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

14th December 2015

To the Office of the Environmental Protection Authority,

Re: EPA No: 2032 EPBC No: 2009/4906

Please find enclosed a submission to the Public Environment Review for the proposed Yeelirrie uranium mine 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, the West Australia Nuclear Free Alliance and the Australia Nuclear Free Alliance.

The overarching themes of this submission include the issues of cumulative impacts, impacts to water and groundwater dependent ecosystems, lack of transparency and the long-term management of tailings. All of these issue are significant, but none more than the threat of the possible extinction of a number of priority subterranean species. We submit that this proposal should be rejected on the grounds that a number of subterranean fauna will become critically endangered and or extinct due to the project. In this submission we ask that you give this section of our submission significant consideration.

We note the ongoing and clear community opposition from Traditional Owners. Though the EPA does not have the remit to advise on these matters we maintain that the social and cultural impacts of the project are of primary importance. We believe the industry view that mining will occur and cannot be stopped - is driving many of these negative social impacts and that these will increase should this view prevail. Mining at Yeelirrie would destroy a number of cultural heritage sites and values that can never be rehabilitated or returned. This proposal simply does not have a social license to operate. Not from the Traditional Owners, the neighbouring pastoralists or from the broader community.

As we have mentioned in earlier uranium related PER and ERMP submissions we continue to be disappointed in the lack of data and management plans in the PER documents. We see the current process, of deferring requirements for management plans until after the public review period, as duplicating rather than streamlining and as excluding public participation rather than increasing transparency. This process denies procedural fairness to the public to view and comment on matters of public interest and is not consistent with best practise or outcomes.

Many of these issues are addressed in detail and appear as reoccurring themes along side site specific and project specific comments.

We would also like to reiterate our view that this proposal, like any uranium mines should have Level of Assessment set as Public Inquiry. Under section 40 (2) (a) of the EP Act 1986 the Environmental Protection Authority can conduct an assessment through a public inquiry, under provisions in the Royal Commission Act 1968. A public inquiry through the state Environmental Protection Act would 'assist in the assessment of a proposal which is very complex and of intense public interest'. (Appendix 1).

We'd like to thank the contributions from Dr Matthew Currell Lecturer, Hydrogeology & Environmental engineering School of Civil, Environmental & Chemical Engineering from RMIT University and Dr Jim Green from Friends of the Earth Australia as well as other professionals who do not wish to be named, but have volunteered their time and expertise to review particular aspects of the Yeelirrie Public Environment Review.

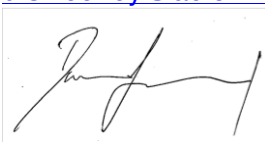
Signed;

Mia Pepper
Nuclear Free Campaigner
Conservation Council WA
mia.pepper@ccwa.org.au

Jo Vallentine
Chair
Anti Nuclear Alliance of Western Australia Jovall@iinet.net.au

Jim Green
National Nuclear Campaigner
Friends of the Earth, Australia
jim.green@foe.org.au

Dave Sweeney,
Nuclear Free Campaigner
Australian Conservation Foundation
d.sweeney@acfonline.org.au



Kado Miuir
Chairperson
West Australia Nuclear Free Alliance

Peter Robertson
Campaign Manager
WAThe Wilderness Society
Peter.robertson@wilderness.org.au

Table of Contents

Subterranean Fauna

The EPA should recommend this project be rejected on the grounds that the Yeelirrie Subterranean Community, a Priority 1 Priority Ecological Community (PEC) comprises a series of highly endemic, diverse stygofauna and troglofauna species within multiple calcrete habitats (Subterranean Ecology 2011). The impacts of the proposed Yeelirrie uranium mine, predominantly the associated groundwater drawdown, pose an unacceptable risk that could see a number of subterranean species become extinct (particularly 15 species that are currently only known from the direct impact zone).

The subterranean fauna in the Yeelirrie area are currently listed as a Priority 1 Priority Ecological Community (PEC). There is strong evidence that this community should be listed as a Threatened Ecological Community (TEC), given the highest diversity of any subterranean ecosystem in the region (115 species), the high rates of species endemicity (only 4 species known from beyond Yeelirrie) and the threat of mining from this proposal, which threatens to destroy the community and the habitat.

Under the definition of a TEC there are three categories - Critically Endangered, Endangered and Vulnerable. The Yeelirrie subterranean fauna are 'Vulnerable' and should therefore be listed as a TEC.

The Yeelirrie subterranean fauna community fits the definition of vulnerable in several areas; it is a community that has been *"adequately surveyed",* with seven individual surveys sampling more than 250 bores and is *"facing a high risk of total destruction or significant modification in the medium to long-term future"…"because of existing or impending threatening processes".*[1]

We believe there is sufficient evidence provided by the work of Bennelongia and Subterranean Ecology to show that there are a significant number of species (15) that only exist in the impact area of the proposed Yeelirrie uranium mine. If the mine is approved and advanced these species could become extinct. There could also be a range of other indirect impacts on the remaining 100 species that rely on the Yeelirrie subterranean ecosystem for their sole habitat.

The calcrete habitat at Yeelirrie has been thoroughly sampled for subterranean fauna. There are very few other subterranean ecosystems in

[1] Department of Environment and Conservation December 2010. Definitions, Categories and Criteria for

WA that have been sampled as much or as systematically. The high level of sampling occurred for several reasons; firstly the baseline survey (Subterranean Ecology 2011) was conducted before new and weaker subterranean guidelines were released in 2013. The current Environmental Assessment Guidelines (EPA 2013) focus only on obligate subterranean fauna (stygobites and troglobites) and allows proponents to make assumptions based on 'surrogates' for species distribution that are untested or based on limited habitat data. The original study by Subterranean Ecology in 2011 was designed to support assessment under Guidance statement 54 (EPA 2003) and 54A (EPA 2007), which did not rely on surrogates and treated all subterranean fauna as requiring individual assessment, therefore the information contained within the baseline survey is greater in depth and detail than the assessment conducted by Bennelongia (Bennelongia 2015) for Cameco under the new guidelines.

Secondly, there were a large number of drill holes at Yeelirrie throughout a large cross section of the palaeodrainage system, which meant that sampling could occur throughout the whole palaeodrainage system, targeting different geological layers such as calcrete, transitional calcrete and alluvium. These drill holes were also custom built to target either stygofauna or troglofauna, which allowed sampling at different depths and throughout the hydrological profile. Subsequently, there was a better than average taxonomic resolution of the subterranean fauna thanks to the intensive use of genetic analysis to identify species in groups which were difficult to identify, and to help determine the differences between species living in different parts of the palaeodrainage system.

From these studies it has been shown that there is very high diversity of 115 species of subterranean fauna within the Yeelirrie area and that this appears to be regionally significant. Bennelongia attributes a large part of this high diversity to the intensive surveying and use of genetic analysis. This is noted, and it should be argued to encourage higher intensity surveying at other similar sites in the region. Instead, the current assessment keeps going back to the high rate of sampling as a reason to dismiss concerns implying that the extraordinary diversity at Yeelirrie would not seem so unusual if other areas were as well sampled. This critical assumption lacks an evidence base.At the same time the current assessment argues that, despite the highest rate of sampling of any subterranean ecosystem in the region, the current patterns of species distribution would appear more favourable, given more sampling. These contrary positions do not stand up to deeper scrutiny, and what is missing is an attempt to relate the species distribution patterns to the extent of or quality of the subterranean habitat.

There are high levels of species endemicity for most of the fauna known

throughout the region (i.e. the ‘calcrete island hypothesis’). If intensive surveying were to occur elsewhere in the region, it may be reasonable to expect even greater diversity from other calcrete habitats it is unlikely to show the species found at Yeelirrie would be found elsewhere.

There were baseline survey’s that sampled calcrete habitats downstream from the central Yeelirrie calcrete at the Yeelirrie Playa, and areas further south east that have been interpreted as being associated with Albion Downs calcrete. These surveys detected a very different subterranean fauna community, with a high level of species turnover between the central calcrete and the areas further downstream. From this evidence we can say with confidence that it is highly unlikely that the species currently known from the drawdown areas or the mine pit at Yeelirrie would be found elsewhere.

The high intensity of sampling, resulting in a very high diversity and high level of endemism within the Yeelirrie palaeodrainage system has been downplayed within the current assessment, but it has very serious implications for the conservation of subterranean species. If significant proportions of the calcrete habitat at Yeelirrie are destroyed by mining or fundamentally changed - 11 species of stygofauna and 4 species of troglofauna will almost certainly become extinct, and the unique species community that makes up the current Priority 1 PEC will be forever diminished.

Habitat - drawdown and mining impact of stygofauna

The drawdown of water from Yeelirrie provides the greatest risk to the Subterranean fauna. The impact of the drawdown is expected to have residual impacts for five hundred years post mining.

The sections of the PER about groundwater and drawdown do not describe the impact on stygofauna habitat but refer to Section 9-2 on subterranean fauna. In Section 9-2 Cameco assert that as the calcrete layer is shallow they have taken a precautionary approach and reduced the drawdown to 0.5m. This figure is not specifically compared to the actual depth of calcrete habitat in any area where the PEC stygofauna community occurs; therefore its relevance is questionable.

It is also unclear what the maximum drawdown level is and where and for how long this will occur.

Other parts of the PER suggest the drawdown will be greater than 1m and in other areas - particularly the northern bores it is suggested that drawdown might be as much as 5m. On page xxxiii Cameco state that the *“Maximum groundwater drawdowns in the Western, Northern and Eastern brackish well*

fields are expected to be approximately 2, 5 and 3 m, respectively. Around the mine pit the drawdown will typically exceed 7 m."

In the section on groundwater recovery on page 283 it appears that 0.5m is in fact the recovery level of ground water post mining.

For example:

- At 100 years post mining there will still be *"small residual drawdowns of 0.3 - 0.5m below the baseline elevations would persist in the area of the nearby eastern and northern well field for more than 200 years."*
- Within the TSF area, the water table eventually recovers to levels about 0.5m below the baseline elevations.

Cameco point to figure 9-16 to show the proposed maximum water drawdown. This cross section shown in figure 9-16 is a different scenario to figure 9-43 that also shows the expected maximum groundwater drawdown. Figure 9-43 indicates that the water table will drop below the calcrete and the carbonated clay quartz into the sandy alluviuim, silty sand, silty sandstone and the clayey alluvium, silty clay and sandy clay zones.

There is no clear indication where in these cross sections the primary and secondary subterranean fauna habitat is, whether it is dispersed through different layers of geology, or if particular species exist in different layers. The key question for the survival of stygofauna is - where is the habitat? what percentage of the habitat will be affected by dewatering/ drawdown and/or mining? And, what percentage of the habitat will be unaffected? These questions have not been answered satisfactorily; there is just an overall unproven assumption that somehow 0.5m will be ok, even though we understand that in fact the drawdown will be much more that 0.5m.

The recovery of the habitat following mining may also be severely affected by incursion of radioactive or toxic substances from mine waste and/or tailings. The mined out areas of the central calcrete, which constitute prime subterranean fauna habitat, are proposed to become a series of tailings cells and dumps for processing material, waste rock and contaminated materials.

No attempt has been made to reinstate any kind of suitable habitat for subterranean fauna in the mine area. The toxic chemicals and radiation that has been modelled to leach from the tailings in vast plumes over many hundreds of years will eventually contaminate the groundwater of other areas within the palaeodrainage system, some of which have their own unique subterranean fauna communities. No attempt has been made to assess or address these indirect impacts on subterranean fauna communities within the contamination zone from the tailings dumps despite containing unique

endemic species that are not known to occur elsewhere within the region.

The Bennelongia report identifies that out of 70 stygofauna species there are 11 that have only been identified in the direct impact area of the proposal - the mine pit and groundwater drawdown zone. These species are:

Taxonomic group	**Species**	**Abundance /(samples)**	**Known distribution**	**Remarks**
Oligochaeta	Enchytraeidae sp.Y4	38 (1)	Central drawdown	Only ever found in the impact area
Oligochaeta	Enchytraeidae sp.Y6	4 (1)	Central drawdown	Only ever found in the impact area
Crustacea, Isopoda	Philosciidae sp. N. Y2	5 (3)	Central drawdown	Only ever found in the impact area
Crustacea, Syncarida	Atopobathynella sp. 'link K'	2 (1)	Central drawdown	Only ever found in the impact area
Crustacea, Syncarida	Halicyclops cf. eberhardi sp. B	372 (4)	Central drawdown	Only ever found in the impact area
Crustacea, Harpacticoida	Kinnecaris lined	100 (1)	Central drawdown	Only ever found in the impact area
Crustacea, Harpacticoida	Novanitocrella 'aria' sp. N.	124 (4)	Central drawdown	Only ever found in the impact area
Crustacea, Harpacticoida	Schizopera akolos	4 (2)	Central drawdown	Only ever found in the impact area
Crustacea, Harpacticoida	Schizopera emphysema	8 (4)	Central drawdown	Only ever found in the impact area
Crustacea, Harpacticoida	Schizopera sp. 7439	5 (1)	Central drawdown	Only ever found in the impact area

In a bid to downplay the risk of extinction the current assessment uses assumptions about habitat and uses 'surrogates' to argue that each of these species are likely to be more widespread beyond the impact zone. For

example:

Atopobathynella sp. 'line K'
Despite the extremely high rate of sampling throughout the Yeelirrie palaeodrainage system, this species has only been found in one bore on 'line K', despite repeated sampling in the nearby bores on many occasions. The current assessment claims that the species could be found elsewhere because it is one of five species of this genus found at Yeelirrie and *"…the two [related] species collected from multiple drill holes were both widespread"* (Bennelongia 2015). This argument seems to be based on selective perception – there is no evidence presented to support the use of the two more widespread species of this genus as surrogates, rather than the two more restricted species. It is clearly convenient for an assessment to choose a more widespread species to use as a surrogate, but this is nothing more than conjecture unless there is some kind of evidence that the species and the surrogate share behavioural or ecological traits that would support the assumption that their ranges will be similar. There is currently no relevant evidence of that for any of the undescribed species of Atopobathynella, therefore this argument is little more than speculation. It also seems disingenuous to suggest that further sampling may find this species in additional areas, as the same amount of sampling has been expended for all species detected to date. After one of the most intensive surveys for subterranean fauna ever undertaken in the region, with almost all of the bores being repeatedly sampled on multiple occasions over several years, if a species was more widely occurring, you would have expected it to be found more widely, particularly when other, related species that are more widely occurring were found to be so. In the case that the current assessment is trying to suggest that new bores should to be drilled in different areas nearby to show that Atopobathynella sp. line K occurs more widely, then why did this not occur between the baseline survey in 2011 and the impact assessment in 2015 that showed exactly the same distribution for this species?

Novanitocrella 'araia' sp.n.
The baseline report (Subterranean Ecology 2011) showed two subspecies of Novanitocrella: N. 'araia' sp.n. and N. 'araia linec' sp.n., however the current assessment has merged these two species into one taxonomic unit. Possibly this was in order to address the problem that one of them was only known from a single individual inside the mine pit, and as a result there is not much that can be said about it. Nevertheless, both forms appear to be restricted to the drawdown area, therefore they are equally threatened by the mining proposal.

Enchytraeidae sp. Y4 and Y6
These species have been identified only from a small subset of a much larger

cohort of Enchytraeidae specimens that were genetically analysed, as the other specimens were unable to be identified. The current assessment is justified in assuming that each of the genetically defined species may therefore occur over a greater area than is currently recognised, but the important question is how much greater? It is puzzling that between the baseline survey and the current assessment, no further attempt was made to conduct additional genetic analysis to better define the species ranges of these taxa, when this may have provided additional information to assess these taxa. In the absence of this kind of information, it is only speculation to state, as the current assessment does, that either of these species 'most likely' occurs throughout the Yeelirrie calcrete.

Schizopera akolos and S. emphysema

The current assessment is confusing and inconsistent in its treatment of these species between tables 4 and 6, and the accompanying impact assessment text (Bennelongia 2015). Table 4 and the text surrounding table 6 seems to indicate that these species are regarded as possibly restricted to the impact zone, yet the comment in table 6 says *"Not restricted".* There does not appear to be any evidence to justify that these species are not restricted. Even the qualifying remarks regarding the potential existence of heterogeneous microhabitats appear to suggest a more complicated habitat for these species that would increase the likelihood that they could be restricted.

The third species of Schizopera (sp. 7439) was only detected from a genetic sub-sample and is equivalent to the previously stated Enchytraeidae species. It is true that there is very little that can be said about the potential distribution of a species in such cases. The default argument in this assessment seems to be that such species are assumed to be less likely to be restricted, based on speculation alone. This goes firmly against the precautionary principle that is usually upheld in such assessments. The lack of full scientific certainty regarding the distributions of these species should not be used to prevent implementation of measures necessary to conserve these species.

The current assessment of the species mentioned above is seriously flawed, and at the current time there is no reasonable argument or weight of evidence to suggest that any of these 10 species of stygofauna are found anywhere other than in the central drawdown area.

Troglofauna:

We are concerned that five species of Troglofauna could suffer critical impacts or become extinct if the proposal is pursued; Trichorhina sp. n. F, Tyrannochthonius sp.n. Y1, Austrohorous sp.n. Y1, Pauropoda sp. S6B and Symphyla sp.Y7.

Tyrannochthonius sp.n. Y1 and Austrohorous sp.n. Y1 were both loosely assessed as *"Not restricted"* based on a single line citation from a study in 2007 or 2008 *"Available data from other studies shows that subterranean pseudoscorpions are usually relatively widespread… in a common karst system."* This is a massive oversimplification of the issues involved in as much as:

a. the Yeelirrie calcretes are not a 'common' karst system, but a series of discontinuous calcrete islands - according the 2011 baseline survey, and,
b. it is not scientifically robust to generalise that 'most' troglofaunal pseudoscorpions are 'not restricted' when there is plenty of evidence that some are indeed restricted. In fact one of the papers cited by Bennelongia - Harvey and Leng 2008, a taxonomic paper, disproves the argument endemism stating that, *"Linnaeolpium linnaei… currently known from only a single location in north-western Western Australia where it was taken from a litter trap within a pisolite mesa, and as such can be readily characterised as a* ***short-range endemic*** *species as defined by Harvey (2002)."*

Meanwhile, Pauropoda sp. S6B and Symphyla sp.Y7 have also only been found in the North Western corner of the proposed pit. The current assessment has stated that: *"given the close proximity of all four species to the edge of the pit, the range of this species is likely to extend outside the pit and impact zone."* This argument is weak and appears to be based solely on conjecture rather than a more detailed examination of the species' potential ranges or habitat preferences.

There is no evidence provided about the suitability or connectivity of habitat beyond the proposed pit, or evidence of any of the troglofauna species existing in other similar habitat within the Yeelirrie palaeodrainage system or beyond. Out of 100 drill holes and 448 troglofauna samples in this area, these four species have only been found in this northwest corner of the proposed pit.

Based on current evidence, it is very difficult to see how the EPA objectives could possibly be achieved in regards to the five species of troglofauna that occur only within the Yeelirrie mine pit. The current assessment is based on weak arguments, selective quotations and assumptions that do not stand up to closer examination. At best the assessment provides only an overly optimistic hope that the range of these species might possibly extend beyond the pit. While this would be convenient for the proponent there is no evidence to suggest it is correct – and it should not satisfy the EPA.

Recent assessments that have failed to detect troglofauna singletons beyond the impact area following multiple rounds of sampling, such as Rio Tinto's Koodaideri Iron Ore Project, have resulted in mining exclusion zones of up to 500m surrounding each location where a troglofauna species was found to be restricted. We would expect, as a minimum response, a similar mitigation measure be applied to the Yeelirrie Project should the project go ahead. In addition, owing to the fact that the pits are proposed to become tailings storage facilities and the toxic/ radioactive chemicals would have a deleterious impact on any fauna within the nearby subterranean habitat, it is expected that a continuous calcrete habitat would be required to be preserved between the location of each of these five troglofauna species and the remaining unaffected habitat beyond the mining pit and the various tailings plumes.

To allow this project to proceed without such mitigation measures or without providing sufficient evidence that these five species exist outside of the impact zone would be to risk extinction level impacts for these species.

Discussion

There is a precedent around the arguments raised by Bennelongia using assumptions about the species existing elsewhere or being widespread without evidence. The trend in this report is to use surrogates or similar species elsewhere as the basis for suggesting the species could be widespread.

Yeelirrie is the most thoroughly sampled area for subterranean fauna in the region. If these species have not been found despite intensive sampling we should apply the precautionary principle and assume that they are not widespread.

In addition to the long term residual impacts of drawdown there is expected to be a slow moving chemical plume coming from the tailings and backfilled pits for over 500 years. The loss of water and increase in pollution are both worse when combined together. The pollution is likely to be more toxic and there is less water to disperse in.

The chemical plume which is expected to move south threatens the southern subterranean fauna community at Zone 6 "South East" and Zone 7 "Yeelirrie Playa".

Changes to salinity, total dissolved oxygen and acidity are all significant factors in ecosystem function and habitat that again could further put pressure on the subterranean fauna. These factors will also be affected by drawdown and reinjection. These factors are not explored in the current assessment, due to the simplification of subterranean fauna impact assessment to the impacts of mining or groundwater drawdown only.

These questions about habitat and habitat protections have neither been asked nor been answered in the PER, leaving ambiguous and conflicting claims about minimising the water drawdown.

We have no confidence that these populations of a Priority 1 PEC will not be critically impacted. The current assessment has only addressed water drawdown as a management strategy for subterranean fauna and has failed to do this convincingly. Some alternative options have been discredited as too expensive. Other options that have been considered appear to reduce impact but cannot mitigate it. Exclusion zones have been discounted altogether as the habitat is interlaced with the mining deposit and yet exclusion zones may be the only option to adequately conserve some of the species, particularly troglofauna.

Based on the current assessment, it is near impossible to see how the EPA's objectives for subterranean fauna could be met. We suggest that the Yeelirrie uranium proposal be completely rejected on the grounds that in its current form, it will likely cause the extinction of at least 10 species of stygofauna and 5 species of troglofauna.

Who is Cameco

Cameco is one of the world's largest uranium producers with operating uranium mines in Canada, the US and Kazakhstan. This provides an opportunity for the WA Government and EPA to consider how this company behaves and operates. Appendix 2 is a table of Cameco's incidents and accidents. The report is 31 pages long with 54 entries detailing incidents, spills, military ties, leaks and transport accidents from Cameco's operations.

Most recently Cameco have been in trouble with the courts in both Canada and the US over allegations of tax avoidance to the tune of $1.5 billion.[2]

Here is a snap shot of just a few concerns with how Cameco operate;

- Cameco pleaded guilty in 1989 to negligence and was fined $10,000 for leaking 2 million litres of radioactive liquid into a creek.
- Inter-Church Uranium Committee (ICUC) from Saskatchewan, Canada, has revealed the export of at least 500 metric tons of depleted uranium to the US military by Cameco Corporation.
- Cameco is in the tax court over $800 million to $850 million in corporate taxes the Canada Revenue Agency says went unpaid between 2008 and 2012.
- Sierra Club Canada reported *"As of 2010, water releases from Deilmann Tailings in cadmium exceed the Saskatchewan standard by an extraordinary 5,782 percent. Uranium concentrations were above*

[2] https://www.biv.com/article/2015/8/cra-targeting-mining-sector-tax-havens/

the standard on average 1,323 percent and at the high level value by 10,153 percent! Radium 226 and lead 210 concentrations on average exceed the standard by 1,481 and 140 percent respectively. ..."

- And *"At the McArthur River site, concentrations of arsenic, selenium, and uranium in water effluent have exceeded the standards by 54 percent for arsenic, 700 percent for selenium and an astronomical 1,230 percent for uranium. There is no reporting done on mercury. Blueberries and fish are contaminated with uranium."*

With allegations of tax fraud, flawed community consultation, radioactive leaks and spills and direct links to the production of depleted uranium weapons Cameco's operations reflect almost every aspect of the nuclear industry which gives it a bad name and causes community opposition.

This publicly documented pattern of non-compliance, mis-management, tax irregularities and community division should be taken into consideration when applying bonds and conditions to ensure compliance. Should this mine be approved the West Australian Government must do everything in its power to protect the environment and the tax-payer from risks arising from Cameco's proposed mines at Yeelirrie and Kintyre.

Mining rate

Cameco's proposal to mine Yeelirrie is significantly different to the earlier BHP Billiton proposal. This change is referenced in the beginning of the PER document (pg. xix). *"In November 2014, Cameco terminated the 2009 State referral and submitted a new referral* ***due to changes to the Project****."* Among some of these changes is the proposal to almost double the rate of mining.

In Cameco's request to terminate assessment No. 1788 in a letter to the EPA on the 12th of November 2014 they state that:

"BHPB had proposed an ore processing production rate of 1.2Mtpa, which resulted in a mine life of approximately 30 years. Cameco does not consider this production rate to be efficient or economically viable and is proposing to increase the ore processing production rate to 2.4Mtpa. At the higher production rate the life of the mine is estimated to be approximately 17 years. The higher ore processing rate will result in higher water demand; more ore produced and increased rates of transport. These levels will exceed the limits of the key characteristics proposed by BHPB in the Scoping Document."

In Section 5.2 *"Evaluation of Project Alternatives"* Cameco outline some of their proposed mining specifications. They do not however assess or compare the proposed mining impacts of the BHP Billiton proposal compared to the impacts of the Cameco proposal.

The increased rate of mining and intensity of mining is likely to have more

severe impacts on the environment than the BHP Billiton proposal. The BHP proposal was not considered as a project alternative. Perhaps one of the contributing factors to BHP Billiton selling the Yeelirrie proposal is that the project was doomed to either have unacceptable environmental impacts or to be unviable economically.

The increased rate of mining is likely to have a range of impacts compared to the BHP Billiton proposal, including:

- The current proposal shaves at least ten years off the mine life
- Increased water demand
- Increased water drawdown
- Increased long term impacts on groundwater
- Increased downstream impacts
- Increased impacts on groundwater dependent ecosytsems
- Increased dust deposition on plants and impacts of flora
- Increased risk of dust pollution in general
- Increased risks association with dust and workplace health and safety
- Increased radon build up
- Increased risk of dust pollution from ore stockpiles
- Increased risk of dust pollution from the open pit

There are likely to be more impacts that have not been identified to date with the revised project configuration.

For some aspects of the new proposal Cameco have relied on information and studies that were done for the BHP Billiton proposal. Some of these cannot and should not be applied to this scaled up project. For example we understand that the studies on ore stockpiles done for the BHP Billiton proposal examined smaller stockpiles but for a longer period of time. Cameco's proposal is for bigger stockpiles for a shorter period of time. We believe the Cameco model has higher associated risks. (See section on Ore Stockpiles).

We are concerned that Cameco's interest in reducing costs by increasing the rate and intensity of mining will have negative consequences for the environment that have not been addressed in the PER. Further, alternatives have not been adequately considered. The economic drivers for this project are also weak which raises other concerns about whether this project could be vulnerable to premature closure or to extended care and maintenance over the mine life. Given that economic uncertainty also increases rehabilitation uncertainty we urge the EPA to consider the risks associated with increased rate of mining proposed by Cameco and to recommend the proponent consider alternatives.

Regulating uranium

We take this opportunity to draw the EPAs 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. Apart from taking place in the proponents home nation 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 'Worlds Best Practice'. There were several areas where WA regulations fell short (Appendix 3). 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.

There are also serious limitations in the DMP's ability to hold companies accountable for non-compliance with environmental conditions. In the Mining Act 1978[3] there are no heads of power given to the Department of Mines and 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.[4] 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. . For WA agencies to press ahead with an industry that has failed to deliver on basic promises of compliance and rehabilitation is irresponsible. We urge the EPA to consider the BAPE findings and heed the warnings found in the panel's recommendations.

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

[4] 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=AFQjCNF2CAxTOIMy7Aj0QdloZiRMMWFlTg&sig2=rZAgQrD68R9j0Flx1milIw&bvm=bv.59568121,d.dGI&cad=rja

Yeelirrie State Agreement

The Yeelirrie State Agreement Act (the Act) is outdated and should be repealed as the Agreement fails to comply with contemporary policy and regulations.

The Act continually refers to 'plans' that are not attached to the Act and do not correspond with current plans - making much of the Act incomprehensible.

The Act provides commitments from the State government on infrastructure that may not be a current priority for public spending or need not serve the public interest. Other sections giving exemptions on labor conditions, royalties and more are simply outdated. For example:

Section 18. (5) (d) claims that *"The State shall construct or cause to be constructed new public roads suitable for the Corporation's operations here under in accordance with the requirements of the Commissioner of Main Roads…"* Public spending on infrastructure for a short-term mine with no immediate prospects and questionable long term prospects would be an unjustified use of public funds.

Section 19. Suggests it may be possible to ship uranium out of Geraldton, Esperance or Fremantle. None of these ports are licensed to export uranium and both the WA Liberal and Labor parties have defended the view that uranium will not be shipped out of a WA port.

Section 20 (2) (1) (c) requires that the Corporation abide by requirements of the State Energy Commission. The Act dedicates two pages to outlining the relationship that the Corporation should have with the State Energy Commission, which no longer exists. The State Energy Commission was delisted in 1995 - 20 years ago. The Yeelirrie Agreement should similarly be revoked as no longer relevant.

Section 21. (3) claims that *"The State shall ensure that during the currency of this Agreement and subject to compliance with it's obligations here under the* ***Corporation shall not be required to comply with the labour conditions*** *imposed by or under the Mining Act in regard to the Mineral lease."*

This is reiterated in Section 21. (7) (a) which says *"The State shall ensure that subject to compliance with its obligations under this Agreement the Corporation shall not be required to copy with the labour conditions imposed by the Mining Act."*

It is absurd that the proponent promotes this mine as important for job creation while benefiting from exemptions to labour conditions. It raises serious concerns to the health and safety of workers and the commitment from both the company and the Government about safety and radiation

protection along with the ability for workers to pursue compensation if they develop work related illnesses. This aspect of the Act further significantly undermines the projects justification and the social value and license.

Section 21 (6) states: *"Notwithstanding the provision of this Clause the Corporation may with the consent of the Minister for Mines from time to time (with abatement of future rent in respect to the area surrendered but without any abatement of the rent already paid or any rent which has become due and has been paid in advance) surrender to the State all or any portion or portions (of reasonable size and shape) of the mineral lease."*

This section raises the very real concern that the company may be able to relinquish parts of the site without rehabilitation. The significant changes to legislation of requirements for mine closure are rehabilitation are also not reflected in the Act. These issues are discussed further in the section on the MRF and bonds.

Section 22 (1) refers to peppercorn leases - and other nominal fees for occupancy rights that are well below current property values and are out dated and should not be accepted.

Section 25. (1) requires royalties at the rate of 3.5% of the f.o.b. value gross sales price for uranium oxide produced from the mineral lease (whether sold as such or converted outside Australia to uranium hexafluoride). This is much less than the 5% required under contemporary laws.[5] This is described in later sections on royalties.

The Yeelirrie State Agreement Act should be repealed. The repealing of this Act would show a significant commitment from the Government and the proponent that should this mine be approved it would be expected to operate consistent with contemporary community expectations and legal and regulatory frameworks. If there is no intention to operate outside current Western Australian laws then there should be no hesitation to repeal the Act.

Royalties

The DMP notes the divergence in royalty rates for uranium in the Mineral Royalty Rate Analysis 2015 - stating:

"The Mining Regulations 1981 apply an ad valorem rate of 5% to uranium sold as a uranium oxide concentrate (yellowcake). The Uranium (Yeelirrie) Agreement Act 1978 (Yeelirrie State Agreement) sets an ad valorem rate of 3.5% for uranium oxide sold in the first seven years after the treatment plant

[5] http://www.dmp.wa.gov.au/documents/Mineral_Royalty_Rate_Analysis_Report.pdf

comes into operation. The Yeelirrie State Agreement provides a royalty review mechanism after the first seven years of operation, and every five years thereafter."

The DMP has recommended (recommendation 14) that the royalty rate for uranium should be lowered to 3.75% based on processing requirements and citing the current low uranium price. Given that uranium mining requires extensive assessment and regulation and therefore high costs to the State Government we would argue that the 5% reflects the drain on the public service from administering and regulating uranium mine proposals (and potentially active mines). In fact we would advocate for a much higher royalty rate than 5% to better reflect the risk to the environment, public health and the state. We note that in Cameco's home town of Saskatchewan they have a tiered royalty rate[6] including:

- *Basic royalty 5% of gross sales*
- *Tiered royalty - tiers increase from 10% to 15% as profit increases*
- *Saskatchewan Resource Credit - a credit of 0.75%*

While we disagree with the DMPs suggestion of reducing the royalty rate for uranium we do agree with the DMP recommendation of removing royalty concessions in State Agreements. The DMP state that:

"The practice of not specifying royalty rates in new State Agreements should continue. Royalty concessions in existing State Agreements should continue to be removed and royalty rates set according to the Mining Act 1978. This should be addressed over time by agreement with the relevant parties as opportunities to renegotiate the agreements arise.

We recommend that the EPA advise that the State Agreement Act be repealed given that it is out of date and out of step with current regulation and expectations on workers health and safety, on royalties and with unrealistic costs to the State.

Rehabilitation Securities/ bonds/ MRF

Having read the Yeelirrie State Agreement Act and the Yeelirrie PER there is no clarity, commitment or acknowledgement of any requirements to hold bonds or securities for the rehabilitation of the proposed Yeelirrie mine.

There are clear state requirements for all tenement holders operating under the Mining Act 1978 to pay a 1% levy under the MRF except for tenements covered by State Agreements[7].

Bonds requirements are now a discretionary power for the Minister to apply a bond or not. There is concern that the political desire of the Government to

[6] http://www.economy.gov.sk.ca/UraniumInfo/Circs
[7] http://www.dmp.wa.gov.au/19344.aspx

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. Despite the current situation the discretion of the Minister is often open to lobbying and the politicising of an issue. 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.

We submit that Cameco should not be exempt from the MRF and in addition to the 1% levy Cameco should be required to provide a bond that equates to 100% of the expected cost of rehabilitation 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 8 core reasons why mine securities for uranium mines should be applied;

1. The uranium market is particularly volatile; it has been 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 can be currently seen in Rio Tinto's decision not to support an extension to mining at the Ranger operation in Kakadu. In the case of any new proposals there is a real risk that they will open and close prematurely without rehabilitation, leaving a burden on the tax-payer 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.*[8]*"* Again please note that the 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 worlds best practice uranium mining - and currently the worlds best practice uranium rehabilitation costs approximately $9.3 billion.

[8] http://www.lexology.com/library/detail.aspx?g=23ed12dc-57fd-441b-bb0d-5e50ee7c7e3b

4. Rehabilitation of uranium mines is disproportionately high, even below worlds 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 million[9].

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 (UAG - see Appendix 3) 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."*[10]

7. The proponent Cameco has a record of poor environmental management and financial compliance. It is based overseas and operates only as a subsidiary in Australia, a status subject to change in the future. Bonds may be the only protection the State has against any premature closure and possible abandonment.

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

Aboriginal Community - consultation

In April 2015 Cameco hosted an open day, arranging buses from Wiluna, Leonora and Meekathara. Mia Pepper from Conservation Council of WA was invited by Traditional Owners to accompany them to the open day. Observations from the open day were simple; there were serious concerns about the uranium mine, the impact on the environment, the act of mining on a cultural site and impacts to cultural heritage. There were one or two people who indicated that they would be open to discussion on some benefits or

[9] ERA 2014-2015 Annual Report https://www.erawa.com.au/about-us/annual-report
[10] Uranium Advisory Group Final Report
http://www.dmp.wa.gov.au/documents/UAG000408v05_April_12-pmd_v2.pdf

community project funding, but did not indicate that they were happy or would consent to the project. Those who voiced that interest were in a clear minority.

However this limited interest expressed in holding conversations about community benefits has caused much conflict and division in the community.

Cameco invited a First Nations employee and representative from Saskatchewan to praise Cameco for their work with Indigenous people in Canada. Cameco's message to the community was that the open day was just one of many conversations to come. They indicated that the mine would go ahead despite these conversations. This attitude was widely viewed as them imposing themselves on an unwilling community.

From the outset we must acknowledge the long opposition to the Yeelirrie project. For over 40 years the family groups in the area have remained united in opposition to mining at Yeelirrie. Yeelirrie in the local language means 'place of death'. This name reflects dreamtime stories about that country. It is an area that local people would not visit because of the stories associated with the area. This has formed much of the basis of opposition, as well as the strong feeling of custodianship and continuing cultural responsibility.

There is a strong feeling from many people in the community that they do not want to send uranium overseas to other communities because of the risk that uranium could end up as nuclear fall out from a reactor or nuclear weapons and because it will inevitably become radioactive waste. Many people feel responsible for that and worry about those responsibilities. This sentiment in the community is strong and hugely touching. The care and respect for traditional stories and connections and the concern and love for people world wide who may be impacted by something from their home - something that is seen as their responsibility.

This sense of obligation and need to protect Yeelirrie was reflected in the 27th May 2010 media release from Central Desert Native Title Service on behalf of the Traditional Owners who had *"instructed Central Desert Native Title Services Ltd they strongly oppose the development and uranium mining of uranium at Yeelirrie."* (Appendix 4) It is our clear understanding that this view is still held and maintained except for a few individuals who are still opposed to the mine but feel there is little or no option to stop the mine and would like to get some benefit from a project that they now think is inevitable. Active opposition from most of a community coupled with resignation from the rest does not constitute social license.

In this submission we would like to raise the issue that the proponent, as seen in many other communities is likely to try to erode community opposition that has lasted over 40 years. Based on what we have witnessed at Kintyre and what we are now witnessing at Yeelirrie it is likely a number of things will happen that create conflict and division which will no doubt have lasting

impacts on internal community relations. This general pattern follows a predictable path:

1. The proponent will engage with people interested in conversations about benefits and funding for projects. This may or may not involve the broader community. These conversations are likely to exclude many people.
2. There may not necessarily be broad social benefit from this funding - but it will rather create division between those who have benefited and those who have not.
3. It will create further division between those who are willing to negotiate over an unwanted project and those who will stand strong.
4. The proponent will continue to make interventions, presentations and hold conversations with the community. This will increasingly exclude people who are not willing to engage or those people will exclude themselves.
5. The proponent will continue to tell people that the mine will go ahead despite community opposition, with or without their support. The community will increasingly feel stuck causing some people to negotiate feeling that they have no other option - already having witnessed the exclusion of many people.
6. There will continue to be people with connections to Yeelirrie who will refuse to accept a mine, will continue to oppose it and are likely to become more and more frustrated with their community and family who have not stood their ground.
7. The overarching impact is long lasting rifts between families and within families. In our experience the uranium sector leads to split communities as well as split atoms.

We feel it is important to highlight this chain of events having witnessed this time and time again over many different mining projects. CCWA has a strong relationship with the community in Leonora who have family ties to Yeelirrie.

This relationship has been built over six years of not just work but of building friendships and walking together, learning together and having a shared concern and vision. We have witnessed the erosion between family relations in the last two years since Cameco purchased and actively engaged in the Yeelirrie proposal. We are deeply saddened by a process that allows corporations to pursue their commercial interest in a way that causes this division in communities and is not representative of the communities overarching opposition to mining at Yeelirrie.

Any genuine project assessment process should recognise and reflect Aboriginal aspirations and concerns. The EPA may not have powers to change or influence the way this company behaves or an overall systemic problem but we feel this is such a serious and direct impact of mining that it is important that this issue is raised in the public realm.

Aboriginal Heritage

Cameco's proposal states *"The project will impact a number of places where archaeological material and culturally modified trees have been identified. Disturbance to some of these places will be unavoidable during development of the project."*

In reference to the Aboriginal Heritage Act 1972 the PER states that *"Cameco's position is that disturbance to Aboriginal heritage sites and the values associated with these sites will be avoided where possible. However, in some cases it may not be possible to avoid disturbance to all Aboriginal heritage sites if the project is to proceed."*

Disturbance is a euphemism for destruction in this case. This project will destroy Aboriginal heritage. The removal and destruction of Aboriginal Heritage is a loss for all, forever. We strongly believe Aboriginal heritage, which is tens of thousands of years old, should be treated with the same regard that we treat European heritage in Australia.

Aboriginal culture is the longest surviving culture in the world. The heritage values of this country and individual sites are extensive. It is a poor policy and a poor trade that would see the Government place the value of a short-term mine over Aboriginal Heritage that has existed for centuries.

It is our collective view, and the view presented by the communities in the Goldfields that we have worked with for over six years on this issue, that these sites should not be disturbed. It is not good enough and it is not acceptable for Aboriginal heritage to be routinely disturbed or destroyed. 'Avoiding where possible' the destruction of Aboriginal Heritage is not sufficient.

The Conservation Council of WA and the Anti Nuclear Alliance of WA have been engaged with and are supportive of the newly formed group Aboriginal Heritage Action Alliance - a group of lawyers, academics, organisations and Aboriginal people. We do not support the proposed changes to the Aboriginal Heritage Act and would be concerned about any impacts the changes might have on the protection of sites at Yeelirrie.

The existing Aboriginal Heritage Act has failed to protect sites from mining and other interests. If the proposed changes are implemented it will be easier for sites to be deregistered and or destroyed with less consultation with Aboriginal people. It is extremely disappointing that these changes have been put forward.

At the Yule River annual meeting with Aboriginal representatives from across WA, Representative bodies from the Kimberley and Pilbara and members of Parliament, a resolution was passed demanding that… *"procedural fairness is*

in the Aboriginal Heritage Act 1972 (WA) for decisions affecting the heritage of Traditional Owners, and that other legal challenges available to protect threatened heritage sites be investigated."[11]

We support this sentiment and effective action for the better protection of Aboriginal Heritage sites.

Project Justification

Cameco has clearly stated that the uranium price does not warrant further development of new uranium mines. The long-term viability of new uranium projects is overstated and misleading. The following section separates the reality from the rhetoric about the uranium industry.

From the mid-2000s until the Fukushima disaster in 2011, expectations of a significant global expansion of nuclear power drove a sharp increase in uranium exploration, the start-up of numerous mines, and a uranium price bubble. However nuclear power has maintained its long-standing pattern of stagnation. Some uranium mines have shut down, some are operating at a loss. Uranium exploration has sharply declined. The uranium price is lower than the average cost of production – and well below the level that would entice mining companies to invest capital in new projects.[12]

Energy consultants Julian Steyn and Thomas Meade wrote in *Nuclear Engineering International* in October 2014:

"The uranium market is characterised by oversupply, which is forecast to continue through most of the current decade. The oversupply situation has been exacerbated by the greater-than-initially-expected decline in demand following Fukushima as well as the increase in primary supply during the same period. Existing production capacity and output from mines under development could cause total supply to exceed demand through the year 2020."[13]

Likewise, investment strategist Christopher Ecclestone from Hallgarten & Company wrote in November 2014:

"There has indeed been a nuclear winter verging on an Ice Age over the last few years with bad news heaped upon bad news within the context of a pretty

[11] http://ymac.org.au/wp-content/uploads/2015/09/150927-media-release-YuleRiver.pdf
[12] For general discussion on the uranium industry, see *Nuclear Monitor* #792, 2 Oct 2014, www.wiseinternational.org/node/4190
See also: 'Nuclear non-starter: Oversupplied, losing money and without a constituency', *Climate Spectator*, 16 Feb 2015, www.businessspectator.com.au/article/2015/2/16/energy-markets/nuclear-non-starter-oversupplied-losing-money-and-without
[13] Julian Steyn and Thomas Meade, 1 Oct 2014, 'Uranium market doldrums continue', www.neimagazine.com/features/featureuranium-market-doldrums-continue-4390747/

dismal financing situation for mining all around. ... The yellow mineral had made fools and liars of many in recent years, including ourselves."[14]

Likewise, RBC Capital Markets analysts said in June 2014 that worldwide supply currently exceeds demand, and that it does not expect the uranium industry's situation to improve until at least 2021 because of accumulated inventories.[15]
China, Japan and some other countries have amassed large stockpiles of uranium – industry analyst David Sadowski said in March 2014 that *"many utilities are sitting on near-record piles"* of uranium.[16]

China is the only country where significant nuclear growth can be anticipated in the coming 10–20 years. However, according to investment bank Macquarie, there are *"serious question marks"* about China's uranium requirements.[17] Macquarie believes that China has enough uranium stockpiled to meet demand for about seven years at forecast 2020 consumption rates – which is around three times greater than the current consumption rate.

Japan is estimated to have stockpiles of around 100 million pounds of uranium oxide.[18] To put that in perspective, world uranium requirements for power reactors amounted to around 171 million pounds in 2014. It will likely take a decade – perhaps longer – before Japan's stockpile is consumed given the protracted nature of the reactor restart process in the aftermath of the Fukushima disaster.[19] Even if all of Japan's 43 'operable' reactors were operating, it would take around five years to consume 100 million pounds of uranium oxide.

Steve Kidd, an independent consultant and economist who worked for the World Nuclear Association for 17 years, wrote in *Nuclear Engineering International Magazine* in May 2014 that *"the case made by the uranium bulls is in reality full of holes"* and he predicts *"a long period of relatively low prices, in which uranium producers will find it hard to make a living"*.[20]

Kidd states that most nuclear power growth to 2030 will be concentrated in China and Russia. But *"uranium demand will almost certainly fall in the key markets in Western Europe and North America",* he states, and in Japan it will

---

[14] http://investorintel.com/nuclear-energy-intel/nexgen-energy-nxe-v-survivor-nuclear-winter/
[15] Vicky Validakis, 6 June, 2014, 'Price collapse sees junior miner ditch uranium to focus on property development', www.miningaustralia.com.au/news/price-collapse-sees-junior-miner-ditch-uranium-to
[16] 29 March 2014, 'Conjuring Profits from Uranium's Resurgence: Interview with David Sadowski', http://theenergycollective.com/streetwiser/360291/conjuring-profits-uraniums-resurgence-david-sadowski
[17] Rhiannon Hoyle, 17 Jan 2015, 'Uranium Rally Running Low on Juice', http://online.barrons.com/articles/uranium-rally-running-low-on-juice-1421462807
[18] http://seekingalpha.com/article/2822326-charting-uraniums-gain-brent-cook-looks-for-sweet-spots-in-the-athabasca-basin
[19] www.businessspectator.com.au/article/2015/2/13/energy-markets/japan-plans-post-fukushima-nuclear-restart
[20] www.neimagazine.com/opinion/opinionthe-future-of-uranium-higher-prices-to-come-4259437/

take a *"long time to unwind the inventory accumulation".* Only low-cost uranium mining operations will prosper while others *"will struggle to stay in business and further mine closures ... are definitely on the horizon."*[21]

Kidd argues that a new era has emerged, where the uranium market is split into three[22]:

- China will favour investing directly in mines to satisfy its requirements – China is not going to 'play ball' with the established uranium market.
- Russia will continue to be a significant nuclear fuel exporter but its own market will remain essentially closed to outsiders. Russia still has secondary supplies to tap into (plenty of surplus highly-enriched uranium remains to be down-blended) and will follow the Chinese and invest directly in uranium assets if their own domestic production remains constrained.
- The established uranium producers will have the remainder of the market to satisfy and that will likely be declining in magnitude. In the US, the number of operating reactors will fall by 2030 and the overall European situation will be one of "gentle decline".

Kidd pulls the threads of his argument together[23]:

"This market segmentation and the way the Chinese and Russians will operate means that the two prime analytical devices utilised in the uranium market are both now useless. First, calculated annual world supply-demand balances (miraculously often showing a shortage after 3-5 years) are irrelevant in a segmented market, where key actors with expanding demand choose to go it alone. For a time in the early 2000s, it looked as if a globalised world nuclear fuel market could emerge, but this has not happened and it is arguably now going into reverse. Secondly, uranium supply curves (based on mine cost data), demonstrating the need for higher prices as demand expands, are also invalidated. China and Russia (and probably India too, if it eventually gets its nuclear act together) will develop uranium assets wherever it best suits them. They have the confidence to bypass the conventional market, which could increasingly become merely a sideshow."

Kidd concludes[24]:

"In this fifth age of uranium, prices will essentially be determined by the cash costs of production of operating mines (and not by the full costs of future mines). This means a reversion to the long period of low (but relatively stable) uranium prices of the late 1980s and 1990s (the third age), but at a higher level to reflect the greater level of production now, the escalation of mining costs and the movements in currency exchange rates. The shortages predicted by many analysts (leading to rapid price increases to provide good

[21] www.neimagazine.com/opinion/opinionthe-future-of-uranium-higher-prices-to-come-4259437/
[22] www.neimagazine.com/opinion/opinionthe-future-of-uranium-higher-prices-to-come-4259437/
[23] www.neimagazine.com/opinion/opinionthe-future-of-uranium-higher-prices-to-come-4259437/
[24] www.neimagazine.com/opinion/opinionthe-future-of-uranium-higher-prices-to-come-4259437/

rates of return on their favourite projects) are purely a mirage. ***The outlook is therefore not favourable for either current or prospective uranium producers. Only those with low-cost operations will prosper. Others will struggle to stay in business and further mine closures ... are definitely on the horizon."***

With stagnant demand and large stockpiles, uranium miners have been left clutching at straws. Some hoped that supply from Russia might be curbed in response to Western sanctions, thus breathing some life into the uranium industry elsewhere – but that has not eventuated.

Some hoped that dwindling secondary supply sources – in particular, the end of the US–Russia Megatons to Megawatts uranium down blending program – would breathe life into the uranium industry. But the end of the Megatons to Megawatts program has had little or no impact. Raymond James analyst David Sadowski noted in August 2014:[25]

"[T]he end of the Megatons to Megawatts high-enriched uranium (HEU) deal was long anticipated to usher in a new period of higher uranium prices. But the same plants that were used to down-blend those warheads can now be used for underfeeding and tails re-enrichment. In this way, the Russian HEU-derived source of supply that provided about 24 million pounds (24 Mlb) to the market did not disappear completely; the supply level was just cut roughly in half."

And if there was a shortfall, surplus weapons material is just one of the secondary sources that can reduce demand for primary mine production. Other secondary sources are underfeeding at enrichment plants (getting more uranium-235 from a given volume of uranium ore), re-enrichment of tails material, government and commercial inventories and uranium recycled from reprocessing plants.

Steve Kidd argues that the replacement of inefficient gaseous diffusion enrichment plants with centrifuge enrichment plants is a "crucial" factor:[26]

"Another crucial factor has been a fundamental realignment in the relationship between uranium and enrichment requirements. The closure of the inefficient gaseous diffusion enrichment plants removed the high marginal cost production which had propped up prices, while notably higher uranium prices in themselves encouraged the use of higher enrichment (through reducing the optimum "tails assay"). Enrichment is now expected to remain cheap and abundant as centrifuge plants are modular and capacity can be expanded relatively easily to meet demand, so this substitution of enrichment for uranium will continue to be important."

[25] Peter Byrne, 5 Aug 2014, 'Why predictions of uranium price boom flopped', www.mineweb.com/mineweb/content/en/mineweb-uranium?oid=249357&sn=Detail
[26] www.neimagazine.com/opinion/opinionthe-future-of-uranium-higher-prices-to-come-4259437/

Huge stockpiles of depleted uranium represent *"an attractive resource while there is overcapacity in enrichment and cheaper prices",* Kidd states.[27]

Indeed some of the same enrichment plants that were used for the Megatons to Megawatts program are now being used for underfeeding and tails re-enrichment as David Sadowski noted in August 2014:[28]

"[T]he end of the Megatons to Megawatts high-enriched uranium (HEU) deal was long anticipated to usher in a new period of higher uranium prices. But the same plants that were used to down-blend those warheads can now be used for underfeeding and tails re-enrichment. In this way, the Russian HEU-derived source of supply that provided about 24 million pounds to the market did not disappear completely; the supply level was just cut roughly in half."

Just as the end of the Megatons to Megawatts program failed to boost uranium prices, so too the restart of reactors in Japan (the first restart was in August 2015) has done very little or nothing to boost prices.

Australia's Uranium Industry

Uranium accounts for a tiny percentage of Australian export revenue. In the 2011/12 financial year[29]:

- uranium accounted for 0.19% of national export revenue (the 2013/14 figure was also 0.19%[30] 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.

In 2011, the total value of global uranium requirements was approximately US$10 billion[31] – 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".*[32] Thus many countries are competing in a market that is modest in size.

---

[27] www.neimagazine.com/opinion/opinionthe-future-of-uranium-higher-prices-to-come-4259437/
[28] www.mineweb.com/mineweb/content/en/mineweb-uranium?oid=249357&sn=Detail
[29] ACF, 2013, 'Yellowcake Fever: exposing the uranium industry's economic myths', www.acfonline.org.au/resources/yellowcake-fever-exposing-uranium-industrys-economic-myths
[30] 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
[31] 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
[32] 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

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%.[33]

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.[34]

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%.[35]

Australia's uranium production of 5,000 tonnes in 2014 was the lowest for 16 years.[36] The industry generates less than 0.2 per cent of national export revenue (0.19% in 2013/14[37]) and accounts for less than 0.02 per cent of jobs in Australia.[38]

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.

---

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

[34] 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

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

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

[37] 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

[38] 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

According to a 2012 report[39] 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 tU3O8[40]). 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."*[41]

Richard Leaver further notes[42]:

"'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 tU[43] 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:

[39] www.bree.gov.au/documents/publications/energy-in-aust/energy-in-australia-2012.pdf
[40] www.world-nuclear.org/info/Facts-and-Figures/World-Nuclear-Power-Reactors-and-Uranium-Requirements/
[41] http://books.google.com.au/books?id=QdOkh26w3McC&pg=PA92
[42] http://books.google.com.au/books?id=QdOkh26w3McC&pg=PA88
[43] www.world-nuclear.org/info/Facts-and-Figures/Uranium-production-figures/

- In a 2012 paper[44], 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 begin operation in the next three to four years".* No mines are operating in WA as of December 2015.

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 report[45]:

- 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 2013/14[46]).

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.[47]

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.

---

[44] http://web.archive.org/web/20130425205831/http://www.aua.org.au/Content/AUASubDEWP.aspx

[45] 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

[46] www.world-nuclear.org/info/Country-Profiles/Countries-A-F/Australia/

[47] 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

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.[48]
- 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.
- 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, states 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.

But do Mr Roy's figures 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 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 <u>total</u> *"base-load capacity"* across all fuels.

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

[48] www.reuters.com/article/2013/01/08/us-nuclear-korea-idUSBRE90704D20130108

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 IBISWorld'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.[49] 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.

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

- 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 Reefton Mining announcing a "major new uranium discovery" in Namibia which was in fact discovered in the 1970s.
- Spending only a small fraction of funds raised on exploration.

Michael West wrote in *The Age* in 2011[50]:

"Until now inveterate fraudsters, even convicted heroin traffickers, have happily promoted their floats on the ASX. Of the 2300-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.[51] 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. 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 powers[52], the ASX prefers the light touch of providing *"additional guidance"* to companies, and ASIC rarely prosecutes.[53]

[50] Michael West, 16 April 2011, 'Not just another crackdown', www.theage.com.au/business/not-just-another-crackdown-20110415-1dhpk.html
[51] www.jorc.org/about.asp
[52] www.jorc.org/noncompliance.asp
[53] www.smh.com.au/business/golden-goose-lays-an-egg-20120322-1vmsz.html

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 nations[54], and Paladin Energy lobbying against proposed changes to Australia's anti-bribery and corruption laws in relation to mining in Africa.[55]

A detailed timeline of the 2005–07 speculative uranium bubble in Australia and its aftermath is posted online.[56]

Management Plans

A continuing concern for our organisations is the issue of transparency and the deferral of management plans to other agencies. We have raised this through the ERMP process for the proposed Wiluna and proposed Kintyre uranium mines. It is with great frustration that we note that deferral of management plans seems to have become entrenched in the assessment process. Such an approach is neither credible nor transparent.

This is also a poor process as:

1. It excludes the public from reviewing and having input into those management plans. The PER process is the only opportunity for the public to make comment on the plans and to see the plans. This means that the public are effectively excluded from the process of reviewing and commenting on management plans.

2. This process undermines the value of community input into a number of specific areas where there is a high level of community interest and potential risk to the community (eg Cultural Heritage, Transport, Fire Prevention, Radiation Management, Dust Management, Groundwater and Surface Water).

3. If the EPA recommends approval of the mine without the management plans - which would provide the information and evidence on how the company intends to manage the risks, they will be doing so without evidence. Decisions of this magnitude should not be based on good faith but rather on good science. This aspect of the assessment process does not comply with the precautionary principle or transparent and inclusive practise..

4. This process creates duplication. Agencies and ministers who review and approve these documents then have to review and assess management plans at a later date.

[54] www.theage.com.au/business/big-miners-oppose-new-financial-disclosure-plan-20120607-1zyy1.html
[55] www.afr.com/p/business/companies/miners_reject_anti_corruption_reforms_NeBuguzm9PBMNjpsVvBPmK
[56] www.choosenuclearfree.net/uranium-exports/bubble/

5. It creates uncertainty for the public about which agency has responsibilities to regulate or powers to enforce. The EPAs approval of a PER with only draft management plans or no management plans raises questions about the enforceability and legal standing of any future conditions or ambient conditions on those management plans by the EPA.

The general pattern in this PER is to identify a problem, downplay the risk and assert that a future Management Plan will be sufficient to manage the risk. We do not consider this to be an effective way to consult with the public nor do we consider this to be a sufficient level of information for which the EPA can draw on to make a recommendation to the Minister on the merits of the proposal.

We are unclear on how this PER is compliant with expectations under the EPBC Bilateral Agreement with the Commonwealth in this regard. We understand that the EPA PER process has been accredited by the Commonwealth which then allows for the Bilateral assessment to occur. However the lack of detail on the planned activity, risks and mitigating strategies across the board raises serious doubt whether this PER process is complaint with expectations under the EPBC Bilateral Agreement.

The following is a list of management plans that have not yet been developed in relation to Cameco's proposal:

- Groundwater Management Plan
- Subterranean Fauna Management Plan
- Flora Management Plan
- Conservation Species Management Plan
- Fauna Management Plan
- Surface Water Management Plan
- Dust Management Plan
- Mine Closure Management Plan
- Greenhouse Gas and Energy Management Plan
- Cultural Heritage Management Plan
- Fire Prevention and Management Plan
- Radiation Management Plan
- Transport Radiation Management Plan

We would urge the EPA recommend conditions for the management plans that have not been included in the PER, these could include:

1. That all future Management Plans be reviewed by the EPA.
2. That all Management Plans be open for public comment before any Government Department or Ministerial approval.
3. That any approved management plans must be complied with by the proponent and failure to comply with approved management plans be subject to penalties to the company and individuals within the company responsible for causing non compliance.

4. That any conditions to the management plans must be adhered to.

Cumulative Impacts

The EPA has previously expressed concerns about the cumulative environmental impacts of projects. In an opinion piece former EPA Chairperson Paul Vogel stated that among *"the key challenges we face is the need for focus on the cumulative impacts of human activities - a holistic, regional approach to address what could otherwise result in an environmental 'death by a thousand cuts'."*

We submit that the East Murchison and Northern Goldfields are already experiencing the impacts of gold, nickel and lead mining and agriculture. With huge demands for water and only small rates of recharge, with impacts on salinity, erosion, land clearing and of course the radiological impact of uranium mining this project would exacerbate the situation Dr Vogel warned against.

We urge the EPA and the proponent to consider this project in conjunction with existing proposals and conditional approvals for uranium mines in the area - including Toro Energy's Wiluna project and new proposals for the Wiluna extension.

The proposed mine pits at Yeelirrie, Lake Way, Centipede, Millipede and Lake Maitland all occur in the Lake Miranda basin and are upstream from Lake Miranda. There is no identifiable discussion on the individual or cumulative impacts on Lake Miranda from any of the uranium proposals in the region. While there is a clear impact on the areas with proposed mines it is vital that the EPA consider downstream impacts - including on Lake Miranda.

We also urge the EPA to consider the proponent's business model of 'expansion where possible' - as noted in the PER. Cameco outline a staged approach to mining and expansion at Rabbit Lake one of their many troubled mines in Canada. They state: "*the mine life at Eagle Point has been continuously extended through discovery of new underground ore zones."*

This is a business model many mining companies adopt. This is the business model Toro Energy has already tried to implement by acquiring additional deposits in the region - like Dawson Hinkler, Firestrike, Nowthanna etc. It is a model that offers increased flexibility to the proponent at the clear expense of environmental, social and procedural certainty.

Mine expansions bring extended impacts for extended periods of time; for example ongoing water extraction further depletes aquifers creating larger zones of water drawdown, increased seepage of tailings, ongoing land clearing etc. While there are constraints on the EPA's ability to predict these future expansion proposals the EPA does have the ability to apply conditions

to proposals that limit or restrict expansions and extended environmental impacts. The EPA also has the ability to consider existing impacts in the region, for example the impacts on aquifers and ground water drawdown at Albion Downs, Gidgee and other bores. The EPA can consider existing approvals in the area like the proposed Wiluna mine and consider cumulative downstream impacts. It is not too early to consider the cumulative impacts from existing mines and proposals with existing approvals in the region.

Other cumulative impacts that should but have not yet been considered include:

- Water extraction and recharge
- Land clearing
- Habitat loss
- Transport risks

Mine Closure

General

Specific environmental aspects of the Yeelirrie uranium proposal are detailed below - along with some comments about the long-term impacts and post closure risks. In this section we focus on over arching mine closure issues and tailings.

The long-term impacts of uranium mining are one of the greatest causes for public opposition as there is no example of a successfully rehabilitated uranium mine in Australia. Each and every former uranium mine has ongoing legacy issues from salinity and erosion to Acid Metalifferous Drainage or increased levels of radiation in the environment.

In the conceptual Mine Closure Plan Cameco outline all of the relevant legislation but fail to provide a detailed description of what those obligations are in relation to the Yeelirrie proposal and how they intend to meet them. We expect this to come in the future Mine Closure Management Plan and urge the EPA and the Minister to require that the proponent have a public consultation period before approval of any future Mine Closure Management Plan.

In the conceptual mine closure plan - Appendix O1 section 3.1.4 outlines what a State Agreement is and why they are created but fails to describe the mine closure obligations under the Yeelirrie State Agreement. From reading the Yeelirrie State Agreement Act itself we cannot identify any clear obligations for mine closure and are unsure if this Act gives any exemptions to Cameco on rehabilitation requirements. We raise this here as a question for direct consideration and response from both the EPA and proponent.

Consultant Nick Tsurikov has raised concerns about regulations and

standards of radiation in rehabilitation and public access to closed sites[57]:

"The grantee party undertakes to return any site of ground disturbance to a condition prescribed by relevant regulatory guidelines for environmental rehabilitation to its original state or so that it poses no radiation threat to the public.

a) Unfortunately, the earlier DoCEP guideline contained the suggestion that "drill sites must be cleaned to 1 microSievert per hour at a height of 1 meter (excluding any natural mineralized outcrops in the area)" that was in direct contradiction with the requirement of the return of the site to its original state.

b) The use of the clean up criterion of "less than 1 microSievert per hour" would result in an unacceptable radiation exposure to members of the general public. Even when only the exposure to external gamma radiation is considered in a dose assessment (not taking into account any other exposure, such as inhalation of dust and ingestion of soil and flora/fauna), the dose constraint of 0.3 mSv/year that is used for classification of contaminated sites (part 6) will be reached in less than two weeks (300 hours or twelve and a half days) of the permanent occupation of the site.

The possibility of Aboriginal people camping on the particular former drilling site for about two weeks or more cannot be ruled out. Therefore, the criterion mentioned above is unacceptable and emphasises the requirement for all radiation management plans approved prior to 2008 to be re-assessed and amended where necessary, as soon as possible."

Post Mining Land Use

There is a cattle station to the north-west of the proposed mine. There are questions around fencing during the mine operations to stop cattle from wondering on to the mine site. There is further uncertainty around whether fencing at the site will be maintained post closure to keep cattle out in order to assist in revegetation efforts and stop any unnecessary radiation exposure to cattle.

We note that a number of former gold pits in the area were not fenced and after being attracted to water many cattle died in the open pits. There are a range of sensitivities around fencing and cattle in the area and although this proposal has plans to backfill there are other risks to cattle from going onsite.

We welcome the target of radiation levels being *"below accepted health guidelines"* this is preferable to *"as low as reasonably achievable (ALARA)"* as this actually gives a benchmark and is less ambiguous. We would welcome

[57] Section 8.2.5 in Tsurikov, Nick, 2009, 'Uranium Exploration: Safety, Environmental, Social and Regulatory Considerations', http://calytrix.biz/papers/index.htm or direct download http://calytrix.biz/papers/09.U_exploration_09.pdf

conditions that reflect this standard, so if radiation levels are found above health guideline levels then the company can be held to account for any remedial work needed to reduce levels. We would welcome Government conditions on any future approval that reflect this standard.

Tailings closure

While there is no clear Mine Closure Management Plan there are some details provided on the progressive closure of mine cells. The scant details provided show there may be a fundamental issue with the approach.

In the section on Tailings Storage Facility - Pg 95 - Cameco describe the capping of tailings and the closure of mine cells. It is suggested capping of the tailings will be done using lower permeability soils. For the rest of the pit they suggest using higher permeability soils over the clay embankment and open pit. The idea being that the pit which surrounds the tailings cells will act as a diversion channel, diverting water away from the tailings cells and into the pit.

Also on Pg. 95 under 'General Infrastructure' the proponent describes all the other materials that will be disposed of inside the pit surrounding the tailings cells. This would include the disposal of contaminated pipes, soils and all other contaminated materials.

If these contaminated materials are placed in the pit areas, and a key design feature is to divert water into this area then what mechanisms are in place to stop these contaminated materials leaching from the pit during rainfall events post closure?

There is no further discussion in the PER about this potential impact or design feature. There is no clear balance sheet on the volumes or types of radiation of those materials and soils to be disposed of in the pit or analysis of the risks of those materials.

In other sections of the PER the proponent gives an estimate of 1.2mm/yr of seepage from the tailings. It is not clear what the volume of this seepage is. Nor is it clear if this seepage includes seepage from the pit as well as the tailings or if there is further seepage from the pit post closure.

This project aspect poses a risk to ground water dependent ecosystems. As explicitly stated earlier in this submission, we are extremely concerned about impacts to subterranean fauna and would like to reiterate those concerns here. The post-mining pit would in essence become a radioactive or 'contaminated materials' waste dump. We do not expect that the proposal for the pit, during or after mining, will ever become suitable habitat for subterranean fauna. We are yet to see any detailed analysis or description articulating whether or not this habitat will be lost forever.

Ore Stockpiles

In the conceptual mine closure plan - Appendix O1 - Cameco outline that there is likely to be metalifferous drainage from the ore stockpile. This would include: boron, barium, molybdenum, strontium, thallium, uranium, vanadium and zinc.

As the first pit is mined and tailings cells constructed it is assumed that large volumes of ore - of varying grades - will be stockpiled. During these first few years of mining we expect the ore stockpile to be a major liability for dispersal of radioactive particles be it from rain and uncontrolled drainage or from wind.

There is no clear balance sheet of ore stockpiling through the life of the mine and there is no accounting of how much ore will be stockpiled.

Dust

In section 6.3.2.2 Cameco state that high grade ore would be stockpiled for no more that 32 months and medium grade or for no more that 12 years. The only safeguard or management strategy discussed by Cameco is this very simple statement *"A dust suppressing material such as hydromulch may be applied to stockpiles to reduce the potential for wind erosion and reduce the demand for dust suppression water."*

There are a number of concerns with this strategy:

1. The proponent has not described the risks or potential impacts of the various ore types.
2. The proponent has not given a balance sheet of how more ore, of what grades, will be stockpiled for how long.
3. The proponent suggest hydromulch 'may' be used, indicating they are no entirely sure if hydromulch could be used or would be effective and provide no discussion on the merits of hydromulch or any alternative options for dust and leach suppression.

Cameco propose to bring this radioactive material to the surface making these radioactive materials bioavailable. They intend to leave this material on the surface for periods of between 32 to 144 months depending on the grade of the ore. The proponent has not detailed a clear management strategy and has not demonstrated a clear understanding of the risks. This aspect of the proposal, which represents a significant risk to the environment and public and workers health, is another ground to dismiss the PER. (Note: this issue is further discussed in the section on air quality).

Drainage

In section 9.10.5.3 of the PER risks associated with runoff and seepage are described. There are three main factors that are used to downplay the risk: 1.

there is a surface water diversion bund, 2. the stockpiles will be in the same area where there is water drawdown and 3. solute release will only be significant in the first rain fall event. These explanations do not address continuing concerns about drainage from ore stockpiles:

- The surface water diversion bund will mitigate some impact of surface water but will not keep water out of the stockpile as there will be some flow of water within the bund and water will fall directly on the stockpile.

- The stockpiles will be above the water drawdown area and leaching will stay inside the affected footprint - this will not stop leaching from the stockpile into the ground water and over time potentially build up and flow outside the footprint or mix with water that is being dewatered and then used for some other onsite process - for example dust suppression.

- In the third point it seems as though Cameco are saying that the most risk of solute release from rain on stockpiled ore is from the first rain and risks are reduced with subsequent rainfall events. This logic falters when you consider that the high grade ore stockpiled is likely to be processed at some point and new ore will be stockpiled to replace it. At least Cameco have suggested that high grade ore will be stockpiled for a maximum of 32 months. At the very least every 32 months there will be different ore stockpiled and at risk of 'solute release' from the next rainfall event.

Appendix M2 shows a balance sheet of how much ore, of which grade ore will be stored in each year of the project. However this balance sheet has scant relevance for Cameco's project as it was developed for BHP Billiton's proposal which was to mine at a rate of 1.2Mtpa unlike this proposal which is to double the rate of mining - up to 3Mtpa.

Appendix M2 suggests the stockpiles will remain for 32 years and at the end of 32 years there are still stockpiles of low grade waste, waste and topsoil. This report was prepared for BHP Billiton in 2011 and, as noted, the Cameco proposal is significantly different to BHP Billiton's. We expect these changes to have a significant impact on the volume of stockpiled material and the length of time that ore is stockpiled and these require dedicated attention and assessment.

The measurement and assumptions in Appendix M2 are not applicable to Cameco's proposal for mining Yeelirrie. Cameco have not provided any updates to the report, they have not demonstrated a clear proposal for stockpiling or managing the risk of metalifferous drainage from the stockpile.

Inversions

We can reasonably assume that ore stockpiles with uranium will be releasing radon gas. Radon gas poses a serious health risk is the primary cause of lung cancer in non-smokers worldwide and we also know radon gas is even more dangerous for smokers[58]. We also know - and as noted by Cameco - that inversions trap radon gas between layers of hot and cold air.

In discussions on inversions in the section on air quality Cameco assume, or only refer to, radon will only be coming from the ground and from the pit. There is no discussion on radon that is coming from ore stockpiles and how the movement of gas coming from a stockpile might act in an inversion. There is simply no assessment of this health risk from the project.

Discussion

In the 'avoid and minimise' section relating to ore stockpiles there are no proposed management strategies to avoid or minimise or manage the risks of inversions and radon build up. In relation to the management of dust and ore stockpiles Cameco state they will use *"conventional dust management techniques, including the use of water sprays, dust suppressants and progressive rehabilitation, will be used to manage dust emissions."* Again we must await a future Dust Management Plan for any real detail or understanding on what actions will be taken to actually manage this risk – this approach is deeply deficient.

The lack of detail and evidence specific to the Cameco proposal and to the ore stockpiles is of great concern. We recommend that the EPA should require that the proponent provide detailed reports on the current proposal incorporating a detailed discussion on all the risks and mitigating strategies. We note that Cameco has relied heavily on an out of date report that was written for the BHP Billiton proposal for Yeelirrie. We note that the BHP Billiton proposal was significantly different particularly in relation to the frequency of mining.

The key threats from ore stockpiles and the impact of ore stockpiles on the environment, public and workers health, flora and fauna have not been adequately addressed. Nor are there sufficient management protocols to manage or mitigate the risks - particularly concerning inversions and dust.

Air Quality

The increased rate of mining up to 3Mtpa (pg. xxii) (compared to earlier proposal to mine at a rate of 1.2Mtpa) poses additional risks for managing dust and air quality through the increased rate of land clearing, the increased

[58] World Health Organisation, October 2014. Fact sheet N°291. http://www.who.int/mediacentre/factsheets/fs291/en/

area to be mined at a given time and the increased volume of ore being stockpiled.

In section 9.8, on air quality, the proponent acknowledges the two greatest risks to air quality are the stockpiling of ore and inversions. There is no detailed information about the stockpile structure and content, nor is there any clear description of risks for above average dust events or regular inversion events. There are no clear management strategies for those events (note: see section above on ore stockpiles).

Cameco does provide some measurements and analysis of the risk of radon from the pit and has acknowledged the risk of radon gas build up during an inversion. However they do not provide any clear management strategy for work conditions during an inversion event.

They state they will have real time radon monitors in the pit and minimize workers exposure. Real time radon monitors should also be placed in other areas of the mine to test and track how radon might move or build up on site during inversions. These tests should be conducted around ore stockpiles where there is also potential for radon.

The assessment of radiation doses from inhalation of radon decay products has been modelled with consideration to inversions. *"Modelling of radon gas in the open pit under stable atmospheric conditions (as would occur under an inversion) was conducted under worst case conditions (maximum hours in the pit under the worst case inversion) and showed that the maximum worker dose from Radon gas would be 4mSv/yr. Real time radon monitors would be established to confirm radon gas levels in the open pit and workers rotated or removed as required to minimise dose."*(pg 119).

However the assertions made here are not supported with evidence or any further description on the assumptions or the data used for this modelling. It is not clear how Cameco arrived at this conclusion. The description on changes to operational activity during inversions to limit exposure to workers is minimal. There is no description of trigger levels of radon for rotating workers. There is no indication that workers will be supplied with equipment to monitor radon doses. Will dose rates for workers be based on modelling and assumptions or on real data or evidence about exposure? This is particularly concerning when considering the Yeelirrie State Agreement Act which give Cameco an exemption from meeting labour conditions. (For more on the health risks of radon exposure see section on radiation and health.)

Cameco has failed to effectively describe the risks associated with inversions on air quality or provide evidence to support claims about inversions and radon build up.

In this section we could not identify what Cameco meant by ‘sensitive receptor’. Nor were we able to establish what Cameco consider to be ‘acceptable levels’ of air pollution.

We are not satisfied or confident Cameco can and will adequately minimise, avoid or monitor the risks associated with elevated levels of radiation or heavy metals in the environment that are dispersed through dust and accumulated during inversions.

Terrestrial Fauna

Habitat

There would be clear impacts on terrestrial fauna through loss of habitat, introduction of weeds, the risk of radiation uptake in the food chain, the bioaccumulation of radiation and heavy metals and subsequent health problems. There is the risk of population fragmentation through habitat loss and breaking up fauna corridors.

While Cameco have an overarching principle to avoid and minimise ground disturbance and clearing, they have not identified or specified any habitat areas that will be protected or any offsets for those areas. After numerous studies it is possible that Cameco have simply deferred this issue to future Management Plans to avoid public criticism as opposed to dealing with this matter through the PER. Again Cameco offer broad-brush solutions to potential problems.

For example Cameco has stated: *“If populations of significant species are identified within the Project boundary and disturbance to those areas cannot be avoided, a specialist zoologist will be consulted prior to ground disturbing activities.”*

This is an example of many similar weak statements about how the proponent intends to manage significant species. This is a problem for the following reasons:

1. This statement offers no commitment to protect species, or the habitat for the species.
2. The only commitment made here is to consult a specialist - not to follow specialist advice.
3. There is no other comment made in this section that provides any clear commitment to protect habitat of significant fauna species - if the clearing is ‘unavoidable’.
4. Significant flora and fauna species are likely to become collateral damage without any clear commitments to protect, preserve, offset, relocate or any other possible management options.

5. There is no clear definition or regulatory guidance for what constitutes as unavoidable - this ambiguity offers the proponent a free range to clear any area no matter how significant as long as they can argue the case that it was ‘unavoidable’.

At this stage we expect that Cameco should have identified whether or not there is a significant species within the project boundary and have a detailed management plan for how they will ensure the protection of that species.

Cameco identify that altering the fire regime can impact on fauna and habitat. They have identified that mining can impact on this if not properly managed but have not indicated how they intend to manage the fire regime as a means of protecting and supporting habitat. Again there is a pending Fire Prevention and Management Plan as well as a Fauna Management Plan that the public are excluded from commenting on. This modular and staggered information flow undermines good planning principles and the EPA’s ability to meaningfully assess this application.

Threatened and migratory species

The PER document outlines some of the key risks for each threatened species. For each description Cameco downplay the risks stating in every case that *“impacts of the project on this species are expected to be negligible”* or *“impacts on these species are expected to be minor”.*

These overly optimistic statements are not supported with any evidence or explanation. There is no rationale for why impacts such as road kill, loss of habitat, fire, feral animals would be ‘minor’ or ‘negligible’. There is no explanation or description of how the Cameco intend to manage these risks and impacts.

Yet again the proponent refers to a Fauna Management Plan that is yet to be developed. Again we have no evidence to suggest that these risks and impacts to endangered species can and will be adequately managed.

Bush foods - radiological uptake

To Cameco’s credit they offered CCWA a one on one lesson on the ERICA tool to explain how the ERICA model works. This session was appreciated and interesting, but not all together convincing. We remain critical about the use of Northern Hemisphere studies as the basis for the ERICA model. The ERICA tool is a tiered assessment. The initial inputs to ERICA for the 70 animals were less that 10uGy/hr so no further assessment was conducted. This type of assessment rules out any clear assessment around different scenarios where the risk to health is increased under certain conditions that are unique to that environment and species.

There are many possible factors that influence radiological uptake in animals that go beyond animal size and diet. Without proper scientific studies on the radiological uptake of Australian animals in different Australian environments ie. Arid, wet tropics under different conditions (cyclones, high winds, high rainfall events, in fire) we submit that there are serious limitations in the ERICA model. This tool cannot replace on the ground testing and assessments of individual species and individual pathways that are more or less significant for different species.

We are unclear on the details of the ARPANSA 2014 kangaroo model and how it was used or implemented to identify the risks to kangaroos in the PER. Cameco stated that they created a kangaroo model using the ERICA tool, but then stated that they did not use it because ARPANSA 2014 did not provide concentration ratio values for thorium so *"the default ERICA value for large mammals is used in the assessment."* So the ARPANSA kangaroo model appears to be irrelevant in this scenario.

There is a story in the region about a kangaroo with black lungs - this has almost become folklore, you can ask almost anyone in the area and mention the kangaroo with the black lung and most people will know what you are talking about. In fact there were two kangaroos that were shot just south of the Magellan lead mine, when they were cut open the lungs and organs were dark red, almost black. In 2011 when BHP Billiton was involved at Yeelirrie some of the Traditional Owners living in Leonora made inquires to BHP Billiton about kangaroos with black lungs. In response BHP Billiton agreed to send some samples off for testing. In late 2014 Traditional Owners from Leonora asked Mia Pepper from CCWA to find out what happened to those samples - they specifically mentioned samples that BHP Billiton took including a kangaroo a goanna and the root of a kurrajong tree.

Mia Pepper spoke to Simon Williamson from Cameco and asked if he could follow up on what happened to the samples taken for testing and advised that the community were still concerned about this matter.

After some months Simon Williamson wrote back saying that Cameco did not intend to do any further sampling and that they had not received or found any data on this from BHP Billiton but that they were working to locate and verify the data which he hoped would be included in the PER. We have not been able to find any record of this in the PER.

It is disappointing that the proponent had an opportunity to engage with the community over a clear concern and example of impact from mining on the environment and has not addressed it informally or in the PER. This shows a lack of commitment to evidence and addressing community concern through evidence. The ERICA tool is no replacement for testing on local animals that could provide new data and evidence.

We also acknowledge that there are significantly different views about the impacts of low levels of radiation. See section on radiation and health, which outlines some of the most recent discussions on the impacts of low doses of ionising radiation. As identified by Cameco there are a number of pathways for radiological uptake in animals. These include birds drinking contaminated water, kangaroos eating grass which has dust on it containing radionuclides or heavy metals from the mine, or animals inhaling radon gas. We expect that this project is likely to have a radiological impact but we have no clear detail to reference in relation to the adequacy of the mitigating strategies that the proponent intends to use to protect fauna from the numerous pathways of radionuclide uptake or heavy metal uptake because there is no Fauna Management Plan.

Again we make the comment that this process is flawed as it lacks transparency. We urge that any future Fauna Management Plan be made available for public comment before any Departmental or Ministerial approval.

Flora and Vegetation

The overall risk to flora and vegetation includes water drawdown, reinjection of water, increased salinity, erosion, dust deposition, disruption to surface water flow and of course - land clearing.

Like other sections above on terrestrial and subterranean fauna, we note that Cameco have a pattern of relying on uncertainty to make optimistic predictions about species existing elsewhere while downplaying the risks.

These risks as outlined by the proponent include

- Indirect impacts on groundwater dependent vegetation due to groundwater abstraction and reinjection and drawdown.
- Indirect impacts to vegetation dependent of surface water due to alterations and disruptions to surface water flows.
- Introduction and spread of weeds or plants from outside the local area, into mining areas and adjacent native vegetation through movement of vehicles and materials.
- Altered fire patterns.
- Indirect impacts on flora and vegetation from dust.
- Uptake of radionuclides.

In addition to this list there are potential impacts from:

- Increased salinity
- Increased erosion
- Land clearing - including stress on remnant vegetation with increased demands from fauna that have less habitat to share.

These important issues relating to flora have not been addressed in the PER.

In addition to these general issues we have specific concerns about Atriplex, Rhagodia and Grevillea berryana.

Grevillea berryana

We are concerned about the extensive clearing of Mulga Grevillea berryana Shrubland. In one section of the PER Cameco state that they will clear 70% of the *Mulga Acacia ayersiana, Grevillea berryana Shrubland (CMGbS)* in Table 9-11 they say that 90.4% of the Mulga *Grevillea berryana Shrubland* will be cleared. Cameco also say that 99% this vegetation community occurs in the 1m drawdown contour. *Grevillea berryana* is known to be a groundwater dependent plant species so we expect this drawdown to have an impact on the species. So whether directly cleared or whether impacted on by water drawdown this species and vegetation community will suffer heavy impacts from clearing and water drawdown. Again rather than providing clear pathways for managing this impact the proponent relies on uncertainty and optimism.

They state that: *"The component species are widespread and abundant where they occur, however the regional representation of the community is not known (most likely due to low intensity mapping outside local Study Area)."*

Without looking for evidence about the component species existing elsewhere Cameco just make the proposition that it is and make no further mention of it here or in any of the Appendices on vegetation and fauna. While it is quite possible that this species is widespread the proponent should provide that evidence. We urge the EPA to require the proponent be thorough in their work and provide detailed information about the range of Mulga *Grevillea berryana Shrubland* outside the project area, or any similar situation where the proponent relies on unfounded assumptions. It is unacceptable for the EPA to accept that 99% of a vegetation community on site will be impacted without any clear management or mitigation strategy or any assurance and evidence that this species is widespread in the region.

Rhagodia

Rhagodia sp. Yeelirrie Station (K.A. Shepherd et al. KS 1396) is a Priority 1 Species. Cameco make the optimistic statement that *"there will be no direct impacts on Priority 1 species Rhagodia sp. Yeelirrie Station, but indirect impacts may result from changes to surface water drainage patterns and affect a small proportion of the population within the Study Area (4.8%)."*We highlight that Rhagodia is a high-risk species. Given that it has only been identified in the project area we view the possible impacts as high impact. Cameco have not done an in depth study into the potential impacts of

water drawdown or dust deposition, increased salinity or any other potential impact that may have dire consequences for this species.

Atriplex sp. Yeelirrie Station

The proponent has done a lot of work on the Atriplex sp. Despite this we remain concerned about the ability the survival of the Western population of Atriplex sp. and question Cameco's ability to revegetate the pit area and re-establish the Western population. The current proposal is to clear the Western population present on the ore-body – this is around 37% of the total *Atriplex* sp. population on the site.

We are concerned about re-establishing the population for a few core reasons.

1. The pit area where the entire Western population is situated will remain affected by water drawdown for 50 years and up to 200 years.
2. The Atriplex Rehabilitation Site, to the west of the central part of the pit will also be affected by water drawdown.
3. The tailings and backfilled pit post closure is expected to have a "salt enhanced crust" - pg. 95. We are concerned that this salt crust will not support the revegetation of the Western Population of Atriplex. We understand from information provided by Cameco that Atriplex is sensitive to changes in salinity.

Tailings

Cameco have not provided a Tailings Management Plan but have given some idea of the overall tailings proposal. We have a number of unanswered questions many specifically relate to Diagram 6-13 & Figure 9.67:

- What is the balance (total volume) of tailings production by operational year ie. Tonnes in year 1, tonnes in year 2, tonnes in year 3 etc.
- What is the total capacity of tailings storage by year
- How will tailings from the processing facility be transported to each of the 22 cells
- Which ingoing and outgoing pipes to the tailings will be permanent and which will be temporary
- How will these pipes be managed
- Where does the "internal drain" drain to
- Has there been consideration of applying an artificial clay liner or any other technology to prevent seepage
- What is the maximum seepage rate from the tailings (noting minimal seepage of 1.2mm/yr)
- Is 1.2mm/yr the distance tailings will seep per year - how will these changes over time - eg. increase, reduce
- What are the impacts of seepage of 1.2mm/yr
- What is the volume of tailings that will seep per year

- What is the impact of that volume of seepage
- What is the expected radiological content of tailings
- What is the expected heavy metal content of tailings
- What is the expected acidity of tailings
- What detection system is there to identify is seepage has gone beyond 1.2mm/yr
- What is acceptable seepage and why?
- What are *"deposition spigots"?*
- Where is the *"pit dewatering system"* in the diagrams
- Is the "*Internal Drain"* the same as the *"central decant system"* - If not what is the difference? If so why do they have different names and could that not cause confusion and potential risk?

Having spoken to Cameco during the PER process to try and gain a better understanding it is clear that a lot of operational details remain uncertain, including in relation to the piping and drainage system. The system seems complex - with room for error, which of course should be considered and mitigated. This has not been demonstrated in the PER and unfortunately has been exempt from this process and public scrutiny.

Not only is there an issue with this process and transparency, but the lack of understanding or planning around certain aspects of the project - like tailings management - adds uncertainty about the ability to manage the risks. Tailings for example pose a significant risk and pathway for radionuclides into the environment. Claims about a seepage rate of 1.2mm/yr seems arbitrary given that so much of the design is yet to be defined. We would like to again draw your attention to Appendix 2 which outlines number incidents and accidents at Cameco's facilities in the US, Canada and Kazakhstan.

On the issue of the many different pipes and potential risk we want to highlight an instance where this risk played out in reality. There was an instance at the Ranger uranium mine at Kakadu where a pipe containing contaminated water was fitted to a drinking water pipe. 28 workers were affected; having consumed or showered in water containing 400 times the legal limit of uranium.

The reality is that industrial accidents happen. Designs are only as good as the operational and safety measures built in to protect against accidents and mistakes. At this stage we have no assurances that these mitigating and operational strategies are either in place or adequate.

There is no real detail or schedule of the balance of mining, stockpiling or processing ore and the production of tailings. This kind of balance sheet - matching up with the capacity balance of tailings storage would be useful to better understand how all of this material at different stages of mining and processing is proposed to be managed.

Expectations on tailings and mine closure

In previous submissions we have made to the EPA about uranium mining we have raised the issue of tailings management and noted a motion passed in WA Parliament on Wednesday, 23 May 2012. The motion was passed with the support of Liberal and Greens Parliamentarians of the day. (note that Labor didn't support this motion as they argued that this requirement was not sufficient for safe management of radioactive mine tailings).

The motion reads: *That this house recommends, should the government proceed with its intention to license uranium mining in Western Australia, the government adopt the equivalent or better environmental management regulatory requirements for any future uranium mine in Western Australia as exists under commonwealth and Northern Territory legislation for the operation of the Ranger uranium mine in the Northern Territory with regard to the disposal of radioactive tailings, including the requirements that -*

a) *the tailings are physically isolated from the environment for at least 10,000 years; and*
b) *any contaminants arising from the tailings do not result in any detrimental environmental impacts for at least 10 000 years.*

This motion is significant in many ways.

- It acknowledges the very long timeframe that radioactive tailings need to be managed for
- It gives a clear expectation on environmental protection from this waste
- It presumes that tailings can and should be physically isolated from the environment (Cameco's proposal explicitly states that tailings will leak)

This standard is similar to the standard enshrined in the regulatory framework governing operations at the Ranger uranium mine in Kakadu. This standard should ensure physical chemical and biological isolation from the surrounding ecosystems for at least 10,000 years. The reality is that no uranium mine has been able to achieve chemical and biological isolation of radioactive materials even during operation of uranium mining. For example two operating uranium mines in Australia with similar processing and tailings storage as proposed by Cameco at the Yeelirrie site have both been unable to contain tailings during operation.

Ranger, Rio Tinto/ Energy Resources Australia, Kakadu NT

- *"approximately 2000 cubic metres of tailings water (process water) had leaked from a pipe in the Tailings Dam Corridor of the Ranger site between late December 1999 and 5 April 2000".*[59]
- *"Alan Hughes, the Commonwealth supervising scientist appointed to monitor the mine's environmental impact, confirmed at a Senate*

[59] http://www.environment.gov.au/resource/investigation-tailings-water-leak-ranger-uranium-mine - Investigation of tailings water leak at the Ranger uranium mine – Office of the Supervising Scientist 2000

committee hearing that about 100 cubic metres a day — the equivalent of 100,000 litres or three petrol tankers — of contaminant were leaking from the mine's tailings dam into rock fissures beneath Kakadu."[60]

- In 2011 the Ranger uranium mine closure was extended due to heavy rains and the potential for the tailings dam to overflow.[61]

Olympic Dam, BHP Billiton, Roxby Downs SA

- 14 March 2012 - Approximately 150 m^3 of tailings slurry leaked from slurry line 3 as a result of failure of one of the flexible joints in the slurry line.[62]
- 1st May 2011 - Approximately 180 m^3 of acidic tailings slurry was released from slurry line 2 as a result of the premature failure of a rubber sleeve on a pinch valve.[63]
- 30th September 2009 - A small leak developed in tailings line 1 adjacent to the northeast corner of Evaporation Pond 2 resulting in tailings slurry spray outside the pipeline corridor onto a nearby undisturbed dune.[64]
- 3rd February 2009 - A spill of approximately 250m^3 of tailings occurred when a tailings line failed causing tailings slurry to spray onto southern wall of Tailings Cell 4.[65]
- 10th December 2008 - Approximately 80m^3 of tailings leach tank feed discharged into a bunded area causing 50m^3 of material to overflow into the processing plant area.[66]
- 20th March 2008 - Approximately 70m^3 of tailings escaped into the tailings pipeline corridor from a pipe failure. The process was shutdown and repairs carried out.[67]
- 18th March 2008 - Approximately 270m^3 of tailings escaped into the tailings pipeline corridor from a pipe failure. The process was shutdown and repairs carried out.[68]

Many more incidents with tailings and leaks are recorded at the Department of Manufacturing, Innovation, Trade, Resources and Energy website: Olympic Dam incident report.

---

[60] http://www.theage.com.au/national/polluted-water-leaking-into-kakadu-from-uranium-mine-20090312-8whw.html The Age – Polluted water leaking into Kakadu from uranium mine. March 13 2009, Lindsay Murdoch.
[61] http://www.world-nuclear-news.org/ENF-Ranger_suspension_extended_as_rains_continue-1204117.html
[62] SA Government Department of Manufacturing, Innovation, Trade, Resources and Energy DMITRE website: Olympic Dam incident report http://www.minerals.dmitre.sa.gov.au/mines__and__developing_projects/approved_mines/olympic_dam/olympic_dam_incident_summary_2003 _-_2012
[63] ibid
[64] ibid
[65] ibid
[66] ibid
[67] ibid
[68] ibid

We expect both a commitment and the demonstrated financial and technical capacity from Cameco to undertake ongoing monitoring until the tailings have reached long term physical, chemical, biological and radiological stability and pose absolutely no risk to the environment for a period of no less than 10,000 years. This is in line with the precautionary principle and intergenerational equity, principles Cameco claims to adopt as underlying environmental principles. We expect that this is done in compliance with the 10,000 year standard for isolation of tailings from the environment. We recommend that conditions be applied to ensure corporate responsibility over the site is not relinquished until tailings can be robustly demonstrated to present no risk.

Water

Groundwater

Yeelirrie is in an arid area, with low groundwater recharge – the study estimates a recharge rate of approximately 2.6 GL/year; in addition natural ET consumes about 89% of this recharge, leaving approximately 0.4GL/year in net recharge.

The extraction rate due to dewatering of the deposit and other milling, tailings and processing needs is estimated to be approximately 53.4Gl, over the project life of ~20 years, that is approximately 2.5GL/year, 6 times more that the net recharge.

The additional water extracted by mining (water that is not met by the net recharge) will be derived from two possible sources:

- Storage depletion – loss of groundwater in storage from around the deposit.
- Capture of discharge – loss of groundwater inflow to Lake Miranda.

When groundwater is extracted above the recharge rate, some combination of these two sources always occurs (e.g. Konikow and Leake, 2015).

During groundwater modelling, Lake Miranda was assigned the property of having a constant head. This essentially supplies the lake with an infinite source of water, and prevents impacts on lake levels from mining from being accurately quantified. Given the high permeability of the aquifers, there is likely to be a strong connection between these and the lake, and given the high extraction volumes from de-watering, a large amount of water that would otherwise discharge to the lake would be captured by the de-watering. This runs the risk of drying out the lake.

In terms of the water derived from storage in the aquifers, the aim of the mining is to reduce water in storage and lower the water table in the deposit. However, the extent of the impact on groundwater levels is something that

could be variable – e.g. the loss of storage may be highly localised, or it may extend into the surrounding region (where it could impact other users).

This variability also poses a significant additional risk to subterranean fauna and groundwater dependent ecosystems.

Having accurate values of transmissivity and storativity is critical to predicting the extent of the drawdown. It appears there is some field data to provide estimates of these values, but the heterogeneity and complex geology may be an issue and increase the uncertainty of this impact. Far more detailed study is needed in order to verify the proponent's claims.

Model properties
It is noted that in the table of aquifer properties (table 4.3) that the vertical hydraulic conductivities are estimated as being constant fractions of the horizontal hydraulic conductivities. In some cases the horizontal and vertical conductivities are estimated to be the same (in the calcrete) while in the other units the ratio is 10:1. The use of a constant value for all units implies that this parameter (the vertical anisotropy) is not well known. The result of this is that the level of cross-connectivity between different layers is probably still quite uncertain.

The interception of this much water will starve any existing features that depend on groundwater discharge (such as Lake Miranda) of their current water. Impacts of cumulative drawdown from BHP's Albion well-field (to the east) and the Yeelirrie project may also be an issue, although the model appears to predict fairly minimal interaction between the two.

Water table drawdown estimates in groundwater modelling are always highly dependent on the model parameters used to simulate the future scenarios, which can be quite uncertain. The model parameters were unidentifiable in the Groundwater modelling study Appendix I1), making it difficult to comment on the accuracy of the future scenarios presented in the PER.

We remain very concerned that the dewatering and water drawdown from mining activity at Yeelirrie will have severe consequences on the subterranean fauna and we again urge the EPA to reject the proposal.

Youno Downs and surrounds

Youno Downs is the neighbouring cattle station. The station has a number of watering points for cattle some of which have not been identified by Cameco and others that are likely to be impacted on by water drawdown. In the PER Cameco have not identified Youno Downs station as a water user (271 & 283). Of particular concern in Cameco's proposed Northern bore field that is quite close to Youno Downs southern bore known as Dempsey. The drawdown from the Northern borefield is expected to b 5m - pg. xxxiii.

Dempsey is a watering point for Youno Downs cattle - the drawdown from the bore field may have a material impact on the ability to use Dempsey as a watering point for the cattle at Youno Downs station. The Dempsey bore is operated by a windmill and seems that the water level has stayed about the same over the 25-30 years that cattle have been run on Youno Down station. This indicates that there is water flowing and that there is some recharge. Any future changes to this are likely to be a direct result of Cameco's extraction of water.

The cattle are of course attracted to water and its believed that cattle from Youno Downs sometimes cross the station boundary and visit the Eastern Mile Bore which is just 2km from the proposed open pit. If the bore were running the cattle are more likely to take the journey to the Eastern Mile Bore. There is no description of this in the PER. We would like to know if Cameco will fence the area?

Also in the surrounding areas to the East there is a rockhole, about 8km east of the mine. Will Cameco monitor this rockhole to ensure that water being taken from the Eastern bore doesn't reduce flows to the rockhole, a unique watering point for native animals in the area.

Rainfall - flooding frequency

Climatic changes reducing groundwater recharge
Cameco describe in detail the rainfall events in the past noting that there is a combination of high rainfall events, increased rain but variable rain over summer and less rain over winter etc. Cameco go on to explain predictions from BoM and CSIRO in 2007 about more increased intensity of extreme rainfall events. We note that similar observations and predication are made in the 2014 State of the Climate report produced by the Buraeu 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."*[69]

Cameco make an important observation that less frequent more intense rainfall events will impact on groundwater recharge rates, as more rainwater will be lost to evapotranspiration. This is supported by evidence on pg 143 of the PER which shows after rainfall event soils beneath the surface are still dry. In this arid area absorption rates of water are relatively low and water tends to pool on the surface - this has certainly been our experience in the region.

While this has been acknowledged by the proponent in the section on climate change (section 7.4.1 pg 128) we have not seen how this evidence has been incorporated into future predictions about the recovery of groundwater over time (pg 283 & figures 9.44, 9.45 & 9.46). We have calculated net recharge rates of 0.4GL/year based on the information provided by Cameco. We would

[69] Commonwealth of Australia 2014, State of the Climate Report.

hope to see more details on expected recharge rates over time and how this impacts on the rehabilitation of subterranean fauna habitat and groundwater dependent ecosystems.

Erosion
It is acknowledged that more intense rainfall is likely to intensify the risks of erosion. This may pose a significant risk to ore stockpiles and runoff. On pg. 251 Cameco state that erosion is likely to *"dropout downstream of the Project"* There is however no further description about the risk and impact of erosion. Presumably the erosion will carry particles with it that will *"dropout downstream of the project."* What exactly will drop out, what is the likelihood of radioactive particles or heavy metals to be transported through erosion and what is the cumulative impact over the life of the mine on the receiving environment?

Climate change - increasing intensity of rainfall events
There are predictions from BoM and CSIRO, acknowledged by Cameco, that rainfall events are likely to become more infrequent and more intense. This change will affect the impacts during mining and post closure.

Cameco refer to ARI event as a 1:100 year event or a 1:1000 year event and suggest they have modelled for those scenarios and are confident the integrity of the infrastructure and design will withstand these events. What is not clear is what the exact worst-case scenario is that infrastructure has been design to withstand and whether or not the infrastructure or design features will remain intact for 50, 100, 1,000 or even 10,000 years. It is also not clear what data was used and what assumptions were made in modelling the scenarios.

In section 9.10.5.3 Cameco claim that in ARI flood event - any release of water from the site would have to be of a sufficient quality. What is not clear is what the parameters are for 'sufficient quality' how many ppm of arsenic, mercury, lead, acid, uranium, radium etc. constitutes as sufficient quality?

In these conditions we are concerned that frequency and intensity of rainfall events, dust storms, cyclones could exceed expectations and have a detrimental impact on:

- Drainage systems capacity (Section 9.4.5).
- Tailings
- Inundation of backfilled areas
- Metalifferous drainage from ore stockpiles

Cameco has demonstrated that *"under the 1,1000 year ARI scenario, the post-closure backfilled pit area would be subject to inundation for the duration of the event and surface water would potentially infiltrate the closed landform."*

This is even more concerning given that post closure these backfilled areas will contain radioactive/ contaminated materials and soils. There may also be

increased pressure on tailings inside the backfilled areas. There is no clear discussion about the impacts of this event and no scenarios provided. Should this event happen post closure for example 100 years after the mine has closed would the post mining design features be intact. How will water from the backfilled pit area interact? Will it leach from the bottom or the sides, will radioactive material float to the surface and interact with surface water.

As mentioned previously Lake Miranda is downstream from Yeelirrie, Lake Way and Lake Maitland. In a 1:1,000 year ARI Lake Miranda. There is no discussion on the cumulative impact of this type of event in the region and impacts on surrounding and downstream environments including Lake Miranda.

We again note the motion passed in WA Parliament that indicates very clearly that some of the materials we are talking about in the post closure site will remain radioactive and volatile for no less than 10,000 years.

Transport

There is no Transport Management Plan provided, so there is scant detail on how Cameco will seek to identify and manage the risks.

For example:

- What security measures will be in place.
- What emergency response is available on the transport route.
- How prepared and willing are emergency response units along the transport route to respond to an accident.
- What are the high-risk parts of the route.
- What communities are along any future transport route
- What are the most common causes of accident in trucks travelling long distances.

In the PER Cameco state: *"Cameco has established a successful outreach program for first responders whereby representatives from Cameco conduct awareness sessions at strategic locations."*

There is no further detail on how this has been advanced along the extensive transport route from Yeelirrie to Port Adelaide. There is no discussion on who the 'first responders' are likely to be, whether they are paid or volunteer services. Cameco has demonstrated that they have offered training but fail to describe in which way it was successful or any demonstration of the success of the training.

Cameco's transport of uranium has not been without incident. We note that in 2013 a truck carrying uranium from Cameco's Ontario Port Hope refinery caught fire[70]. The driver was quick to act and disconnected the load from the

[70] www.thestar.com/business/2013/10/31/burning_t ruck_hauling_nuclear_load_flies_under_radar.html

truck. This quick thinking of the driver was responsible for avoiding a major accident. Cameco denied any responsibility for the accident that was instead deflected to the trucking company.

In 2010 a shipment of uranium from Vancouver to China was refused by China and sent back to Vancouver after a number of sea containers were damaged[71].

In 2013 in Ontario, where Cameco have the Port Hope Refinery, it was reported that more than one truck in seven carrying radioactive material has been pulled off the road by Ontario ministry of transportation inspectors for failing safety or other requirements. 16 out of 102 inspected trucks were placed *"out-of-service,"* which means the vehicle *"must be repaired or the violation corrected before it is allowed to proceed."* Violations included faulty brake lights; "load security" problems; flat tyres; false log books; damaged air lines; and a driver with no dangerous goods training. In other cases, trucks were allowed to proceed but were issued with enforcement actions for problems with hours of service; annual inspection requirement; missing placards; exceeding gross weight limit; speed limiter; over length combination over height vehicle; and vehicle registration / insurance.

Australia has had its share of transport accidents too. 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: [72]

"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."

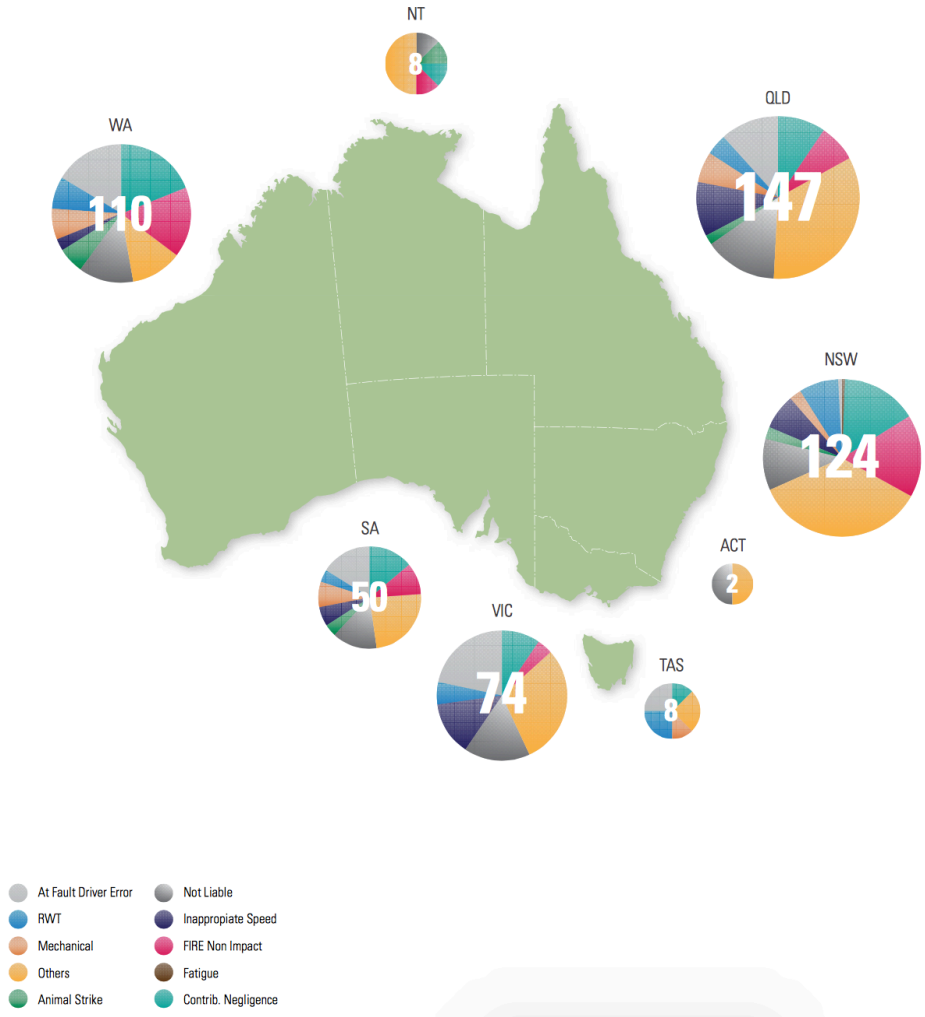
"As highlighted in the 2013 crash report, the worst performing State was Queensland followed by Western Australia."

"Most incidents occurred between the hours of 1000 and 1600 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.

[71] www.cameco.com/media/news_releases/2011/?id =543
[72] http://www.nti.com.au/files/files/NTARC/2015_Major_Accident_Investigation_LR.pdf

“Truck fires continue to account for 10.7% of large loss incidents with electrical failure accounting for 68.5% of cabin / engine compartment fires.”

We would expect that any future Transport Management Plan would be made available for public scrutiny and comment.



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."[73]

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."*[74]

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."*[75]

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).[76]

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 report[77] states that *"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*

---

[73] 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

[74] 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

[75] 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

[76] www.ianfairlie.org/news/a-100-msv-threshold-for-radiation-effects.

[77] 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

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.[78]

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."*[79]

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."[80]

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

---

[78] 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

[79] 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.

[80] 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

from uranium mine tailings is responsible for 2,775–5,550 deaths annually. A similar analysis is presented by nuclear physicist Richard Garwin.[81]

The following discussion on the topic of radiogenic effects from uranium mining is excerpted from a longer paper by Nuclear Radiologist Dr Peter Karamoskos[82]:

"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

[81] Richard L. Garwin, 2001, 'Can the World Do Without Nuclear Power?', www.solarpeace.ch/solarpeace/Download/20010409_Garwin_NuclearPowerArticle.pdf
[82] Peter Karamoskos, 2010, 'Nuclear Power & Public Health', http://evatt.org.au/papers/nuclear-power-public-health.html

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 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 the following statement calling on Toro Energy to stop promoting dangerous radiation junk science junk. A similar statement was signed by 39 Australian medical practitioners in 2014; questioning Cameco's decision to sponsor speaking events by Boreham[83] (Appendix 5 and 6).

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.

[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

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.

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.

Safeguards

There are many problems and limitations with the international safeguards system.[87] 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.[88] 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."[89] 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 (MUF). There have been incidents of large-scale MUF in Australia's uranium customer countries such as the UK and Japan.[90]

---

[87] For information on safeguards see the papers listed at www.foe.org.au/anti-nuclear/links#safeguards
[88] See section 6 in: 'The Nuclear Safeguards System: An Illusion of Protection', 2010, www.choosenuclearfree.net/safeguards/
[89] 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
[90] See section 4 in: 'The Nuclear Safeguards System: An Illusion of Protection', 2010, www.choosenuclearfree.net/safeguards/

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."*[91] 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.

6. 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.

7. 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.

8. 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 Committe on Treaties (JSCT) 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."*[92] However the Australian Government rejected the recommendation in its 2009 response to the JSCT report.[93]

9. 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 reactor in Iraq in 1981, the US bombed and

[91] IAEA, 1993, Against the Spread of Nuclear Weapons: IAEA Safeguards in the 1990s.
[92] 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
[93] Australian Government, 2009, 'Government Response to Report 94 of the Joint Standing Committee on Treaties: Australia-Russia Nuclear Cooperation Agreement'

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."*[94]

Australia's uranium export policy / customer countries

Here brief comment is made about the choice of uranium 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."*[95]

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,

[94] Mike Rann, March 1982, 'Uranium: Play It Safe'.
[95] John Carlson, 1998, http://web.archive.org/web/20040217071924/http://www.aph.gov.au/hansard/joint/commttee/j2022.pdf, p.15

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 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.[96] 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?"*[97]

Japan's plutonium stockpiling and reprocessing plans continue to cause regional concern – for example China has recently voiced concern.[98] 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

---

96

http://web.archive.org/web/20081114064230/http://archive.greenpeace.org/pressreleases/nuctrans/1999sep1.html

97

http://web.archive.org/web/20081114064230/http://archive.greenpeace.org/pressreleases/nuctrans/1999sep1.html

98 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

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

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."*[99]

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 include the refusal of successive Australian governments to publicly release:

1. Country-by-country information on the separation and stockpiling of Australian-obligated plutonium.

[99] 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.

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 JSCT recommended that: *"Further consideration is given to the justification for secrecy of Material Unaccounted For'."*[100] There is no legitimate justification for the secrecy surrounding MUF. ASNO has done no better than to cite commercial confidentiality.[101] 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."[102]

Uranium sales to India

The Australian government has recently further 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 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).[103]

---

[100] 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

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

[102] 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

[103] See their submissions to the JSCT: www.aph.gov.au/Parliamentary_Business/Committees/Joint/Treaties/28_October_2014/Submissions

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."*[104]

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 JSCT: *"If the Government does compromise Australia's safeguards conditions, inevitably this will lead to other agreement partners asking for similar treatment."*[105]

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.

Concluding comments

We urge the EPA to recommend the Yeelirrie proposal be rejected on the grounds that there are unacceptable risks to subterranean fauna that could result in one or multiple species of stygofauna and troglofauna becoming extinct.

We further urge the EPA to support the rescission or, at minimum, review of the Yeelirrie State Agreement as it is not consistent with current best industry or regulatory standards and practice. The Agreement is also inconsistent with existing state government commitments, policies and community expectations.

Uranium mining and rehabilitation is complex, contaminating and costly and the Yeelirrie proposal threatens many endemic flora and fauna species. We urge the EPA to apply the precautionary principle and protect against the unacceptable risks presented by this proposal and recommend that this proposal not proceed and that any and all future uranium applications be subject to assessment via Public Inquiry, as provided for in section 40 (2) (a) of the EP Act 1986.

Should the EPA choose to recommend approval of this detail deficient application we urge the EPA to require the following conditions of the proponent:

- Provide an unconditional performance bond that is equal to 100% of

[104] www.aph.gov.au/DocumentStore.ashx?id=35fb7f72-904c-4d44-b387-f34e4afb77f9&subId=301365
[105] www.aph.gov.au/DocumentStore.ashx?id=79a1a29e-5691-4299-8923-06e633780d4b&subId=301365

the expected mine closure and rehabilitation costs and that the adequacy of this amount be annually reviewed.

- That all the pending management plans be made available for public comment as part of the assessment process before any approval by relevant Government agencies.
- Provide alternative options with detailed analysis of environmental impacts for different scenarios of the rate of mining, including reducing the rate from 3 Mtpa to 1.5 or 2 Mtpa.
- Install dust-monitoring stations at Noibla Homestead on Youno Downs Station and at the Youno Downs Homestead.
- Ensure there is no offsite dust pollution and make any failure to realise this subject to penalty
- Install additional real time radon gas monitoring stations in multiple locations onsite, including around the ore stockpiles.
- Ensure that the sourcing of water for the project will have no impact on the quality or capacity of neighbouring stations access to water.
- Provide analysis on the cumulative impacts from existing mining in the region, including focused analysis on the cumulative downstream impacts of mining operations on Lake Miranda.