mining industry in Australia and export revenue could amount to \$1.75 billion.

These figures do not stack up. According to the World Nuclear Association, India's uranium demand this year will be 1,862 tonnes of uranium oxide. Australia supplies 11% of global demand, so if Australia supplies 11% of Indian demand that's an extra 205 tonnes. Exports would increase from 6,702 tonnes to 6,907 tonnes and revenue would increase by \$19 million from \$622 million to \$641 million – an increase of 3%.

So how does a paltry 3% increase turn into a doubling of the size of the uranium industry? And how does \$19 million turn into \$1.75 billion?

Firstly, via absurd projections of the long-term growth of India's nuclear power industry. The Treaties Committee report says that India's nuclear power capacity is expected to grow exponentially from 5.3 gigawatts (GW) in 2014 to 1,094 GW in 2050. The 1,094 GW figure is taken from the Minerals Council of Australia (MCA), and the MCA in turn takes it from the World Nuclear Association. But the World Nuclear Association doesn't predict 1,094 GW of nuclear capacity, it predicts 1,094 GW of **total** "base-load capacity" across all fuels.

Further, such projections confuse annual export revenue and total revenue over many years.

Even with all those accounting tricks, you can't reach the \$1.75 billion figure. That figure appears in the foreword to the Treaties Committee report but it isn't mentioned (or justified) in the body of the report. Most likely, the figure is based on some speculation from the MCA: *"Australian uranium sales to India by 2030 could be between 1,000 and 2,000 tonnes, worth between \$100 million and \$225 million in export earnings. The total additional revenue through to 2030 could be between \$750 million up to \$1.5 billion to the Australian economy."* Perhaps industry enthusiasts then added GST to get from \$1.5 billion to \$1.75 billion.

Even the MCA's upper figure of \$225 million annual revenue by 2030 only represents a 36% increase on 2013/14 uranium export revenue.

Other figures provided in the Treaties Committee report sharply contradict the more enthusiastic industry claims. For example the report cites an estimate by the Australian Safeguards and Non-Proliferation Office that India's uranium demand could reach 2,000 tonnes by 2025, valued at about \$200 million. So if Australia secures 11% of that demand, annual revenue would be \$22 million.

According to IBIS World's March 2015 market report, 987 people are employed in Australia's uranium industry. Uranium exports would likely increase by 3% if sales to India proceed, and if we assume that jobs also increase by 3% that takes to the total up to 1,016 jobs – an increase of 29 jobs.

As mentioned previously, India's nuclear program is in a "deep freeze" according to a November 2014 article in the *Hindustan Times*, and India's energy minister Piyush Goyal said

in November 2014 that the government remains "cautious" about developing nuclear power and he pointed to waning interest in the US and Europe.

The 2005–07 uranium bubble:

The uranium bubble that peaked in 2007 was a sadly familiar case of speculative mining of the market. Journalist Marcus Priest provided a detailed account in the *Australian Financial Review* in May 2007.⁴⁰ Priest described some of the practices:

- Shallow drilling or drilling beside an old hole that had good grades (called 'address pegging' or 'nearology').
- Claiming to have found a geological type resembling a known deposit (e.g. Olympic Dam-style mineralisation).
- Citing in-situ values for possible deposits without any reference to the cost, viability or legality of mining.
- Using a lower cut-off grade of recoverable uranium to inflate the size of the estimate.
- Capital raising or floating based on nothing more than applications for exploration leases which may never be granted because for various reasons such as environmental constraints (e.g. Fission Energy had licence applications in a WA national park and nature reserve).
- Conflating a tenement application with a "project".
- Companies with little or no experience, and a track record of jumping from one fad to the next, jumping on the uranium bandwagon.
- Conflating the old and the new – Priest cites the example of Reefion Mining announcing a "major new uranium discovery" in Namibia which was in fact discovered in the 1970s.
- Spending only a small fraction of the funds raised on exploration.

Michael West wrote in *The Age* in 2011⁴¹:

"Until now inveterate fraudsters, even convicted heroin traffickers, have happily promoted their floats on the ASX. Of the 2,300-odd companies listed on the bourse it would be safe to say a couple of hundred are simply pump-and-dump schemes, executive options scams and the like that are controlled by people whose primary intent is to mine wallets, not mineral deposits."

Until now, the same promoters have beaten a path back to the market – decade in, decade out – pouncing on every fad, boom and bubble. That they haven't been required to disclose their myriad failures – before "backdoor listing" the likes of a "uranium" asset into a nickel explorer's shell, itself born from a dotcom play, having emerged from the ruins of a biotechnology float – has played nicely into the hands of the promoters, brokers, lawyers, accountants and other capital markets fee-takers. Retail investors, though, have been savaged time and again.

Mechanisms have been developed seeking to address the over inflation of resource estimates.⁴² Changes to the requirements of the Joint Ore Reserves Committee code were expected to come into effect in December 2013 – for example a pre-feasibility level study will have to be conducted before including an estimate of an ore reserve in a public report.

⁴⁰ Marcus Priest, 26 May 2007, 'Uranium Bubble?', www.foe.org.au/sites/default/files/Uranium%20Bubble%20AFR%202007.pdf

⁴¹ Michael West, 16 April 2011, 'Not just another crackdown', www.theage.com.au/business/not-just-another-crackdown-20110415-1dhp.html

⁴² www.jorc.org/about.asp

However deficiencies remain and there seems to be little or no appetite or activity to address a raft of other problems.

Moreover, compliance and regulation remain compromised – the JORC Committee has no powers⁴³, the ASX prefers the light touch of providing "*additional guidance*" to companies, and ASIC rarely prosecutes.⁴⁴

Meanwhile, uranium mining companies are resisting reform. Examples include Rio Tinto and BHP Billiton lobbying the European Union to abandon plans to enforce full financial disclosure on all projects including those in developing nations⁴⁵, and Paladin Energy lobbying against proposed changes to Australia's anti-bribery and corruption laws in relation to mining in Africa.⁴⁶

A detailed timeline of the 2005–07 speculative uranium bubble in Australia and its aftermath is posted online.⁴⁷

Uranium sales to India:

For this submission we would like to raise concern over Toro Energy's ambitions to mine uranium and export uranium to India.

Toro's interest in selling uranium to India is evidenced through their submissions to the JSCOT inquiry into the Australia/ India Nuclear Cooperation Treaty in Jan 2015⁴⁸ and through their involvement on the Australia/ India CEO Forum in January 2015.

Vanessa Guthrie told Australia Mining "*It (India) is one of the fastest growing global economies and as Prime Minister Modi's highly successful visit to Australia late last year has demonstrated, India offers a very significant opportunity for sales of Australian uranium*".⁴⁹

The key concern about selling uranium to India from Government, Bureaucrats, academics, environmentalist and peace advocates is based on the lack of distinction between India's civilian and military nuclear program. In addition there have been major concerns about the safety of nuclear reactors and independent monitoring of reactors.

Firstly it is important to note just how actively India is progressing their nuclear weapons capabilities. Between November 2014 and December 2015 India tested the following nuclear capable missiles:

- the [Nirbhay](#) nuclear capable cruise missile 17th October of 2014,
- the [Agni II](#) ballistic missile tested at a military base in Odisha missile 9th November 2014 (3000km range)
- the [Prithvi-II](#) surface to surface ballistic missile, tested at a military base in Odisha on the 19th February 2015, (350km range)
- the [Dhanush](#) nuclear capable ballistic missile, launched from a naval ship in the Bay of Bengal on the 9th April 2015

⁴³ www.jorc.org/noncompliance.asp

⁴⁴ www.smh.com.au/business/golden-goose-lays-an-egg-20120322-1vmsz.html

⁴⁵ www.theage.com.au/business/big-miners-oppose-new-financial-disclosure-plan-20120607-1zzy1.html

⁴⁶ www.afr.com/p/business/companies/miners_reject_anti_corruption_reforms_NeBuguzm9PBMNjpsVvBPmK

⁴⁷ www.choosenuclearfree.net/uranium-exports/bubble/

⁴⁸ http://www.aph.gov.au/Parliamentary_Business/Committees/Joint/Treaties/28_October_2014/Submissions

⁴⁹ <http://www.australianmining.com.au/news/toro-energy-ceo-chosen-to-represent-australia-in-i>

- the [Agni III](#) missile, launched from Wheeler Island off the Odisha coast, on April 16th 2015, (3,000km + range)
- the [B-05](#) India's first submarine launched nuclear capable missile launched from INS Arihant submarine on 11th July 2015,
- the [Nirbhay](#) cruise missile tested at a military base in Odisha on the October 16th 2015 (750km – 1000km range – but test failed)
- the [Agni IV](#) launched from Abdul Kalam Island off the Odisha coast on the 9th of November 2015 (4,000km range)

The Indian Government has boasted about their ability to launch nuclear weapons from air, land and sea and expressed excitement about joining an elite club of countries with Inter-Continental Ballistic Missiles (ICBM).

The JSOCT report on uranium sales to India make an interesting distinction between a nuclear arms race between India and Pakistan, and the increasing tensions between India and China - driving India's ambitions to develop thermonuclear weapons.

It would be very short-sighted not to consider the very real connection and risk that if the mines at Wiluna are progressed and sell uranium to India it is very possible that uranium from WA could end up in Indian nuclear weapons - fuelling tensions between India and China and between India and Pakistan.

It is naïve to think of the Wiluna proposal as just a mine with local impacts. It is not. It is part of an industry that has inextricable links to the development of the most horrific and destructive weapons on earth. The links between this proposal and weapons are made clear by Toro's intent to sell to India a country with clear intentions to modernize and expand their nuclear weapons.

Toro Energy's submission to the JSCOT inquiry suggests that their commercial interests in selling uranium to India are somehow altruistic and will pull people out of poverty. This view conveniently ignores the complex nature of poverty in India beyond access to energy which may of course never be affordable. The concern for India's poor does not extend some of India's poorest people in the village of Jaduguda⁵⁰ and Koodunkalum⁵¹ or the 27 villages surrounding the Jaitapur nuclear power proposal⁵². Jadugoda has suffered decades of radiation exposure from a uranium mine – and consequently the communities have suffered from miscarriages, birth defects and leukemia. In Koodunkalum, a fishing village that was devastated by a tsunami in 2004, there is now a nuclear reactor under construction. Following thousands of residents protesting there was an outbreak of violence from police and villagers were shot and killed.

The Australian government has compromised the safeguards system by signing a nuclear cooperation agreement with India that weakens safeguards standards in many respects. The Australian Parliament's Joint Standing Committee on Treaties (JSCT) argued that uranium sales to India should not proceed until stringent conditions have been met. Instead of taking this sound advice, the government has shamefully rejected JSCT's recommendations. In its current form the agreement has been strongly opposed by, among others, a former

⁵⁰ <http://www.wise-uranium.org/umopjdg.html>

⁵¹ <http://infochangeindia.org/environment/rethinking-nuclear-energy/twenty-years-of-resistance-at-koodankulam.html>

⁵² <http://indianexpress.com/article/cities/mumbai/jaitapur-nuclear-power-project-protesters-write-to-japan-pm-warn-of-stepping-up-pressure/>

Director-General of the Australian Safeguards and Non-Proliferation Office - John Carlson, a former Chair of the Board of Governors of the International Atomic Energy Agency - Ronald Walker, a former Assistant Director of the US Arms Control and Disarmament Agency - Prof. Lawrence Scheinman, and an Australian nuclear arms control expert -Crispin Rovere.⁵³

John Carlson, who headed Australia's safeguards office for 21 years, argued that the agreement with India "*represents a serious weakening of Australia's ... safeguards conditions*" and that weaknesses in the agreement "*mean Australian material could be used in support of India's nuclear weapon program.*"⁵⁴

It is likely that there will now be sustained pressure for Australia to apply equally inadequate standards to other countries. As John Carlson noted in a submission to JSCOT: "*If the Government does compromise Australia's safeguards conditions, inevitably this will lead to other agreement partners asking for similar treatment.*"⁵⁵

Moreover, other nuclear and uranium exporting countries are likely to follow Australia's lead and weaken their safeguards requirements. This disturbing and cascading retreat from responsibility would further compromise non-proliferation objectives and mechanisms.

Safeguards:

There are many problems and limitations with the international safeguards system.⁵⁶ In articles and speeches during his tenure as IAEA Director General from 1997– 2009, Dr. Mohamed El Baradei said that the Agency's basic rights of inspection are "*fairly limited*", that the safeguards system suffers from "*vulnerabilities*" and "*clearly needs reinforcement*", that efforts to improve the system have been "*half-hearted*", and that the safeguards system operates on a "*shoestring budget ... comparable to that of a local police department*".

Problems with safeguards include:

1. Chronic under-resourcing.⁵⁷ El Baradei told the IAEA Board of Governors in 2009: "*I would be misleading world public opinion to create an impression that we are doing what we are supposed to do, when we know that we don't have the money to do it.*"⁵⁸ Little has changed since 2009. Meanwhile, the scale of the safeguards challenge is ever-increasing as new facilities are built and materials stockpiles grow.
2. Issues relating to national sovereignty and commercial confidentiality adversely impact on safeguards.
3. The inevitability of accounting discrepancies. Nuclear accounting discrepancies are commonplace and inevitable due to the difficulty of precisely measuring nuclear materials. The accounting discrepancies are known as Material Unaccounted For

⁵³ See their submissions to the JSCT:

www.aph.gov.au/Parliamentary_Business/Committees/Joint/Treaties/28_October_2014/Submissions

⁵⁴ www.aph.gov.au/DocumentStore.ashx?id=35fb7f72-904c-4d44-b387-f34e4afb77f9&subId=301365

⁵⁵ www.aph.gov.au/DocumentStore.ashx?id=79a1a29e-5691-4299-8923-06e633780d4b&subId=301365

⁵⁶ For information on safeguards see the papers listed at www.foe.org.au/anti-nuclear/links#safeguards

⁵⁷ See section 6 in: 'The Nuclear Safeguards System: An Illusion of Protection', 2010, www.choosenuclearfree.net/safeguards/

⁵⁸ Mohamed El Baradei, 16 June 2009, 'Director General's Intervention on Budget at IAEA Board of Governors', www.iaea.org/newscenter/statements/director-generals-intervention-budget-iaea-board-governors

(MUF). There have been incidents of large-scale MUF in Australia's uranium customer countries such as the UK and Japan.⁵⁹

4. Incorrect/outdated assumptions about the amount of fissile material required to build a weapon.
5. The fact that the IAEA has no mandate to prevent the misuse of civil nuclear facilities and materials – at best it can detect misuse/diversion and refer the problem to the UN Security Council. As the IAEA states: *"It is clear that no international safeguards system can physically prevent diversion or the setting up of an undeclared or clandestine nuclear programme."*⁶⁰
6. Numerous examples illustrate how difficult and protracted the resolution (or attempted resolution) of such issues can be, e.g. North Korea, Iran, Iraq in the 1970s and again in the early 1990s. Countries that have breached their safeguards obligations can simply withdraw from the NPT and pursue a weapons program, as North Korea has done.
7. Safeguards are shrouded in secrecy – to give one example, the IAEA used to publish aggregate data on the number of inspections in India, Israel and Pakistan, but even that limited information is no longer publicly available.
8. There are precedents for the complete breakdown of nuclear safeguards in the context of political and military conflict – examples include Iraq, Yugoslavia and several African countries.
9. Currently, IAEA safeguards only begin at the stage of uranium enrichment. Application of IAEA safeguards should be extended to fully apply to mined uranium ores, to refined uranium oxides, to uranium hexafluoride gas, and to uranium conversion facilities, as well as enrichment and subsequent stages of the nuclear fuel cycle. The Joint Standing Committee on Treaties (JSCOT) recommended in 2008 that *"the Australian Government lobbies the IAEA and the five declared nuclear weapons states under the NPT to make the safeguarding of all conversion facilities mandatory."*⁶¹ However the Australian Government rejected the recommendation in its 2009 response to the JSCOT report.⁶²
10. There is no resolution in sight to some of the most fundamental problems with safeguards such as countries invoking their right to pull out of the Nuclear Non-Proliferation Treaty (NPT) and developing a weapons capability as North Korea has done. More generally, responses to suspected non-compliance with safeguards agreements have been highly variable, ranging from inaction to economic sanctions to UN Security Council-mandated decommissioning programmes. Some states prefer to take matters into their own hands: Israel bombed and destroyed a nuclear

⁵⁹ See section 4 in: 'The Nuclear Safeguards System: An Illusion of Protection', 2010, www.choosenuclearfree.net/safeguards/

⁶⁰ IAEA, 1993, *Against the Spread of Nuclear Weapons: IAEA Safeguards in the 1990s*.

⁶¹ Joint Standing Committee on Treaties, 2008, 'Report 94: Review into Treaties tabled on 14 May 2008', www.aph.gov.au/parliamentary_business/committees/house_of_representatives_committees?url=jsct/14may2008/report1/fullreport.pdf

⁶² Australian Government, 2009, 'Government Response to Report 94 of the Joint Standing Committee on Treaties: Australia-Russia Nuclear Cooperation Agreement'

reactor in Iraq in 1981, the US bombed and destroyed a reactor in Iraq in 1991 and Israel bombed and destroyed a suspected reactor site in Syria in 2007.

In 1982 Mike Rann identified the core problem: *"Again and again, it has been demonstrated here and overseas that when problems over safeguards prove difficult, commercial considerations will come first."*⁶³

Australia's uranium export policy / customer countries:

In 1998, the then Director-General of the Australian Safeguards and Non-proliferation office (ASNO) said: *"One of the features of Australian policy ... is very careful selection of our treaty partners. We have concluded bilateral arrangements only with countries whose credentials are impeccable in this area."*⁶⁴

That was not true at the time (e.g. sales to declared nuclear weapons states that pay scant regard to their NPT obligations) and it is certainly not true now.

The federal government permits uranium sales to:

- Repressive, secretive countries (e.g. China and Russia – albeit the case that sales to Russia have been suspended).
- Nuclear weapons states that are not fulfilling their disarmament obligations under the Nuclear Non-Proliferation Treaty (US, Russia, China, France, UK) or countries that are not NPT signatories, ie/ India.
- Countries that have not ratified the Comprehensive Test Ban Treaty (China, USA, India).
- Countries with a history of weapons-related research based on their civil nuclear programs (South Korea and Taiwan).

Provisions in bilateral agreements – enrichment and reprocessing:

In addition to IAEA safeguards, countries purchasing Australian uranium must sign a bilateral agreement. However there are no Australian inspections of nuclear materials stockpiles or facilities using Australian Obligated Nuclear Materials (AONM – primarily uranium and its by-products such as plutonium) – Australia is entirely reliant on the inadequate and underfunded inspection system of the IAEA.

The most important provisions in bilateral agreements are for prior Australian consent before Australian nuclear material is transferred to a third party, enriched beyond 20% uranium-235, or reprocessed. However no Australian government has ever refused permission to separate plutonium from spent fuel via reprocessing (and there has never been a request to enrich beyond 20% U-235). Even when reprocessing leads to the stockpiling of plutonium (which can be used directly in nuclear weapons), ongoing or 'programmatic' permission has been granted by Australian governments. Hence there are stockpiles of Australian-obligated separated plutonium in Japan and in some European countries.

Japan, a major customer of Australian uranium, has a nuclear 'threshold' or 'breakout' capability – it could produce nuclear weapons within months of a decision to do so, relying

⁶³ Mike Rann, March 1982, 'Uranium: Play It Safe'.

⁶⁴ John Carlson, 1998,

<http://web.archive.org/web/20040217071924/http://www.aph.gov.au/hansard/joint/commttee/j2022.pdf>, p.15

heavily on facilities, materials and expertise from its civil nuclear program. An obvious source of fissile material for a weapons program in Japan would be its stockpile of plutonium – including Australian-obligated plutonium. In April 2002, the then leader of Japan's Liberal Party, Ichiro Ozawa, said Japan should consider building nuclear weapons to counter China and suggested a source of fissile material: *"It would be so easy for us to produce nuclear warheads; we have plutonium at nuclear power plants in Japan, enough to make several thousand such warheads."* Similar comments are made on a semi-frequent basis by Japanese politicians.

Japan's plutonium program increases regional tensions and proliferation risks. Diplomatic cables in 1993 and 1994 from US Ambassadors in Tokyo describe Japan's accumulation of plutonium as *"massive"* and questioned the rationale for the stockpiling of so much plutonium since it appeared to be economically unjustified.⁶⁵ A March 1993 diplomatic cable from US Ambassador Armacost in Tokyo to Secretary of State Warren Christopher, obtained under the US Freedom of Information Act, posed these questions: *"Can Japan expect that if it embarks on a massive plutonium recycling program that Korea and other nations would not press ahead with reprocessing programs? Would not the perception of Japan's being awash in plutonium and possessing leading edge rocket technology create anxiety in the region?"*⁶⁶

Japan's plutonium stockpiling and reprocessing plans continue to cause regional concern – for example China has recently voiced concern.⁶⁷ Moreover it continues to complicate efforts to prevent other regional countries (esp. South Korea) from going down the same plutonium/reprocessing path.

Despite this, Australia continues to provide open-ended ('programmatic') approval for Japan to separate Australian-obligated plutonium. The government could and should prohibit the stockpiling of Australian-obligated plutonium. At the very least, the government should revert to the previous Australian policy of requiring approval for plutonium separation / reprocessing on a case-by-case basis.

It is frequently claimed that the *"strict"* or *"stringent"* conditions placed on AONM encourage a strengthening of non-proliferation measures generally. However by permitting the stockpiling of plutonium the Australian government is not 'raising the bar' but is setting a poor example and encouraging other uranium exporters to adopt or persist with equally irresponsible policies. While the Australian government does not have the authority to prohibit stockpiling, it does have the authority to permit transfers and reprocessing of AONM and could therefore put an end to the stockpiling of Australian-obligated plutonium.

Not all facilities processing AONM are subject to IAEA inspections:

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<http://web.archive.org/web/20081114064230/http://archive.greenpeace.org/pressreleases/nucrans/1999sep1.html>

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<http://web.archive.org/web/20081114064230/http://archive.greenpeace.org/pressreleases/nucrans/1999sep1.html>

⁶⁷ Jonathan Tirone and Jacob Adelman, 24 March 2014, 'Japan's Plutonium Plans Stoke China Tensions on A-Bomb Risk', www.bloomberg.com/news/2014-03-23/japan-s-plutonium-potential-stokes-china-tensions-on-a-bomb-risk.html

Australia allows the processing of AONM in facilities that are not covered by IAEA safeguards at all. While AONM is meant to be subject to IAEA safeguards from the enrichment stage onwards, ASNO is willing to make exceptions.

For example ASNO has recommended that the Australian government agree to the processing of Australian uranium in unsafeguarded enrichment plants in Russia and the recommendation was readily accepted by the federal government. ASNO states: "*Russia does not propose to place these enrichment facilities on its Eligible Facilities List because the facilities were never designed for the application of safeguards and could not be readily adapted for safeguards purposes.*"⁶⁸

The enrichment facilities would not require any adaptation whatsoever. Russia simply needs to permit the application of safeguards and the IAEA could then adopt safeguards measures such as inspections, the use of video monitoring etc.

Australia's uranium exports are shrouded in secrecy:

Nuclear transfers and developments demand the highest level of transparency; however this is often not the case. Some example of unjustified secrecy includes the refusal of successive Australian governments to publicly release:

1. Country-by-country information on the separation and stockpiling of Australian-obligated plutonium.
2. 'Administrative Arrangements' which contain vital information about the safeguards arrangements required by Australia.
3. Information on nuclear accounting discrepancies (Material Unaccounted For) including the volumes of nuclear materials, the countries involved, and the reasons given to explain these accounting discrepancies. The JSCOT recommended that: "*Further consideration is given to the justification for secrecy of Material Unaccounted For.*"⁶⁹ There is no legitimate justification for the secrecy surrounding MUF. ASNO has done no better than to cite commercial confidentiality.⁷⁰ All MUF information, past, present and future, should be reported publicly and this should be done on a country-by-country and facility-by-facility basis. Some other countries (e.g. Japan) release MUF data and thus Australia's secrecy clearly fails to meet best practice.
4. The quantities of AONM held in each country are confidential. ASNO states: "The actual quantities of AONM held in each country, and accounted for by that country pursuant to the relevant agreement with Australia, are considered by ASNO's counterparts to be confidential information."⁷¹

⁶⁸ ASNO, 2008, Answer 'DD' in response to Questions on Notice to ASNO, Question 20, Output 1.1.10, October 2008 session of Senate Estimates, questions by Senator Ludlam.

⁶⁹ Joint Standing Committee on Treaties, 2008, 'Report 94: Review into Treaties tabled on 14 May 2008', List of Recommendations,
www.aph.gov.au/parliamentary_business/committees/house_of_representatives_committees?url=jsct/14may2008/report1/fullreport.pdf

⁷⁰

www.aph.gov.au/parliamentary_business/committees/house_of_representatives_committees?url=jsct/14may2008/subs/sub22_1.pdf

⁷¹ ASNO – Australian Safeguards and Non-proliferation Office, 2001-02, Annual Report,
www.asno.dfat.gov.au/annual_report_0102/asno_annual_report_2001_2002.pdf

Radiation and Health:

The difference between uranium mining and the mining of most other minerals is radiation exposure. (There are also radiological risks involved with some other mining operations, e.g. rare earths, mineral sands.)

The consensus or near-consensus scientific position is that there is no safe level of exposure to ionising radiation. The United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) states in a 2010 report that *"the current balance of available evidence tends to favour a non-threshold response for the mutational component of radiation-associated cancer induction at low doses and low dose rates."*⁷²

Likewise, the 2006 report of the US National Academy of Sciences' Committee on the Biological Effects of Ionising Radiation (BEIR) states that *"the risk of cancer proceeds in a linear fashion at lower doses without a threshold and ... the smallest dose has the potential to cause a small increase in risk to humans."*⁷³

Likewise, a report in the *Proceedings of the National Academy of Sciences* states: *"Given that it is supported by experimentally grounded, quantifiable, biophysical arguments, a linear extrapolation of cancer risks from intermediate to very low doses currently appears to be the most appropriate methodology."*⁷⁴

Demonstrating and quantifying the effects of low-dose, low dose rate exposure to ionising radiation becomes increasingly difficult at ever-lower doses. Yet – despite countless claims to the contrary – around 10 studies have shown effects for doses below 100 millisieverts (mSv).⁷⁵

Uncertainties will always persist. In circumstances where people are exposed to low-level radiation, epidemiological studies are unlikely to be able to demonstrate a statistically significant increase in cancer rates. Cancers are common diseases and most are multi causal. Other complications include the long latency period for some cancers, and limited or uneven data on cancer incidence and mortality. The upshot is that cancer incidence and mortality statistics are being pushed up and down by a myriad of factors at any point in time and it becomes impossible or near impossible to isolate any one factor.

While there is (and always will be) uncertainty with the Linear No-Threshold model at low doses and dose rates, it is important to note that **the true risks may be either higher or lower than LNT** – a point that needs emphasis and constant repetition because nuclear lobbyists routinely conflate uncertainty with zero risk. The BEIR report⁷⁶ states that

⁷² UNSCEAR, 2010, Report of the United Nations Scientific Committee on the Effects of Atomic Radiation on the Effects of Atomic Radiation 2010', www.unscear.org/docs/reports/2010/UNSCEAR_2010_Report_M.pdf

⁷³ US Committee on the Biological Effects of Ionising Radiation, US National Academy of Sciences, 2006, 'Health Risks from Exposure to Low Levels of Ionizing Radiation: BEIR VII Phase 2', www.nap.edu/books/030909156X/html

⁷⁴ David Brenner et al., 2003, 'Cancer risks attributable to low doses of ionizing radiation: Assessing what we really know', *Proceedings of the National Academy of Sciences*, November 25, 2003, vol.100, no.24, pp.13761–13766, www.ncbi.nlm.nih.gov/pubmed/14610281

⁷⁵ www.ianfairlie.org/news/a-100-msv-threshold-for-radiation-effects.

⁷⁶ US Committee on the Biological Effects of Ionising Radiation, US National Academy of Sciences, 2006, 'Health Risks from Exposure to Low Levels of Ionizing Radiation: BEIR VII Phase 2',

"combined analyses are compatible with a range of possibilities, from a reduction of risk at low doses to risks twice those upon which current radiation protection recommendations are based." The BEIR report also states: "The committee recognizes that its risk estimates become more uncertain when applied to very low doses. Departures from a linear model at low doses, however, could either increase or decrease the risk per unit dose."

Radon:

In recent years the International Commission on Radiological Protection (ICRP) has upwardly revised its estimate of the carcinogenicity of radon. The latest ICRP evaluation of epidemiological studies of lung cancer risk from radon and radon progeny indicates that the risk is greater by approximately a factor of two than previously estimated.⁷⁷

The ICRP's upwards revision of the hazards associated with radon exposure is clearly inconsistent with specious claims that the 'modern' view is that low-level radiation exposure is harmless.

ARPANSA has noted that the reassessment of the hazards associated with radon exposure *"will have significant implications for the uranium industry worldwide, particularly for underground uranium mines."*⁷⁸

Uranium, Radiation and Health:

In a paper prepared for the Australian Uranium Association, Sydney University academic Manfred Lenzen states:

*"According to the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR), the global component from mill tailings is the most significant source of radiological exposure in the entire nuclear fuel chain. This holds irrespective of whether the 1993 or 2000 assessment is taken as a basis. Taking the higher estimate as more realistic, 150 Sv/GWe translate into 55.5 kSv globally, which is equivalent to an annual dose of about 0.01 mSv/capita if the entire world population were equally exposed. This estimate agrees well with ranges given in the assessment of uranium mines by Nilsson and Randhem 2008, who state a range of 0.1 to 0.001 mSv/cap."*⁷⁹

Using the above figure (55.5kSv) and using a risk estimate for exposure to low-level radiation of 0.05–0.1 cancer fatalities per Sievert, radiation exposure from uranium mine tailings is responsible for 2,775–5,550 deaths annually. A similar analysis is presented by nuclear physicist Richard Garwin.⁸⁰

www.nap.edu/books/030909156X/html

⁷⁷ ICRP, 2010, 'Lung Cancer Risk from Radon and Progeny and Statement on Radon', ICRP Publication 115, Ann. ICRP 40(1), www.icrp.org/publication.asp?id=ICRP%20Publication%20115

⁷⁸ Prof. Peter Johnston, Acting CEO of ARPANSA, 14 Dec 2012, letter Z12020625, included in answers to Estimates Questions of Notice, Senate Community Affairs Committee, question e13-133.

⁷⁹ Manfred Lenzen, 2009, 'Current state of development of electricity-generating technologies – a literature review',

<http://web.archive.org/web/20140124203606/http://aua.org.au/Content/Lenzenreport.aspx>

Direct download <http://web.archive.org/web/20140124203606/http://aua.org.au/DisplayFile.aspx?FileID=36>

⁸⁰ Richard L. Garwin, 2001, 'Can the World Do Without Nuclear Power?',

www.solarpeace.ch/solarpeace/Download/20010409_Garwin_NuclearPowerArticle.pdf

The following discussion on the topic of radiogenic effects from uranium mining is excerpted from a longer paper by Nuclear Radiologist Dr Peter Karamoskos⁸¹:

"The link between uranium mining and lung cancer has long been established. Certain groups of underground miners in Europe were identified as having increased mortality from respiratory disease as early as the 16th century. Lung cancer as the cause was not recognised until the 19th century. The radioactive gas, radon, was identified as the cause in the 1950's. Studies of underground miners, especially those exposed to high concentrations of radon, have consistently demonstrated the development of lung cancer, in both smokers and non-smokers. On this basis, the International Agency for Research on Cancer (IARC) classified radon as a carcinogen in 1988. In 2009, the ICRP stated that radon gas delivers twice the absorbed dose to humans as originally thought and hence is in the process of reassessing the permissible levels. Previous dose estimates to miners need to be approximately doubled to accurately reflect the lung cancer hazard.

"The Biological Effects of Ionising Radiation VI report (1999) reviewed eleven cohort studies of 60,000 underground miners with 2,600 deaths from lung cancer, eight of which were uranium mines in Europe, North America, Asia and Australia. These found a progressively increasing frequency of lung cancer in miners directly proportional to the cumulative amount of radon exposure in a linear fashion. Smokers had the highest incidence of lung cancer, as would be expected; however, the greatest increase in lung cancer was noted in non-smokers. The highest percentage increase in lung cancer was noted 5-14 years after exposure and in the youngest miners.

"Uranium miners are also exposed to IR (ionising radiation) directly from gamma radiation and the dose from this is cumulative to that from radon. At the Olympic Dam underground uranium mine, the total dose per miner is approximately 6mSv, of which 2-4 mSv (allowing for the new ICRP dose coefficients) are due to radon and the balance due to gamma radiation.

"Most modern uranium mines have air extraction systems and monitored ambient measures of radon concentrations to ensure levels remain low. Current levels of radon in underground uranium mines are only a fraction of mines over one hundred years ago. Furthermore, miners are given personal protective equipment (PPE) including masks to filter out the radioactive particulate matter. However, many underground miners find the masks extremely uncomfortable, especially in the hot underground environment they must contend with. It is estimated that up to 50% of underground uranium miners in Australia do not use their masks, and thus drastically increase their risk of lung cancer, whilst underestimating their actual radiation dose (since this is calculated assuming PPE's are used).

"The Olympic Dam doses mentioned above are typical of modern mine practices. The average miner at Olympic Dam is in his twenties and stays on average five years at the site. A typical calculation using the linear no threshold model and the latest BEIR-VII figures of radiation carcinogenesis risks indicates miners at Olympic Dam therefore have a 1:420 chance of contracting cancer, most likely lung cancer. Note that as the research demonstrates risk of developing lung cancer is greater for younger workers. These risks are not insubstantial. Radiation safety and risk principles can be quite complex and it is debatable whether miners have the training to understand the basis of such risks, or are even

⁸¹ Peter Karamoskos, 2010, 'Nuclear Power & Public Health', <http://evatt.org.au/papers/nuclear-power-public-health.html>

informed of these risks in a comprehensive and accurate manner that they can comprehend and make an informed work decision."

Uranium companies promote dangerous radiation junk science:

In May 2012, 48 Australian medical practitioners signed a statement calling on Toro Energy to stop promoting dangerous radiation junk science⁸². A similar statement was signed by 39 Australian medical practitioners in 2014; questioning Cameco's decision to sponsor speaking events by Boreham⁸³ (Appendix 9).

In 2008 Boreham visited Australia to work with Toro Energy, Uranium One and Heathgate Resources in the area of employee radiation training and community consultation on radiation and uranium.⁸⁴

In 2010, Boreham spoke at a 'Radiation Information Seminar' in Adelaide which was co-hosted by the Australian Uranium Association and Toro Energy.⁸⁵

BHP Billiton and Rio Tinto were sponsors of a 2011 conference that included Boreham on the speaking platform – with no speakers presenting the mainstream scientific understanding of radiation/health.⁸⁶

Thus many of the uranium companies in Australia have been actively promoting views directly at odds with the consensus / near-consensus scientific position that there is no safe level of exposure to ionising radiation. ARPANSA (and equivalent state/territory bodies) could and should take a proactive role promoting established science to counter the self-serving promotion of fringe views by uranium companies. The proliferation of this fringe scientific view creates a poor culture for safety in the industry where the risk of radiation is undermined.

Uranium company representatives should explain to the WA Government why they have promoted self-serving contrarian views regarding radiation and health instead of promoting the accepted scientific understanding that there is no safe level of exposure to ionising radiation.

Concluding remarks:

The inclusion of 77 Appendix, including Peer Review studies has been highly resource demanding for civil society groups and community members – especially given that this PER was released during the public comment period for the Yeelirrie PER and that the Mulga Rock PER was also released during the Wiluna public comment period. The Peer Review studies highlighted serious gaps in studies and further information needed to proceed with certainty about impacts and mitigating strategies. We note and welcome that the Peer Review process has assisted in making comments and reviewing the extensive materials.

⁸² <https://www.mapw.org.au/files/downloads/Medical%20Statement%20-%20Toro%20-%20final2.pdf>

⁸³ www.mapw.org.au/news/cameco-stop-promoting-radiation-junk-science

⁸⁴ Toro Energy, 2008, Radiation Information Seminar, www.ausimm.com.au/Content/wir/doug_boreham_invit.pdf

⁸⁵ www.ausimm.com.au/content/docs/adelaide_news_apr10.pdf

⁸⁶ www.aioh.org.au/conference/2011/presenters.html

We make the observation that had Toro focussed more on doing actual studies and data collection on the ground rather than computer models and reviews of computer models that they could have had more substantive findings about the environment and their impacts. As it turns out they did not collect the necessary data which has resulted in an unacceptable level of uncertainty for many aspects of the proposal that have a high environmental risk. For this reason we call on the EPA to recommend that this proposal is not approved, and require the proponent to resubmit studies with real data.