DETAILED COMMENTS AND FEEDBACK SUBMITTED BY SAHABAT ALAM MALAYSIA AND THE CONSUMERS ASSOCIATION OF PENANG (CAP) TO THE DEPARTMENT OF ENVIRONMENT PUTRAJAYA

ON THE ENVIRONMENTAL IMPACT ASSESSMENT (EIA) FOR THE PROPOSED DEVELOPMENT OF A DEDICATED PERMANENT DISPOSAL FACILITY (PDF) FOR THE WATER LEACH PURIFICATION RESIDUE (WLP) AT BUKIT KETAM IN MUKIM KUALA KUANTAN, DAERAH KUANTAN, PAHANG

SUBMITTED ON: 19 March 2021

A. Introduction

Sahabat Alam Malaysia (SAM) and the Consumers Association of Penang (CAP) are pleased to provide the following feedback and comments to the aforesaid EIA. Our comments flow from consultations with our experts and local communities who are concerned about the project, as well as from the discussions that took place on the EIA during the meetings of the EIA Technical Review Committee set up by the DOE, held on 10 and 15 February 2021, of which SAM was a member.

Some of the issues raised in this submission arise from SAM's previous submissions to the DOE, viz. our comments on the Terms of Reference for the EIA, preliminary comments on 9 February 2021 and additional comments submitted on 22 February 2021.

Having gone through the EIA, we are of the view that it should not be approved and ought to be rejected for the reasons set out below. In short, the EIA has many flaws and shortcomings and is also not in conforming with the Environment Quality Act (EQA) 1974 as well as the Town and Country Planning Act (TCPA) 1976.

We also support the submission of independent experts, Assoc. Prof. Gavin M. Mudd and Assoc. Prof. Matthew J. Currell, from Environmental Engineering, RMIT University, Melbourne, Australia and trust that the DOE will consider their expert views seriously.

We are of the view that the EIA for the Lynas PDF must be rejected and cannot be approved for the reasons set out below.

B. Grounds for rejection

1. Contravention of Section 34A(4)(a) of the EQA '74

SAM's comments on the legal issue raised as regards the TOR for the EIA remains valid, and this shows that the EIA has failed to address this fundamental concern.

According to Section 34A(4), *"If the DG, on examining the report (which refers to the EIA for the project) and after making such inquiries as he considers necessary is of the opinion that (a)* ***the report is not in accordance with the development plan*** *or physical plan approved by the relevant approving authority….he* ***shall not approve the report****, giving reasons for not approving, and shall inform the person and relevant approving authority accordingly."* (Emphasis added).

Section 2 of the EQA defines the term 'development plan' as having *"…the same meaning assigned to it under the TCPA."* According to Section 2 of the TCPA, *"development plan in relation to an area, means (a) the local plan for the area…"*

Once the DG is aware that the EIA for the project is in violation of a development plan, which in this case, refers to a local plan for the area, she cannot approve the EIA report as it would be contrary to Section 34A(4)(a).

The DG has no discretion on the matter but to reject the EIA if it violates the local plan.

As noted in the EIA, according to the Kuantan Local Plan (KLP) 2035, the Bukit Kuantan Forest Reserve is considered as a Class I ESA of cultural value; therefore, no form of development or activities other than low-impact recreational, research or educational activities are allowed in the area. (See page 66 of TOR, 6.16, Vol. 1).

The State government may have agreed for the project site to be degazetted as a forest reserve for the development of the PDF but unless the KLP 2035 is amended as per the TCPA provisions, the current KLP continues to be the relevant plan, and the DG cannot be considering a future local plan which is non-existent.

In the EIA, a letter from the Majlis Perbandaran Kuantan has been produced dated 22 December 2020, which states that the change in landuse zoning will be taken into account in the revision of the KLP 2035. (see page 1-12 and Appendix 1.5.5).

It is presumptuous to assume that the KLP will be amended without objections, or that the objections can be ignored, in the public consultations process. This is so in view of the decision of the Court of Appeal delivered on 27 Jan 2021 in relation to the Taman Rimba Kiara case (in Civil Appeal No. W-01(A)-712-12/2018) on the planning law and process in this country. The Court of Appeal has made clear that any deviation from a structure plan (and in our case, a local plan) must be for good reason and must be explained and the reasons provided for doing so. Hence, the authorities can be challenged for departing from the KLP 2035 which stipulates the Bukit Kuantan Forest Reserve as Class 1 ESA.

In any event, as we have pointed out before, the DG's decision under Sect 34A(4)(a) of the EQA relates to an existing development plan and not a future plan that has not come into effect.

2. A fundamental weakness of the EIA is the failure to consider and address the missing information on the environmental impacts of the larger MCISWDS.

The proposed siting of the PDF in a water catchment area and a forest reserve is itself cause of major concern. In addition, of serious alarm is the siting of the PDF within a larger proposed project, the Multi-Category Industrial Scheduled Waste Disposal Site (MCISWDS).

According to the EIA on Page 1-8, "*The EIA has been prepared only for the 58.25 ha (143.95 ac) land allocated to Lynas for the development of the PDF which is solely dedicated for the WLP residue….This EIA does not include the larger area that will be gazetted for the establishment of the MCISWDS….Of the 202.35 ha (500 ac), the Project site will occupy an area of 58.25 ha (143.95 ac) or almost 29% of the entire MCISWDS…*"

A fundamental weakness of the EIA is the missing information on the environmental impacts of the larger MCISWDS. We have been told that the MCISWDS is still under planning and does not yet have a detailed project layout or an EIA. However, since the PDF is a component of the MCISWDS, the Lynas PDF EIA is grossly inadequate in assessing the overall environmental impacts to the existing environment and the implications of that for the PDF that will result due to the MCISWDS.

The preparation and review of this "smaller" EIA (the PDF) before the "larger" EIA (for the master MCISWDS project) will set a precedent for future EIAs processes, with consequences which will be grave for environment assessments, as such piecemeal approaches are deeply flawed in not appreciating the overall impacts to the environment.

In addition, we wish to stress the following points.

a) Why the overall environmental impacts of the MCISWDS project must be considered -

There are two aspects to consider here. The first aspect is about the environmental carrying capacity, and the second is about the need to consider the changed environment as regards the Lynas PDF when the MCISWDS is constructed and used.

First, in general, as regards the carrying capacity, one key aspect relates to the rivers flowing from the project site. Carrying capacity in this context is about the maximum amount of pollution load that a river assimilates without becoming impaired. Dr. Zaki Zainudin, a water quality expert and also part of the Sg Kim Kim pollution investigation team, discussed carrying capacity in one of his interviews:

"… rivers have the natural capacity to carry pollutants but their carrying capacity levels depend on their water volume. If a river is endowed with a high volume of water, its carrying capacity is also high. Likewise, rivers with low water volume have low carrying capacities. During a drought, there's less water flowing in a river. The pollutants that are discharged into the river may be permissible under the law, but it will worsen the pollution level due to the river's reduced carrying capacity."[1]

A river's carrying capacity is directly correlated to Total Maximum Daily Load. i.e., the capacity of the river water to dilute or absorb any pollutant or effluent. [2]

As we all know, water quality has been one of the key concerns especially when this proposed PDF is located within a water catchment area. One undisputable common goal for all is to ensure a clean and safe water quality for the Kuantan population.

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[1] Quoted in Kurniawati Kamarudin, "Put water security first," *The Sun Daily*, 2 February 2020, https://www.thesundaily.my/opinion/put-water-security-first

[2] Sim Leoi Leoi, Clarissa Chung and Lutfil Hadi, "This is how we're choking our water sources," *The Star*, 12 November 2020, https://www.thestar.com.my/news/nation/2020/11/12/this-is-how-we039re-choking-our-water-sources?fbclid=IwAR0v4pH264cuxM3PQzpvO5dmS88PV88aL7wxmrT0k7cfk-wDfY6uu2snuX0

Assuming that the PDF's final discharge comes to the existing environment first, and is able to meet all the stipulated limits under the law, it will, like Dr. Zaki says, inevitably reduce the rivers' carrying capacity. To add to this, the Leachate Treatment Plant (LTP) discharge that will first flow into the intermittent or ephemeral stream and then flow towards Sg. Ara. Again as pointed out by Dr. Zaki, low water volume would mean low carrying capacities.

When the larger MCISWDS comes in later, the effluents are likely to be discharged into the same river. This is something we are unable to tell from the EIA as this has not been considered at all. The final discharges may well be within the permissible level. However, **depending on the river's carrying capacity to dilute or absorb any pollutant or effluent, it will to a certain extent, change the river water quality. The extent to which the changes can be tolerated so as not to affect access to clean and safe drinking water is not certain. This is indeed a risk.**

Then, there is the issue of the water treatment plant's capacity to get rid of the pollutants. Based on the feedback during the EIATRC, the water treatment plant is of the conventional type. Here, we are just dealing with the usual aspects of water pollution – the total suspended solids, the BOD, COD, heavy metals, etc, and have not considered the issue of radionuclides yet.

Second, the PDF EIA only considers **the existing environment concerning the PDF site** and does not take into account the changes to the existing environment that will take place due to the construction of the MCISWDS facility and its use in the future when the industrial wastes are stored.

One of the reasons for considering the changing environment is that we are dealing with radionuclides, with long-lives such as thorium which has a half-life of 14 billion years. The changing environment **DOES** matter because the LTP is designed with a 50% removal efficiency for the radiological parameters. That means we can still expect some level of Thorium and Uranium in the receiving environment.

The EIA claims that*, "The thorium and radium compounds in the WLP residue is very insoluble unless at pH <2, [of which] <u>not found in natural environment</u>."* (Emphasis added).

However, we do not know how the natural environment might change when the MCISWDS comes in. Note that we are just highlighting the pH condition. There may be other factors that we need to consider, for example, the changed aquifer characteristics, the flow rate, water temperature, etc. It is worth noting that in the worst-case scenario for the groundwater quality modelling in page 7-103 did say that, *"…the simulated migration of thorium-232 and radium-228 as well as other contaminants are heavily dependent on aquifer characteristics."*

All in all, there are huge uncertainties regarding the PDF, when we do not take into account the changes to the existing environment that will take place due to the construction of the MCISWDS and the consequent use of the area for storing industrial wastes.

The construction and use of the future MCISWDS presents uncertainties regarding the existing environment which must be factored in beforehand. The modelling results conducted for the Lynas PDF will not be the same if the effects of the MCISWDS are taken into account.

While there may be some buffer provided between the PDF and the future adjacent MCISWDS components, the groundwater and river water flow are all interconnected. This is also why we

need this EIA to give us the full picture – the overall environmental impacts to the existing environment from the MCISWDS construction and use for industrial wastes on the PDF and vice-versa.

b) The MCISWDS EIA should be done before the consideration of the PDF EIA -

The environment is not a matter that can be managed in segments, one at a time. We need to look at the use of environmental baseline monitoring in any EIA preparation, where baseline monitoring is conducted to understand the pre-project existing environmental conditions. This allows one to gauge the extent to which the proposed project changes the existing environment. In our case, the proposed project should be the overall larger MCISWDS, before considering the smaller Lynas PDF project.

For example, on the baseline water quality, as pointed out by Dr. Zaki, *"Malaysian rivers are categorised into five classes – I, II, III, IV and V – based on the descending order of water quality, with Class I considered good and Class V the most polluted. However, the water quality will differ from segment to segment depending on the level of pollution."* [3] Currently, because of how the system works, a Class II river water can be downgraded to Class III when more and more pollutants are discharged from the new development projects.

The absence of the water quality category fixed to every segment of the river means that the authority can only rely on the baseline monitoring results for every proposed project and make sure that the proposed project does not worsen the water quality in comparison to its baseline level.

As such, when the MCISWDS EIA is done after the PDF is constructed, the baseline water quality monitoring results in the MCISWDS are highly unlikely to be the same as that contained in the PDF EIA. This will be the same in relation to other aspects of the baseline monitoring in relation to the existing environment.

When we know about the existence of this MCISWDS, it is indeed more prudent and imperative to assess the overall environmental impacts based on the baseline monitoring of the entire area first. **The sequence of which EIA comes first does matter very much.**

c) Issue of the existing environment providing the natural barrier -

Chapter 5 in the EIA claims that the containment and isolation of the WLP residue is provided through a series of natural barriers in the current existing environment, in addition to the provision of some engineering barrier. The EIA stresses that the PDF is *"located within a valley and surrounded by hills, which would fundamentally create a good containment system for the WLP residue"* and this appears to be the 'natural barrier' that is relied on. (See section 7.14.3, Page 7-192, first para)

Relying on the 'natural barriers' assumes that there will be no changes to the existing environment, and this we know for sure will not be the case. The project site is situated within the larger scheduled waste disposal site, and there are bound to be changes as pointed out earlier to the existing environment. Regrettably, the natural barrier and course of Sg. Ara have not been shown clearly in a topographic map in Chapter 6 under section 6.1 Topography.

[3] Quoted in Kurniawati Kamarudin, "Put water security first," *The Sun Daily*, 2 February 2020, https://www.thesundaily.my/opinion/put-water-security-first

To conclude, on the basis that we know about the existence of the larger project and that the PDF is indeed a component of the MCISWDS, the current Lynas PDF EIA can be deemed as being grossly inadequate from the perspective of evaluating the overall impacts to the environment, especially when the PDF will contain the WLP with thorium, which has a half-life of 14 billion years.

3. Issues over classification of WLP waste

We have raised similar concerns on the classification of waste during our TOR feedback submission and also our additional questions on the EIA earlier. In fact, this comment here is directly related to our additional question submitted to DOE on 22 February 2021 – bullet point no. 3 on the classification of the WLP as VLLW on Figure 5.3.1: IAEA Classification Scheme for Radioactive Waste.

Further to our additional question on the discrepancy between the quantitative values shown in Figure 5.3.1 (on Page 5-16 in the EIA) and the cited sources of IAEA documents, we have further concerns on the activity concentrations shown in Figure 5.3.1.

The quantitative values from Figure 5.3.1 are also reflected in Table 1.3.1 titled 'Summarised Classification Scheme for Radioactive Waste' in Chapter 1 (Page 1-7) of the EIA, and the sources are listed as IAEA GSG-1,2009 and IAEA TECDOC 1712, 2013.

To verify whether those activity concentrations (with questionable sources) are at least correct, we need to refer to the activity concentrations of a large variety of NORM wastes listed in the IAEA TECDOC 1712 (2013). Based on the IAEA TECDOC 1712 (2013)[4], Table 2 on page 12 lists activity concentrations in sediments and sludges in the NORM- waste generating industry. The maximum listed in this table is 10,000 Bq/g in the rare earth extraction industry.

This is by a factor of 200 above the upper activity concentration shown in Figure 5.3.1. Further, in the same IAEA document, Figure 4: Radionuclide Activity Concentrations in Some Natural Materials on page 17 lists the activity concentrations of natural materials and uranium ores and monazite exceeding 1,000 Bq/g. This therefore challenges the justification in the EIA report and its respective sources which cite that NORM only has an upper activity of 400 Bq/g activity concentration.

The same applies to the x-axis (horizontal axis) in Figure 5.3.1. The half-life time is listed as 100 days and 30 years. But as stated on page 5-21 in the EIA, "*Th-232, with a half-life of 14 billion years, will not decay appreciably over time scales of interest.*" The numbers on the half-life time on x-axis were neither found in Figure 1 on page 5 of the AELB's Criteria for Siting of Disposal Facility for Waste Containing Naturally Occurring Radioactive Material (NORM) nor the Figure 1 on Page 7 of the IAEA GSG-1 Classification of Radioactive Waste.

In this regard, we support the submissions of the independent experts Assoc. Prof. Gavin M. Mudd and Assoc. Prof. Matthew J. Currell the WLP wastes should properly be classified as low level waste due to the very high concentrations of thorium present and certainly not as very low level waste.

As pointed out by Mudd and Currel, "the safety cases in many nations assume that institutional controls on radioactive waste facilities will be effective for a period of up to 300 years (IAEA,

[4] https://www.iaea.org/publications/10396/management-of-norm-residues

2009). The half-lives of uranium (as U^{238}) and thorium, however, are 4.5 and 14.1 billion years, respectively (see Langmuir, 1997) – meaning that an institutional control period of no more than 300 years is patently inadequate for isolating such long-lived radionuclides in a shallow tropical context. **The waste therefore represents an indefinite or perpetual management risk to the surficial environment and nearby communities**."

Based on all the discrepancies and gaps that we have found and commented on throughout the TOR and at the EIA consideration stage, we have **very serious concerns that the way the wastes have been classified and addressed in the EIA appear to downplay the risks of the long-lived radionuclides in the WLP**.

4. The EIA fails to address public concerns on water quality issues.

First, we agree with Dr. Zaki Zainuddin during the EIATRC that the water modelling approach adopted by the EIA consultants contain several misleading assumptions that influenced the results.

The parameters selected in the water modelling are not the parameters of concern. Table 7.1.13 on Page 7-20 in the water quality modelling analysis section has already identified mercury (Hg), chromium (Cr), lead (Pb) and Barium (Ba) as the parameters not targeted for removal [in the LTP] as their concentrations are readily low or undetected. Therefore, there is no basis for the water quality modelling to select these parameters, instead of the parameters of concern. Based on Table 5.5.6 on Page 5-37, the parameters of concern that should have been included in the model are sulphide, zinc, iron, manganese, COD, etc., that were reported to be of high-level concentration in the influent value. This is a key weakness in the EIA report, knowing that water contamination is a key public concern.

Second, the water quality modelling is unable to simulate the complex compound state of radionuclides. The water quality modelling in the EIA assumes radionuclides as a conservative tracer. As such, it models the movement of the radionuclides through flow and diffusion, although the thorium is claimed to be insoluble in the EIA.

According to the EIA on Page 7-191, *"The major constituent of thorium in the WLP residue exist as thorium pyrophosphate which is characterised as a very insoluble material and has high affinity of being adsorb onto most soil material. The daughters of radium, are considered to be fairly soluble in water making it prone to being mobile and dispersed into the environment."* (Section 7.14.1, Page 7-191, Para 2)

The water modelling result for radionuclide on Page 7-33 states that, *"As for the radionuclides, which were modelled as conservative tracer, the mass concentration of thorium was significantly reduced upon entering Sg. Kuantan, where sufficient river flow is available to provide adequate dilution. Radium on the other hand was already at a lower concentration and become increasingly negligible as it enters Sg. Kuantan."*(Section 7.15.3, Page 7-33, Last para)

This, in our view is misleading. When the water quality modelling is unable to simulate the complex compound state of radionuclides, the water modelling does not tell us anything about the fate of thorium and radium when they are released into the river; how they decay and release other radionuclides and how this might impact the water quality. This is a key concern for the public when the EIA states that the LTP removal efficiency for the radionuclides' parameters

is 50% and that the final effluent discharge will still contain Uranium-238 and Thorium-232. Uranium-238 and Thorium-232 (see Page 5-40 for LTP removal efficiency).

Third, the EIA should conduct baseline river water sampling for thorium, uranium, radium, gross alpha, and gross beta at all the water sampling stations. We take note that the RIA baseline monitoring covers radioactivity concentrations within water samples from three locations, i.e., 5 km, 10 km and 20 km from the PDF. However, this information is deemed insufficient. The baseline radioactivity concentration data at every water sampling station is important because the LTP final effluent discharge will contain Uranium-238 and Thorium-232 (see Page 5-40 for LTP removal efficiency). Therefore, the baseline data is critical as a benchmark to monitor for any further contamination from the LTP discharge.

When the water modelling did not include parameters of concern, fails to simulate the complex compound state of radionuclides and the absence of baseline radioactivity concentration at every water sampling station, the water modelling is far from adequate.

The EIA therefore does not just fail to address public concerns over water quality issues, but has impaired the aquatic ecology assessment and health impact assessment results as they were conducted based on the water modelling results which are flawed.

5. Pollutant discharges would result in violations of National Water Quality Standards

Page 6-6 of the EIA described the surface waters that would be impacted by discharges of pollutants associated with construction and operation of the project:

> *"Based on the topographical map published by the Jabatan Ukur dan Pemetaan Malaysia (JUPEM) and the topographical survey performed Project site, stormwater and surface runoff from the Project site will flow into Sg. Ara. From Sg. Ara, the runoff traverse 12 km south before converging into Sg. Riau. Sg. Riau flows in a southerly direction for another 11.5 km before reaching its confluence with Sg. Kuantan. From the confluence, Sg. Kuantan meanders for another 27 km before reaching the coast. The total distance (by river length) from the Project site to the coastline is approximately 50.5 km. Both Sg Riau and Sg. Kuantan fall within Class II of the National Water Quality Standard (NWQS); recording a water quality index (WQI) value of 83 and 84 respectively."*

For Class II waters, the National Water Quality Standards imposes a limit on levels of total suspended solids (TSS) of 50 milligrams per liter (mg/L).[5]

Despite this standard, Figure 7.1.8d (construction scenario) and Figure 7.1.9d (operation scenario) shows that TSS levels immediately downstream of the project would approach 80 mg/L for nearly two kilometers downstream of the project.

This violation of Malaysian National Water Quality Standards is admitted in the EIA and the impacts are described as follows on pages7-151 and 7-152, as shown below respectively:

> *"Based on hydraulic modelling conducted, the level of TSS in Scenario 2 (Construction scenario) was slightly higher in Sg. Kuantan with range from 68 – 80 mg/L. This exceeds the the recommended safe limits of TSS of <50 mg/L*

[5] See: https://www.doe.gov.my/portalv1/wp-content/uploads/2019/05/Standard-Kualiti-Air-Kebangsaan.pdf

for aquatic organisms (Boyd, 2003). Excess suspended solid in the water could alter macrobenthic community composition (Azrina et al., 2006). The direct impact of excess sediment on benthic fauna also includes abrasion and clogging of filtration mechanisms, which could disturb ingestion and respiration system (Berry et al., 2003). However, this relates to suspended sediment and not bed loads. It is difficult to assess the loss in macrobenthic populations that would potentially arise from the proposed projects due to the lack of data. It is also impossible to isolate sedimentation patterns relating to the proposed project against other development in the Kuantan river basin." (Emphasis added)

"As for TSS, the levels at Sg. Riau for Scenario 1 ad 2 were below the recommended level for aquatic organisms (<50 mg/L) (Boyd, 2003). However, in Sg. Kuantan, TSS levels for Scenario 2 (Construction Scenario) was higher than Scenario 1 (Baseline), ranging from 68 – 80 mg/L. High concentrations of suspended solid may potentially clog the gills and respiratory passages of fish, increasing their susceptibility to disease. Sediment deposition could also clog spawning gravels, which reduces habitat availability and affect fish reproduction by lowering dissolved oxygen levels (Redding and Midlen, 1991). High suspended solids level could lead to light reduction and visual impairment, thus limiting the visibility for the fish to find their prey (Tan and Rohasliney, 2013). Therefore, there would be a reduction on the reproductive rate that would eventually decrease the abundance and diversity of fish in Sg. Kuantan." (Emphasis added)

These admitted violations of the National Water Quality Standards and impacts on macrobenthos and fish are further reasons why the EIA cannot be approved.

6. Uncertainties over the LTP discharge

We understand that the LTP is constructed to treat any contaminated storm water before discharging into the ephemeral Sg. Ara. The contaminated surface runoff is expected to come from the cell basin, internal embankment slope, service road, trucks washing bay, decontamination area at the WLP transfer station, and the vicinity of LTP. The LTP removal efficiency for the radionuclides' parameters is 50% (see Page 5-40 for LTP removal efficiency). As such, the final effluent discharge will still contain Uranium-238 and Thorium-232, each with a reported radioactive level of 2.5 Bq/L and 1.0 Bq/L respectively as shown on Table 5.5.7 on Page 5-38.

First, it is understood from the EIA that the thorium in WLP has low solubility that tends to be adsorbed to moist soils. If thorium is insoluble as claimed, it will be critical for the EIA to provide information and analysis on where will the insoluble thorium end up after being released into the environment.

The Biological Resources section in the EIA on Page 7-156 concludes that, "*In general, the accumulation of radionuclides from the water into the tissue of organisms would depend on the environmental conditions and concentration (i.e., pH, hardness and water temperature), feeding habits and exposure time*." The EIA on page 7-155 admits that there is very limited data and studies on the effect of thorium on biota, especially aquatic biota. The fisheries section

concludes that the impact of the project on aquatic ecology is considered insignificant, provided that all mitigation measures are undertaken properly.

One of the proposed mitigation measures presented during the EIATRC was the need to undertake a biological food contamination monitoring study. This proposed study was not considered in the EIA report. Therefore, **it remains unknown as to how the insoluble thorium will end up settling on the bottom of the river water and affect the benthic zone, and how it might bioaccumulate and eventually contaminate the food chain over the long term.**

Second, the proposed LTP discharge is worrying, when there are no specific standards for the special effluent discharge that contain radioactive substances such as the WLP in Malaysia. The EIA refers to the following regulations which are not relevant as they do not deal with limits on radionuclides.

a. Environmental Quality (Control of Pollution from Solid Waste Transfer Station and Landfill) Regulations 2009;
b. Standard A of the Environmental Quality (Industrial Effluent) Regulations 2009
c. Standard B of the Environmental Quality (Industrial Effluent) Regulations 2009

"Generally, the three above-mentioned standards were compared, and the more stringent limits out of the three were halved in order to obtain a strict environmental compliance."(Page 7-19, last para)

The proposed standard limits on Table 7.1.13 claim to be "better" or more stringent than the three standards above and this assertion therefore is baseless and misleading.

Further, Table 7.1.13 is misleading when the stipulated limit of ^{232}Th (1.0 Bq/L) and ^{238}U (10 Bq/L) were put under the column of EQ (Control of Pollution from Solid Waste Transfer Station and Landfill) Regulations 2009. There is no limit set for ^{232}Th and ^{238}U under the said regulations. Based on Table 5.5.7 on 5-38, the limits were taken from a WHO guideline.

Third, the LTP final discharge will flow into Sg. Ara, when the receiving stream is ephemeral in nature. In an ephemeral stream, we may expect the stream to be filled with concentrated effluents from the PDF**.** This is a key concern, but the EIA report only provides the influent characteristics using a composite of 95% active surface runoff and 5% leachate as per Table 5.5.6.

Based on Table 5.5.6 on Page 5-37, it should be noted that the composite of 95% surface runoff and 5% leachate already recorded 2000 mg/L Sulphide (Standard A limit is 0.50 mg/L), 200 mg/L of Iron (Standard A limit if 1.0 mg/L), 65 mg/L of Manganese (Standard A limit is 0.20).

Hence, we do not know how high are the actual levels of these parameters in the leachate.

Further, what remains unknown is the change in influent characteristics, including the leachate characteristics with respect to rainfall intensity. This is critical as the concentration of contaminants in the influent may increase if there is less rainfall and less surface runoff. Therefore, the consultants should have **revealed the information of the actual characteristics of the leachate.**

Fourth, the Radiological Impact Assessment (RIA) did not seem to consider the 50% LTP removal efficiency for radionuclides.

"*MoP [members of the public] could be exposed to radiation from the disposal procedures through three possible pathways; atmospheric transport of dust containing long-lived radionuclides of ^{238}U and ^{232}Th, atmospheric transport of short-lived radionuclides (radon and thoron daughters) as well as hydrological transport of long-lived radionuclides contained within the water bodies from the proposed Project site.* ***These pathways are however expected to be highly limited since the PDF is located within a valley and surrounded by hills, which would fundamentally create a good containment system for the WLP residue****, limiting the potential of the residue from being transported beyond the proposed Project's boundary….Radiation risk from ingesting contaminated river fish and drinking water from water bodies near the proposed PDF site* ***could only be realised if radionuclides****; including radium,* ***escape into the river*** *or leach into groundwater. Based on the on-going monitoring of the existing WLP RSF since 2013, no such significant increase in natural radioactivity in the water bodies have been detected. Such findings may be attributed to the isolation system that is in place (e.g. HDPE and clay liners) or/and the insolubility of the radionuclides itself that prevents any significant leaching into the groundwater system. With respect to the PDF, the establishment of the protective linings along with the drainage system during the operational stage* ***would further decrease this possibility while any leachate or waters that are contaminated by the WLP residue generated will be collected in a sump and treated before being discharged into the environment****."* (Section 7.14.3, Page 7-192, first para)

Further, on Table 7.14.2: Exposure scenario, Critical group, Exposure pathways and Method of Assessment on Page 7-193, the exposure scenario (3) Exposure to receptors at the closest off-site dwelling sites for the duration of the operation, one of the exposure pathways identified is the contamination through run-off from the PDF. **There is no specific mention of the LTP discharge as the potential exposure pathway in the RIA section**. Note that this is different from the accidental release or spillage scenario as the LTP discharge is on a regular basis.

Given the above, there are serious limitations and uncertainties in relation to the LTP discharge and the grave risks this poses.

7. The use of outdated data and laboratory-produced WLP residue in the thorium solubility analysis.

The claim of thorium insolubility is key to many of the impact analysis/modelling assumptions provided in the EIA. However, as we have raised in SAM's preliminary comment to the DOE, the use of a laboratory-produced WLP residue analysis results from 10 years ago to determine the thorium solubility is unjustifiable. See below extract form the EIA:

> *"Lynas has analysed the thorium concentration of the laboratory-produced WLP residue leachate by SGS (an accredited laboratory in Australia) in September 2010. These measurements are presented in Table 5.3.5. The WLP was produced at low temperature (250˚C) in a laboratory setting and presents a worst-case scenario for the WLP."* (Page 5-18, Section C(i) 'Thorium Solubility').

In addition, there is also no Toxicity Characteristics Leaching Procedure (TCLP) data for thorium and radium to reaffirm the low solubility and leaching potential of these radioactive materials. The EIA cites many sources about thorium insolubility but these were mostly missing from the list of references to verify these claims.

A UKM research paper in 2018 titled "Modified Leaching of 238U and 232 Th from Water Leach Purification (WLP) Residue" states that thorium can leach at pH 4. It found that "*These results show the maximum potential remobilisation of 238U and 232Th at pH 4 with the same contact time of 14 days. At a similar duration, the maximum percentages of leaching are 5.50% and 3.99% for 238U and 232Th, respectively. Moreover, at pH 7, the minimum leaching percentages of 238U and 232Th are 4.7% and 3.61%, correspondingly. Thus, remobilising 238U and 232Th shows that the rate of leaching is influenced by the pH of leachant used. The maximum concentrations of 238U and 232Th are obtained at low pH such as pH 4. At pH 7 and 8, the leached amounts of 238U and 232Th are minimum. Therefore, combining the SPLP and batch method is practical for estimating the leaching and remobilisation of 232Th and 238U from WLP residues. The combined method may be useful for monitoring and risk assessment in environmental studies*."[6]

All in all, the EIA fails to provide a credible and up-to-date data about the thorium solubility test and under what conditions that thorium is soluble/insoluble. If it remains insoluble (thorium has a long half-life of 14 billion years), the EIA should provide the much-needed information of the fate of the insoluble thorium, especially on how might it accumulate and undergo decay series which releases other radionuclides and the possibility of entering our food chain. This is a serious shortcoming of the EIA.

8. Failure to consider climate impacts due forest clearing

Chapter 7 of the EIA (Evaluation of Impacts) contains no assessment of how the project would impact the Earth's climate. Deforestation makes a significant contribution to global carbon emissions, resulting in emissions of cleared vegetation that is burned or decays and the loss of vegetation that takes up carbon dioxide (CO2) from the atmosphere. Greenhouse gas emissions associated with deforestation are estimated using the following equation:[7]

[6] Nur Shahidah et al., "Modified Leaching of 238U and 232 Th from Water Leach Purification (WLP) Residue," 29 October 2018, Malaysian Journal of Analytical Sciences, DOI: https://doi.org/10.17576/mjas-2018-2206-06

[7] Global Observation for Forest Cover and Land Dynamics: REDD+ training materials by GOFC-GOLD: Module 2.3 Estimating emission factors for forest cover change (deforestation & forest degradation). https://www.forestcarbonpartnership.org/system/files/documents/Module%202.3%20Lecture_08_05_15_final_0.pdf

$$EF = \left(C_{bio,pre} - C_{bio,post} - C_{wp} + \{[CS_0 - CS_D]/D\}\right) \times \frac{44}{12} + E_{oth}$$

Where:

EF	= Emission factor, t CO_2-e ha^{-1}
$C_{bio,pre}$	= C stock in biomass prior to forest change, t C ha^{-1}
$C_{bio,post}$	= C stock in biomass post-deforestation, t C ha^{-1}
CS_O	= Initial or reference soil organic carbon,
CS_D	= Soil organic carbon at default time D, t C ha-1
D	=Default time period to transition to a new equilibrium value (20 year)
C_{wp}	= Carbon stored in long term wood products, t C ha^{-1}
44/12	= Conversion factor for C to CO_2
E_{oth}	= Emissions of non-CO_2 gases, such as CH_4 & N_2O released during burning, t CO_2-e ha^{-1}

Carbon biomass in rainforests of Malaysia typically exceed 250 tons per hectare.[8] For the proposed development of the PDF, the amount of land affected by the project would be substantial.

Page 1-1 of the EIA states:

> "*The proposed Project site is located within a larger parcel of land covering 202.35 ha (500 ac) which has been earmarked for the establishment of a new "Multi-Category Industrial Scheduled Waste Disposal Site (MCISWDS)" ("Tapak Pelupusan Sisa Industri Berjadual Pelbagai Kategori") to be developed by Gading Senggara Sdn. Bhd. (GSSB). The entire land parcel is located within the Bukit Kuantan Forest Reserve, which is currently in the process of being alienated from its forest reserve status. Of the 202.35 ha (500 ac), the Project site will occupy an area of 58.25 ha (143.95 ac) or almost 29% of the entire MCISWDS."*

Therefore, clearing only 58.25 hectares of forested land within the Bukit Kuantan Forest Reserve could result in emission of at least 53,000 tons of CO_2.

250 tons of C/ha x 58.25 ha x 44 t of CO2/12 t of C = 53,400 tons of CO_2

These CO2 emissions, which are in addition to direct emissions of CO2 from the use of diesel fuel by heavy vehicles transporting WLP residue, have not been disclosed to stakeholders and decision-makers.

9. Missing decommissioning or abandonment plan

According to the EIA Guidelines for Radioactive Materials and Radioactive Wastes 2018, the EIA should provide an abandonment/decomissioning plan framework and the environmental monitoring and audit programmes for post-abandonment activity. This is critical considering

[8] Adachi, M., Ito, A., Ishida, A., Kadir, W. R., Ladpala, P., & Yamagata, Y. (2011). Carbon budget of tropical forests in Southeast Asia and the effects of deforestation: an approach using a process-based model and field measurements. Biogeosciences, 8(9), 2635-2647. https://bg.copernicus.org/articles/8/2635/2011/bg-8-2635-2011.pdf

that the proposed project is a PDF for WLP, with the presence of naturally occurring thorium (see below the half-lives for Th-232).

> *"Th-232 and Ra-228 are important as both have half-lives in the years (T ½ of Th-232 and Ra-228 are 14 billion years and 5.75 years respectively)."* (Chapter 2, pg. 11)

The EIA discusses the post closure period very briefly in Chapter 5 and Chapter 8 (see below), while Chapter 9 provides only typical preliminary information about the environmental monitoring program during post-closure and also states that the information on the Project's closure and abandonment plan will be included in chapter 6 of the EMP.

> "*The post-closure begins when waste acceptance, handling and emplacement operations are concluded and the facility has been capped and landscaped. After closure, the safety of the facility is provided by passive means inherent in the characteristics of the site and of the facility. During the post-closure phase, institutional control, such as controls over access to or use of the site will be put in place and continue for a period to be determined by the regulatory authority (i.e. DOE and AELB)."* (Chapter 5, pg. 5-80) (Emphasis added)

> *"During the detection monitoring phase, the monitoring will be carried out against the DOE's Threshold Value. This consists of a semi-annual sampling throughout the facility's active life and post-closure care period."* (Chapter 8, pg. 8-30) (Emphasis added)

However, based on the guideline, the EIA should at least have a dedicated section to provide a decommissioning plan framework. Given the nature of this proposed project, this information is critical for decision makers and stakeholders to understand the long-term post-closure care, detection monitoring and especially on who will be held responsible should any spillage or leakage happen. This is another inadequacy of the current EIA under consideration.

C. Conclusion

SAM and CAP wish to reiterate that the EIA for the Lynas PDF cannot be approved for the reasons stated above and must be rejected.

We trust that the DOE will give serious consideration to all the submissions that have been made, not only from groups, individuals and local communities in this country, but also from public interest groups, individuals and experts in Australia who are deeply concerned with the activities of Lynas.

Meenakshi Raman

On behalf of SAM and CAP