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**Grounds of AidWatch’s Objection to Lynas’ Proposal for Sg karang**

**There is NO Justification for Malaysia to Keep Lynas’ WLP Waste In Malaysia**

The system of radiation that is used worldwide is based on the recommendations of: the International Commission for Radiation Protection (ICRP); and the International Commission on Radiation Units and Measurements (ICRU). The ICRP system of protection is based on three fundamental principles: **justification, optimisation and dose limitation**. [[1]](#endnote-1)

The principle of justification requires that any decision that alters the radiation exposure situation should do **more good** than harm; in other words, the introduction of a radiation source **should result in sufficient individual or societal benefit** to offset the detriment it causes. **The fact that the doses arising from a practice may be well below the public dose limit does not remove the requirement for justification or optimisation.**

The principle of optimisation requires that the likelihood of incurring exposures, the number of people exposed, and the magnitude of their individual exposure should all be kept as low as reasonably achievable, taking into account economic and societal factors. In addition, as part of the optimisation procedure, the ICRP recommends that there should be restriction on the doses to individuals from a particular source and this leads to the concept of dose constraints.

The third principle of the ICRP’s system of protection is that of dose limitation. This principle requires that the dose to individuals from planned exposure situations, other than medical exposure of patients, should not exceed the appropriate limits recommended by the Commission.

In the case of the WLP waste, it belongs to Lynas Rare Earth Inc. (Lynas). In 2012, Lynas has legally committed to removing this waste from Malaysia. The Government has widely publicised and assured Malaysians of it but has since reneged on this promise. AidWatch is aware that this is the subject of a judicial review appeal currently pending decision at the Federal Appeal Court.

In the first place, the Lynas Advanced Materials Plant (LAMP) has operated in Gebeng/Kuantan against strong public objection over its poor handling of toxic radioactive waste and pollution. Its public consultation has been selective and controlled despite the known long-term hazards of rare earth (RE) toxic waste and pollution.

What justification or optimisation can Lynas offer Malaysians to accept such a huge quantity of radioactive waste, when the radioactive materials and toxic heavy metals have originated from its mine in Mt Weld, and the company has profited from the lax regulatory environment and enjoyed a generous 12-year tax break **WITHOUT** a social licence to do so?

Furthermore, what justification can Lynas offer Malaysia to accept its toxic radioactive waste when it has a ready-made location at Mt Weld with an approved low-level radioactive waste management plan in place for its NORM (naturally occurring radioactive materials) wastes?

DoE should note that Australia, **Western Australian (WA) Environmental Protection Agency (EPA) has approved Lynas’ proposed Kalgoorlie RE processing plant ON CONDITION that it transports and returns both the hazardous and radioactive wastes to its Mt Weld mine site for disposal** in accordance with WA regulations and guidelines for low-level radioactive waste[[2]](#endnote-2), AWAY from populated centre in a remote and isolated area.

**20-year Design Life of the PDF is Grossly Inadequate**

**DoE should note that the radioactivity of the Ranger uranium mine waste in Northern Territory is about 5.8 Bq/g, lower than Lynas’ WLP waste at 7Bq/g**. It is currently undergoing rehabilitation where the radionuclides in that the tailings must be isolated from the environment through a disposal design life of **at least 10,000 years**.[[3]](#endnote-3)

**Short Lifespan of HDPE Cell Lining**

According to the EIA of the proposed Lynas PDF, the cell lining system is likely to be intact for just 20 years:

“In the event of cell liner system breach (worst case scenario), the contaminants will be contained within the boundary of the Project site over a duration of 20 years. It will not be a concern from human health and ecological perspective, because the concentrations are far below the respective CLMCG SSLs for tap and/or the NGWQS.” (p. ES-20), and

“The construction of the PDF has included a cell liner system which is designed to

prevent breach of contaminants into the groundwater. Should the cell liner system is

breached, it is expected that the contaminant will be retained within the project site

boundary for a duration of 20 years. Furthermore, the concentrations are far below the

respective CLMCG SSLs for tap and/or the NGWQS.” (p. 10-2)

Claiming that it will not be a concern because of the low concentration cannot be a justification that the PDF will work safely. In fact, it has proven that the PDF is not designed safely to contain all of the toxic and radioactive elements in the WLP waste for beyond 20 years! Besides, the concentrations are likely to increase over time – in terms of Th-232 and U-238, a timeline of 10,000 years is only marginally humanly realistic. Radioactive doses and heavy metal exposures can biologically accumulate over time posing greater danger and risk as time goes by to future generations, unfairly, since they have not benefitted from any of the profits from Lynas.

Further, in Section 8.5.1 e) “The HDPE layer is generally guaranteed for about 25 years; if it is damaged due to age or institution, the spot should be dug up and repaired.” p. 8-42

Since the purpose of the so-called PDF is primarily to store all the WLP waste to a height of 8 meters, how will any damage or tear be detected and how will it be physically possible to reach the spot or location that requires repair?

For the RSF that is in use, since according to the 2018 ERC report, groundwater has been contaminated and some of the monitoring stations are showing high level of contamination from nickel, lead, etc..(p.78-81 of ERC report) has any attempt been made to identify the leak, or to dig out the WLP waste stored in the damaged spot? It is easy to make claims but claims that cannot be substantiated are as good as useless and should not be included in a credible and professional EIA, least of all for a major infrastructure project such as that of the WLP waste PDF.

**The Location of the Proposed PDF will be inundated in 2100**

In p. ES-11, it states clearly that the “shoreline nearest to the Project area (3km), is not expected to be inundated until 2100.” And in p.6-58, “The National Hydraulic Research Institute of Malaysia (NAHRIM), in their study ‘The Study of the Impact of Climate Change on Sea Level Rise in Malaysia’ in 2010 produced an inundation map for the whole country based on sea level rise projection for year 2030, 2050 and 2100 based on the most conservative scenario which is Representative Concentration Pathway (RCP) 8.5. The projected inundation is derived by the combined effects of sea level rise and tides.“

Clearly, sea level rise modelling has shown that the PDF site is expected to be inundated post 2100, a mere 78 years away from today! Under no circumstance should DoE approve of Lynas’ proposed PDF since the toxic elements in the WLP waste must be contained and not to be released to affect local community and the environment.

**Radioactive Waste Dump is Unsafe in a Low-lying Peat Mangrove**

Tropical peatland is a vital carbon sink, water reservoir ecosystem that supports unique species of plants and animals on top of providing a wide range of functions.[[4]](#endnote-4) The Balok peat mangrove is very much a part of the local landscape which supports the fishery, recreational and tourism industries. It should be repaired and protected to reduce greenhouse gas emissions, to tackle climate change and for its many other ecosystem functions for the community – especially for younger and future generations, not to be further degraded.[[5]](#endnote-5)

In advanced countries like the USA and Australia, radioactive waste dump proposals for remote and isolated dry or semi-arid desert region have been rejected on scientific grounds because it is unsafe. Excavating the Balok peatland metres deep to create a mega radioactive waste dump is destabilising and destructive of a vital landscape, releasing massive quantity of carbon dioxide and methane. It directly undermines and contradicts Pahang Regent, HRH Tengku Hassanal Ibrahim Alam Shah’s support and the Pahang state Government’s plan for the Blueprint for Conservation and Sustainability at COP26.[[6]](#endnote-6)

**Bad Reputation for Malaysia for Setting a Low Standard for Radioactive Waste Management**

Approving Lynas’ Sungai Karang PDF proposal will cast a negative image of Malaysia as a case of bad practice for the world’s largest below-standard radioactive waste dump in a peat swamp, creating a costly mega toxic legacy to burden younger and future generations of Malaysians.

**Lynas and the Atomic Energy Licensing Board (AELB) of Malaysia have compromised public and environmental safety and protection by incorrectly classifying the WLP waste** as a very low-level radioactive waste (VLLW) when it should be a low-level radioactive waste (LLW). According to the IAEA: LLW is “Waste that is above clearance levels, but with limited amounts of long-lived radionuclides.”[[7]](#endnote-7)

The WA Government has recently confirmed that the WLP waste is a LLW: “Facilities for storage of low-level radioactive waste already exist at the Mt Weld mine and the mine is located in an isolated area. The by-products will return from (sic) where the ore was mined away from any residential populations. “ [[8]](#endnote-8).

AELB and Lynas’ claims that the WLP waste is classified as very low-level radioactive waste (VLLW) citing references to IAEA is flawed and problematic as shown by Mr Gerhard Schmidt’s 2020 analysis and discussion, and that of Dr Lee Chee Hong, a private Engineering Consultant – both reports are attached for reference. The incorrect and below-standard classification in Malaysia will result in poor management, increased maintenance costs, hazards and radiation exposures that will negatively impact on public health and the environment for Malaysia in the long run.

**Gebeng Industrial Estate (GIE) has been earmarked for chemical industrial complexes, not as a radioactive waste dump site**. Locating the PDF so close to plants containing tanks of flammable, combustible, and corrosive chemicals as well as fuel is not safe, and least of all scientifically logical.

**The total amount of Water Leach Purification (WLP) waste destined for the PDF is huge**: > 1 million cubic metres or 1.6 million tonnes in wet weight – enough to fill 21,226x40-ft containers, if lined up back-to-back, will stretch to 260km, or equivalent to the road distance from Kuantan to the capital city Kuala Lumpur.

**The WLP waste is contaminated with 1953ppm of thorium-232 (Th-232) and 28ppm of uranium-238 (U-238),[[9]](#endnote-9) both have half-life in the billions of years**. While these radionuclides are present in our environment naturally, radionuclides found in industrial waste have been processed and are known to be sources of cell mutating and cancer-causing ionising radiation. [[10]](#endnote-10) Thorium and uranium are sources of ionising radiation5 with a half-life of 14 billion and 4 billion years, respectively. These radionuclides, although naturally occurring, have been exposed and concentrated through the mining, milling, harsh chemical and thermal processing - essentially technically enhanced as TENORM6; and are concentrated and left in the waste together with heavy metals and chemicals in an acidic iron phosphate gypsum, potentially leaching into the environment over time through weathering processes when the PDF structure and system fail to contain the waste. posing serious hazards to the surrounding environment and groundwater, putting human health at risk ultimately.

**There is no safe dose of exposure to ionising radiation.** Internationally, the permitted levels and sources of radiation exposure for workers and the public have steadily dropped as detailed cancer and genetic impact studies revealed links with low doses of ionising radiation.[[11]](#endnote-11) There is no safe dose of ionising radiation exposure – a conclusion drawn by the US National Academy of Science since 20057 and the reason for the linear no-threshold regulatory approach to radiation safety and protection adopted by most responsible governments8.

It is this very reason that management of waste contaminated with Th-232 and U-238 is costly, technically complex, and socially challenging. Pushing ahead with the Lynas proposal without a social licence from Malaysians is unacceptable and not transparent.

Expediting the approvals process puts not only human and environmental  health at risk (especially that of future generations due to the delay-effects of the toxic  elements found in the waste), but also Malaysia’s environmental laws and regulations that have developed over decades, for example the Water Services Industry Act which stipulated that contamination of potable water may attract the death penalty.

Please refer to further discussion about ionising radiation in the fact sheet in prepared by the late Dr Bill Williams.

**The WLP waste is about 60 times more (with 3 times more thorium mass) than the radioactive waste generated by Asian Rare Earth in Bukit Merah[[12]](#endnote-12)**, yet the budget for the PDF is paltry for a mere 20-year design life[[13]](#endnote-13) in comparison with the US$100 million spent in disposing of the ARE waste in the 10,000-year design life engineered facility at the Kledang Hill.[[14]](#endnote-14)

**The EIA has not carried out detailed mass balance analysis of different elements in the WLP waste**. A range of toxic elements were disclosed in Lynas 2011 Safety Case Analysis of the WLP waste in 2011, including zinc (Zn), cadmium (Cd), nickel (Ni), lead (Pb), mercury (Hg), arsenic (As) and cerium (Ce). The toxic elements and radionuclides in the WLP waste in its acidic iron phosphate medium can leach, mobilise, and concentrate to pollute the surrounding environment over time when the PDF is no longer able to contain the waste. The integrity of the PDF is unlikely to remain intact beyond 20 years.

**The EIA revealed that the final effluent discharge will still contain radioactive Thorium-232, Uranium-238, toxic heavy metals and chemicals**. This is in violation of the Water Services Industry Act (WSIA)[[15]](#endnote-15) which specifically prohibits the contamination of potable water with radioactive and/or toxic substances. The EIA has not considered that the Balok peatland may be geohydrologically linked to the extensive riverine system which feed into the water supply of the City of Kuantan, or the mangrove forest ecosystem.

**The modelling used in the EIA is unrealistically optimistic.** It has not taken into consideration other long-term (in the tens, hundreds, or thousands of years) changes from environmental degradation or climate change induced extreme weather events especially extreme drought and flooding events which have been scientifically forecast to severely impact and change different landscapes[[16]](#endnote-16) and the PDF is only 3km from the South China Sea. For example, sea level rise and coastal inundation of the project site is modelled to occur in 2100. However there may be other severe changes and conditions which the modelling has not managed to capture.

**The combined health and environmental effects of both hazardous and radioactive materials, both of which would bioaccumulate in living cells and vital organs, could be exponentially worse than each on their own**.[[17]](#endnote-17) Recent research studies have found RE to be harmful to humans in different ways[[18]](#endnote-18) and can hamper brain functions when exposed to young children among others.[[19]](#endnote-19)

**According to the 2018 Government Executive Review of the LAMP[[20]](#endnote-20), groundwater from Lynas’ own monitoring stations has shown serious contamination by some toxic elements**. At least 50 households across 9 villages dependent on ground water for their daily consumption and uses within 5km from the LAMP. No follow up has been done to ensure that their water supply is safe even though under the WSIA, contamination of potable water is a serious crime.

**There has not been any health baseline data or detailed monitoring of residents’ health conditions in a transparent and scientifically rigorous manner** despite the known health effects of RE industry pollution, clearly indicating the limitation of regulatory and law enforcement capabilities in Malaysia.

**DoE’s tolerance of the groundwater and the Balok River contamination against Malaysia’s own laws such as its own Environmental Quality Act and WSIA further adds to public distrust**. To date, the full monitoring data from the LAMP has yet to be released for public scrutiny against IAEA’s 2011 recommendation[[21]](#endnote-21). This does not help boost public confidence that DoE has carried out its mandated duty of care in the national and public interests.

**There was no public tender to select the most appropriate company with the necessary experience, track record and qualifications to undertake the PDF project**. Instead, a newly formed company with strong political connection and influence, with no prior experience in radiation safety and protection or toxic waste management has been awarded the construction contract.[[22]](#endnote-22)

**The proposal to construct a mega radioactive/toxic waste PDF is of national significance, and yet it has not been referred to the National Physical Planning Council (NPPC)**[[23]](#endnote-23) **for consideration**. Sungai Karang district is a peri-urban population growth area for Pahang close to the border of Terengganu in proximity to dense residential estates, popular tourist destinations including the Club Med along the coast, and fishing locations in the South China Sea.

1. https://ec.europa.eu/health/scientific\_committees/opinions\_layman/security-scanners/en/l-3/2-radiation-protection.htm [↑](#endnote-ref-1)
2. Western Australia Environmental Protection Agency, Kalgoorlie Rare Earths Processing Facility, Lynas Kalgoorlie Pty Ltd, Report 1712, October 2021 [↑](#endnote-ref-2)
3. Data updated from Mudd, GM (2014) *The Future of Yellowcake: A Global Assessment of Uranium Resources and Mining*. Science of the Total Environment, Volume 472, p. 590-607 referenced in the submission to DoE on the PDF Proposal for the Bukit Ketam EIA, March 2021 [↑](#endnote-ref-3)
4. <https://hal.archives-ouvertes.fr/hal-00599518/file/PEER_stage2_10.1111%252Fj.1365-2486.2010.02279.x.pdf> : global and regional importance of the tropical peatland carbon pool; https://www.wur.nl/upload\_mm/a/f/4/013a2161-9803-47a7-9585-a5e85072d7b9\_RestorationBook5.pdf#page=94: Peat-water Interrelationships in a Tropical Peatland Ecosystem; <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1692688/pdf/11605630.pdf> Interdependence of Peat and Vegetation in a Tropical Peat Swamp Forest [↑](#endnote-ref-4)
5. <https://www.researchgate.net/profile/Hamdan-Omar-3/publication/303840563_Assessing_rate_of_deforestation_and_changes_of_carbon_stock_on_mangroves_in_Pahang_Malaysia/links/5757915108ae04a1b6b69499/Assessing-rate-of-deforestation-and-changes-of-carbon-stock-on-mangroves-in-Pahang-Malaysia.pdf> [↑](#endnote-ref-5)
6. https://www.thestar.com.my/news/nation/2021/11/05/pahang-govt-approves-proposed-green-border-initiative [↑](#endnote-ref-6)
7. <https://www.pub.iaea.org/MTCD/Publications/PDF/Pub1419_web.pdf> Classification of Radioactive Waste, p.5 [↑](#endnote-ref-7)
8. Western Australia Environmental Protection Agency, Kalgoorlie Rare Earths Processing Facility, Lynas Kalgoorlie Pty Ltd, Report 1712, p. October 2021 [↑](#endnote-ref-8)
9. <https://www.osti.gov/biblio/22266092-thorium-uranium-rare-earth-elements-content-lanthanide-concentrate-lc-water-leach-purification-wlp-residue-lynas-advanced-materials-plant-lamp> independently analysed content of Th-232 and U-238 in Lynas’ lanthanide concentrate and WLP waste by UKM. [↑](#endnote-ref-9)
10. <https://www.ncbi.nlm.nih.gov/books/NBK218130/> human cancer risk estimates related to ingestion of thorium radionuclides & <https://www.who.int/news-room/fact-sheets/detail/ionizing-radiation-health-effects-and-protective-measures> [↑](#endnote-ref-10)
11. <https://ec.europa.eu/health/scientific_committees/opinions_layman/security-scanners/en/l-3/2-radiation-protection.htm> - [↑](#endnote-ref-11)
12. <https://www.geosyntec.com/projects/item/6015-decommissioning-and-disposal-of-former-rare-earth-processing-facility> [↑](#endnote-ref-12)
13. Section 8.5.1 “..the HDPE layer is generally guaranteed for about 25 years;” [↑](#endnote-ref-13)
14. https://www.geosyntec.com/projects/item/6015-decommissioning-and-disposal-of-former-rare-earth-processing-facility [↑](#endnote-ref-14)
15. Part X, 121 (1) a to c and (2) (a) & (b) General Offences and penalties: Offence of contamination of Water. [↑](#endnote-ref-15)
16. Ehsan, S. et. al., Current and potential impacts of sea level rise in the coastal areas of Malaysia, IOP Conf. Series: Earth and Environmental Science 228 (2019) & Tornado hit Gebeng in August 2021 https://www.facebook.com/watch/?v=291569902326638 [↑](#endnote-ref-16)
17. [https://www-pub.iaea.org/MTCD/Publications/PDF/TRS442\_web.pdf *Remediation of Sites with Mixed Contamination of Radioactive And other Hazardous Materials* & https://www.mdpi.com/2305-6304/6/4/65/htm](https://www-pub.iaea.org/MTCD/Publications/PDF/TRS442_web.pdf%20Remediation%20of%20Sites%20with%20Mixed%20Contamination%20of%20Radioactive%20And%20other%20Hazardous%20Materials%20&%20https://www.mdpi.com/2305-6304/6/4/65/htm) Heavy Metal Mixture Exposure and Effects in Developing Nations: An Update, 2018 [↑](#endnote-ref-17)
18. https://link.springer.com/chapter/10.1007/978-3-030-52421-0\_1 [↑](#endnote-ref-18)
19. <https://pubmed.ncbi.nlm.nih.gov/15098471/> : various research findings on the health effects of rare earth [↑](#endnote-ref-19)
20. Malaysian Government’s Executive Review Committee on the Lynas Rare Earth Plant (ERC), December 2018, p.79-81 [↑](#endnote-ref-20)
21. <https://www.iaea.org/sites/default/files/lynas-report2011.pdf> Report of the International Review Mission on LAMP, p. 5&6, 2011 [↑](#endnote-ref-21)
22. <https://www.malaysiakini.com/news/596998> Pahang Regent Tengku Hassanal Ibrahim Alam Shah has regained his stake in Gading Senggara Sdn Bhd (GSSB) [↑](#endnote-ref-22)
23. https://www.planmalaysia.gov.my/index.php/en/help/14-umum/70-national-physical-planning-division [↑](#endnote-ref-23)