

## **BHP Olympic Dam operates under *outdated* 1991 era Radiation Exposure Standards:**

*Briefing Paper prepared by David Noonan, Independent Environment Campaigner, 18 May 2020*

Worker radiation exposure limits in SA are governed by *outdated* 1991 era standards set in national Codes.

With [BHP to expand Olympic Dam](#) copper-uranium mine and SA legislating a new *Radiation Protection and Control Act 2020*, SA must require a Safer Worker Radiation Exposure Standard that is fit for the 2020's.

However, the [Bill before Parliament](#) section 49 "*Limits of exposure to ionising radiation not to be more stringent than limits fixed under certain codes ect*" seeks to continue to prohibit any safer more stringent radiation exposure limit being applied to mining and mineral processing in SA – than set in national Codes.

The Bill Schedule 1 part 9 prohibits licensing conditions for worker radiation protection at Olympic Dam from being "*more stringent*" than requirements of Codes listed in the 1982 *Roxby Downs (Indenture Ratification) Act* clause 10. The [1982 Indenture Act](#) grants untenable legal privileges to BHP vested interests through to 2036.

These national Codes are unlikely to be reformed and mirror an international regime set back in 1991 when the ICRP reduced its occupational exposure limits to 20 mSv per annum (averaged over five years within which up to 50 mSv in a single year was permitted). This is the occupational regulatory limit that is still imposed in SA.

Worker exposure standards in SA must not be constrained by an international failure to reform or be influenced by nuclear and mining industry interests. By 2021, [SA will be the only jurisdiction](#) in Australia where uranium mining takes place. In 2020 SA must improve safety for workers in Radiation Exposure Standards.

### **Strong evidence to Reform a 30-year old standard and apply a Safer Lower Worker Exposure Limit:**

Evidence of radiation health impacts is authoritative and warrants a safer standard be set than the existing limit of 20 mSv per annum. For instance, the [US National Academy of Science, BEIR VII report \(2006\)](#) states:

*"... [T]here is a linear dose-response relationship between exposure to ionizing radiation and the development of solid cancers in humans. It is unlikely that there is a threshold below which cancers are not induced."*

[BHP gave a Commitment](#) over 2009-2011 during EIS assessment of a prior Olympic Dam mine expansion, described as a "*safeguard that BHP can commit to at this time*", to limit workforce radiation exposure doses to less than half the limits set in the international, national and SA Codes (see p.1 & p.6 of the pdf):

*"BHP would comply with internationally accepted radiation limits for workers and the public and would set a goal of maintaining doses at less than 50% of the internationally acceptable limits for workers."*

However, BHP did not proceed with that 'goal' after the company cancelled a proposed open pit mine project, and SA did not take up that key opportunity to legislate a safer lower radiation exposure limit for workers. A decade on, it is reasonable to expect a safer standard in the 2020's than previously put forward by BHP, the primary proponent of uranium mining in SA, in BHP's 2009-11 proposed 'goal' of a limit of 10 mSv per annum.

For instance, a total maximum ionising radiation permissible dose of 5 mSv a year for nuclear industry workers was a key Recommendation of the independent European Committee on Radiation Risk in [2003](#). In 2010 the Committee recommended that annual exposure limits for nuclear workers should be 2mSv a year (ECRR, "[2010 Recommendations of the ECRR. The Health Effects of ionising Radiation Exposure at Low Doses for Radiation Protection Purposes: Regulators' Edition](#)", Edited by Chris Busby and Rosalie Bertell, p.181).

The Bill should be amended to remove constraints on applying a Safer Worker Radiation Exposure Limit in SA and a Public Radiation Safety Review must be held to determine a radiation exposure limit fit for the 2020's.

## **BHP Olympic Dam underground mine workers face a significant increase in cancer risk:**

[Evatt Foundation Journal](#) papers (“Nuclear power & public health”, Dec 2011, by Peter Karamoskos MBBS, FRANZCR, nuclear radiologist and former public representative of the ARPANSA Radiation Health Committee) have discussed ionising radiation health exposure risks to BHP Olympic Dam copper-uranium mine workers:

*“... The potential health impacts of the nuclear fuel cycle not only concern the general public but also nuclear workers. The nuclear fuel cycle includes the mining and milling of uranium ore ...*

*The carcinogenicity of ionising radiation is well established. BEIR VII assigns a risk factor of 5 per cent per Sv, or roughly 1:25000 chance of contracting cancer per mSv dose per annum. ... The complete nuclear fuel cycle poses health risks at every stage. ...*

**Radiation risks to uranium miners:** *The link between uranium mining and lung cancer has long been established. ... In 2009, the ICRP stated that radon gas delivers twice the absorbed dose to humans as originally thought and is in the process of reassessing the permissible levels. At this stage, previous dose estimates to miners need to be approximately doubled to accurately reflect the lung cancer hazard. ... These found a progressively increasing frequency of lung cancer 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, but 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 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 6 mSv, of which 2-4 mSv (allowing for the new ICRP dose coefficients) are due to radon and the balance due to gamma radiation. ...*

*Miners are now given personal protective equipment (PPE) including masks to filter out the radioactive particulate matter. Yet many underground miners find the masks extremely uncomfortable, especially in the hot underground environment they must contend with. It is estimated that up to 50 per cent of underground uranium miners in Australia do not use their masks, and thus drastically increase their risk of lung cancer while underestimating their actual radiation dose (since this is calculated assuming PPEs are used).*

*The Olympic Dam doses mentioned above are typical of modern mine practices. The average miner at Olympic Dam is in his 20s 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 the research demonstrates that the 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, or are even informed of the risks in a comprehensive and accurate manner that they can comprehend and make an informed work decision.*

**Conclusion:** *... Perhaps the most glaring concern is that the nuclear power industry developed with safety concerns trailing a distant second. ...*

*We now have voluminous evidence of public health risks of low levels of ionising radiation, even within occupational regulatory limits. We also know that there is no 'safe' level of radiation exposure below which radiation does not lead to a risk of cancer - there is no safe threshold. ... The long association with uranium mining and lung cancer is unequivocal, due to radon gas exposure. Recent evidence points to radon gas being twice as hazardous as first thought. There is also increasing evidence of an increased rate of solid cancers in nuclear industry workers throughout the nuclear fuel chain proportional to their radiation dose.*

Health risks to BHP Olympic Dam mine workers were further discussed by the independent NGO [Energy Science Coalition](#) in [Briefing Paper 22](#), “Nuclear Power and Public Health”, 2012, by Peter Karamoskos MBBS, FRANZCR. **Note:** These 2011-12 estimates of radiation impacts are now likely to be an underestimate of risk.

## **BHP Olympic Dam workers face radiation health impacts double that of cancer risks alone:**

A plain language summary of radiation impacts and recent studies by the Medical Association for Prevention of War ([MAPW](#)) in a Fed 2020 [submission](#) (p.6-10) to the Vic Govt Nuclear Inquiry held 2019-2020, states:

***“Powerful recent epidemiological studies have estimated greater radiation-related health risks than previously thought.<sup>1</sup> ...***

### ***Non-cancer risks and radiation***

*Ionising radiation also increases the risk of occurrence and death from some non-cancer diseases, including cardiovascular (especially heart attacks and strokes) and respiratory disease. This has been clearly demonstrated at moderate and high doses, and recent evidence has confirmed that non-cancer deaths also increase at low total doses and dose rates, such as occur in nuclear industry workers.<sup>2</sup>*

***The increased risk of death from heart and other circulatory diseases is estimated to be comparable in magnitude to the radiation-related cancer risk, meaning that the total extra risk of dying because of exposure to radiation is likely to be around double the increased risk of death from cancer alone.<sup>3</sup>”***

**Note:** The most extensive epidemiological [study](#) was coordinated by the International Agency for Research on Cancer, called [INWORKS](#) the study launched in 2011 and reported Oct 2015: “Risk of cancer from occupational exposure to ionising radiation: retrospective cohort study of workers in France, the United Kingdom, and the United States”. Further [INWORKS](#) study journal reports published in 2017 & in 2018 are available on request.

The MAPW submission (Feb 2020, p.9-10) states: ***“Cancer risks for nuclear industry workers:***

*Updated results of large long-term studies of hundreds of thousands of nuclear industry workers coordinated by the International Agency for Research on Cancer on risks for leukaemia<sup>4</sup> and solid cancers<sup>5</sup> were reported in 2015. The studies included 308,000 workers from France, the UK, and the US, followed up to an average age of 58 years. The cumulative doses were well within the current most widely recommended dose limit for nuclear industry workers of an average of no more than 20 mSv per year.*

***Rates of both leukemia and solid cancers were elevated...and will continue to rise as the subjects age. ...These large and powerful studies show risks even at very low-dose rates and total doses well within recommended occupational limits.***

***Together, the above studies conclusively demonstrate the absence of a threshold for ionising radiation related cancer risk. In other words, any exposure can do harm, and the amount of harm is increased with increased exposure.”***

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<sup>1</sup> A New Era of low-dose Radiation Epidemiology. <https://www.ncbi.nlm.nih.gov/pubmed/26231501>

<sup>2</sup> Mortality from Circulatory Diseases and other Non-Cancer Outcomes among Nuclear Workers in France, the United Kingdom and the United States ([INWORKS](#)). <https://www.ncbi.nlm.nih.gov/pubmed/28692406>

<sup>3</sup> Systematic Review and Meta-analysis of Circulatory Disease from Exposure to Low-Level Ionizing Radiation and Estimates of Potential Population Mortality Risks <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3556625/>

<sup>4</sup> Ionising radiation and risk of death from leukaemia and lymphoma in radiation-monitored workers ([INWORKS](#)): an international cohort study [https://www.thelancet.com/journals/lanhae/article/PIIS2352-3026\(15\)00094-0/fulltext](https://www.thelancet.com/journals/lanhae/article/PIIS2352-3026(15)00094-0/fulltext)

<sup>5</sup> Risk of cancer from occupational exposure to ionising radiation: retrospective cohort study of workers in France, the United Kingdom, and the United States ([INWORKS](#)). <https://www.ncbi.nlm.nih.gov/pubmed/26487649>

The MAPW submission continues: ***“Upward trends of radiation risks:***

*The science of radiation and health is still evolving. There has been a consistent trend over time that the more we know about radiation effects, the greater those effects appear to be. ... Globally recognised “acceptable” levels have always been lowered in accordance with new evidence of increased risks.*

*For example, from 1950 to 1991, the maximum recommended whole-body radiation annual dose limits for radiation industry workers was reduced from approximately 250 to 20 mSv, **where it remains.***

***The current recommended dose limit is not a dose below which there is no health risk. Rather, it represents the most recent compromise between safety and optimally protecting people on the one hand, and commercial and other vested interests and cost considerations on the other.”***

### **The Bill and the Olympic Dam mine expansion must trigger a Radiation Safety Review:**

In combination, the *Radiation Protection and Control Bill 2020* now before Parliament and the pending EIS assessment of BHP’s Olympic Dam mine expansion, countenance a precautionary approach to worker safety standards applied to mining operations in SA and must trigger a comprehensive Radiation Safety Review. In particular, the infrastructure and operations that may be allowed in the case of the BHP Olympic Dam mine expansion will determine the capacity of this project to respond to safer stricter worker exposure standards and must not entrench past outdated standards, but provide for advances.

There is strong evidence that SA’s radiation dose limits are outdated and do not provide sufficient protection. This Review must take into account evidence of both greater radiation-related health risk from cancer and of significant extra health risks from ionising radiation increasing the risk of occurrence and death from some non-cancer diseases, including cardiovascular (especially heart attacks and strokes) and respiratory disease.

The current ICRP and SA standards that allows for a worker to be exposed to a dose level of up to 20 mSv a year are now far outdated: At *twice* the level of the BHP Commitment 2009-2011 of a “safeguard” to in effect provide a maximum dose level of 10 mSv; And at *four times* the level of independent ECRR Recommendations set in 2003 for a total max ionising radiation permissible dose of 5 mSv a year for nuclear industry workers.

In the face of strong scientific evidence, the inertia at international & national levels and influence of mining interests must not hold back the timely Safety Review and Reform of worker radiation exposure limits in SA.

### **How long will SA wait to Review and Reform worker radiation exposure health risks?**

***“Health implications of ionising radiation”*** (2017) by Prof Tilman A. Ruff AO, a public health physician presents a comprehensive and compelling case for timely review of worker radiation exposures. Extract:

***“...any and all levels of ionising radiation exposure, including doses too low to cause any short-term effects or symptoms, are associated with increased risks of long-term genetic damage, chronic disease, and increases in almost all types of cancer, proportional to the dose. Radiation both increases the chance of developing cancer and brings earlier its onset. These excess risks persist for the lifetime of those exposed. ...***

*It has been conclusively established that there is no dose of radiation below which there is no incremental health risk—all radiation exposure adds to long-term health risks. ...*

*The increased risk of death from heart and other circulatory diseases is estimated to be comparable in magnitude to the radiation-related cancer risk, meaning that the total extra risk of dying because of exposure to radiation is likely to be around double the increased risk of death from cancer alone.”*

For information on BHP's expansion of Olympic Dam mine, visit: <https://nuclear.foe.org.au/olympic-dam/>