# 3 STATEMENT OF NEED

## 3.1 BACKGROUND

Historically, the NUF was classified as a radioactive material by the Atomic Energy Licensing Board (AELB) and therefore was regulated under the Atomic Energy Licensing Act, 1984 by the AELB for the period (2008 – September 2014). As a radioactive material it was initially stored in a residue storage facility (RSF) as a slurry that was designed and constructed in strict compliance with the requirements of the AELB. The potential environmental, health and safety impacts arising from the onsite storage of the NUF within the RSF were addressed in the Radiological Impact Assessment carried out in 2007.

The RSF was also addressed in the first EIA prepared for Lynas in 2008 and the design consideration of the RSF as well as the management of the NUF was captured in the EIA approval conditions. Of relevance is EIA approval condition No. 41 that reads as follows:

**EIA Approval Condition No. 41:**

*The Residue Storage Facilities (RSF) and other related components must have the verification at the design stage and is confirmed safe and stable geotechnically from responsible Certified Engineers. The proposed design, engineering plan and method of construction must be the result of detail studies and uses the best available techniques, and also takes into consideration storage capacity of at least for 5 years of plant operation and must have the verification and written approval from the Atomic Energy Licensing Board (AELB). A copy of the approved plan must be forwarded to the Department of Environment Pahang before construction begins.*

Subsequently, as the properties of the thickened and filtered material became known, Lynas moved to a dry stacking design, which minimises the amount of disturbed area. The NUF was then stacked within the RSF, and hence, the engineered cells containing the solid and drier form of NUF was referred to as the Dry Storage Facility (DSF). Lynas switched to the DSF in 2015. Other advantages of the DSF is it's stable for the long term and easily removed for commercialisation purpose. DSF is best for water recovery and easiest to cap and rehabilitate upon closures. In terms of engineering design, the RSF is designed to liquid slurries, whereas the DSF is designed to hold solids.

A chronology of NUF residue management since commissioning of the LAMP in the fourth quarter of 2012 is provided below:

- Lynas had duly complied with the requirements by DOE (via the approval of the EIA) and the AELB (via the approval of the Radiological Impact Assessment and a series of technical submissions as part of the Class A Milling Licence (Siting & Construction) and obtained the approval from the AELB to construct the RSF in 2010.

- AELB issued a letter on the 13th of Nov 2013 stating the removal of the NUF from its purview as the residue was deemed non-radioactive. This decision was made upon review of Lynas' application dated 16th of July 2013 which included comprehensive test results of the NUF (**Appendix 3.1**).

- On the 28 Nov 2013, Lynas notified the DOE formally that the NUF and FGD are not radioactive materials and applied to store these residues on site until commercialisation or reuse of residues are approved by the relevant authorities.

- On 30th Dec 2013 Lynas notified DOE on the construction of the Geotubes (refer to Section 4.2.2) on the LAMP site as an alternative storage method for the NUF. After several exchanges of letters between Lynas and the DOE, on the 25th of April 2014, DOE acknowledged Lynas application to construct the Geotubes.

- On 28 January 2015, Lynas applied to construct and use the Dry Stacking Facility (DSF) for the temporary storage of NUF pending commercialisation. This was approved by the DOE on 11 February 2015 (**Appendix 3.2**)

- In 2018, Lynas received a directive from the DOE dated 27th August 2018 instructing Lynas to dispose of the NUF to any prescribed premises licensed by the DOE. In response, Lynas submitted an Action Plan dated 5th of September 2018 that proposes the construction of a secure landfill (comprising the existing DSF1 and future construction of 4 additional DSFs) within the LAMP site itself. This proposal was accepted by the department and the go ahead was given to Lynas to proceed with the submission of the Prescribed Premise Licence application.

The key points that justify the establishment of the secure landfill within the LAMP site are discussed in the sub-sections below.

## 3.2 JUSTIFICATION FOR THE SECURE LANDFILL WITHIN THE LAMP SITE

### 3.2.1 NUF DSF Meets the Regulatory Requirements of a Secured Landfill

The design and construction of the DSF (which is the same as the RSF) has been reviewed and approved by the relevant authorities including the DOE and the AELB. This approval was based on Lynas' compliance with EIA Approval Condition No: 41 which was one of the 75 conditions imposed on Lynas for the approval for the EIA study carried out in 2008. The condition required the design of the NUF storage facility to be geotechnically stable with minimal risk to the environment and endorsed by a Professional Engineer registered with the Board of Engineers, Malaysia. The DSF[1] was designed in accordance with the following guidelines considered as "best practice" guidelines:

[1] In the EIA Approval Condition issued in 2008, the term RSF is used. Since then the term DSF is used to describe the dry stacking method employed by Lynas which is more effective. However, the design and construction of the DSF is identical to the RSF. Hence, the term DSF is used.

- Department of Industry and Resources, Western Australia: Guidelines on the Safe' Design and Operating Standards for Tailings Storage. Government of Western Australia, January 2007;
- Australian National Committee On Large Dams, 1999. Guidelines on Tailings Dam Design, Construction and Operation. October 1999;
- State of Nevada: NAC 445A.437 Minimum Design Criteria: Tailings Impoundments; and
- State of Nevada: NAC 445A.438 Minimum Design Criteria: Liners.

The geotechnical design of embankments has been carried out so that the following minimum factors of safety have been achieved as per ANCOLD guidelines (**Table 3.1**):

**Table 3.1: Minimum Safety Factor per ANCOLD Guidelines**

| Case Analysed | Minimum FOS |
|---|---|
| CONSTRUCTION PHASE<br>Applicable during initial construction prior to commissioning | 1.2 |
| SHORT-TERM STATIC LOADING<br>Post-initial construction, operating conditions. | 1.3 |
| LONG-TERM STATIC LOADING<br>Post operating conditions; closure | 1.5 |
| PSEUDO-STATIC (EARTHQUAKE LOADING)<br>Applicable at any time | 1.1 |

The DSF designs also took into consideration the following factors that were approved by the regulators especially the DOE and AELB prior to construction:

- Site characteristics;
- Geology and Geotechnical investigation of site;
- Residues testings;
- DSF water design management;
- DSF design;
- Environmental monitoring, seepage monitoring and monitoring of stability settlement; and
- Rehabilitation and closure program.

The design philosophy of the DSF includes the following:

- The DSF is bunded and built above ground;
- The base of the DSF is double lined with 2 mm HDPE liner and clay or equivalent material (geosynthetic clay liner) to adsorb any possible leachate. (However, it must reiterated that the NUF residue (SW205) is confirmed to be non-toxic, non-ecotoxic, non-radioactive and non-hazardous).
- Below the dual liner is an underlined leak detection system (ULLDS), which will collect any leachate that leaks from the cells.
- The DSF is integrated with supporting facilities including the Industrial Effluent Treatment Plant (IETS) to ensure that surface runoff and stormwater collected in the DSF is conveyed to the IETS for treatment and there is no uncontrolled lease to the environment without any treatment.

- The IETS has been proven to be able to treat processed water as designed as the final discharge complies with the limits stipulated under Standard B of the Environmental Quality (Industrial Effluent) Regulations, 2009; and
- The DSFs have been in safe operation for the past 6 years since LAMP commencement operations in the third quarter of 2012. There have been no incidences of embankment failures or accidental release of the NUF into the surrounding environment.

### 3.2.2 Readily Available Space within the LAMP Site

The storage philosophy assumes a storage period of 10 years as Lynas is confident that during this time the NUF can be successfully commercialised whereby the NUF will be removed offsite from the DSFs for other industrial applications. The total available space for NUF storage on the LAMP site as of November 2018 is 4.9 million $m^3$ whilst the estimated space required for the storage of NUF (generated over a period of 10 years) is 4.4 million $m^3$. This means there is an extra of 500,000 $m^3$ or 0.5 million $m^3$ of space that will be still available. Therefore, the LAMP site has sufficient area for the storage of NUF over the next 10 years (2028).

### 3.2.3 Track Record of Regulatory Compliance

Lynas has operated the NUF DSF for more than 6 years without any non-compliance related to surface water quality and groundwater quality. Surface runoff and leachate streams collected within the DSF are conveyed to the IETS for treatment. No significant exceedances have been observed in the quality of the final discharge.

The integrity of the dual liner system comprising the 2 mm HDPE liner and clay or geosynthetic clay that separates the NUF from the groundwater has not been breached and there have been no leaks that have resulted in groundwater contamination (based on the groundwater quality monitoring results).

### 3.2.4 Security of the Onsite Secure Landfill

By establishing the secure landfill facility within the LAMP site, the NUF storage is more secure as the LAMP's security management system that has been put in place will prevent any unwanted intrusion. The security system is enforced by LAMP's Safety, Health, Environment and Security Department.

### 3.2.5 Ease of the Reuse and Recycling of the NUF

Based on robust research and development undertaken by Lynas and the very positive outcome of the research, the NUF is not deemed as waste material because the term waste denotes an end product or material suitable only for disposal after all avenues for reuse and reprocess have been exhausted. This is in line with the aspirations of DOE's philosophy of 'cradle to cradle' which will reduce the quantity of waste to be disposed in landfills or incinerated.

Malaysia's experience with similar gypsum residues have shown that the permanent burial of useful material such as gypsum which can be used as an alternative raw material in other industrial applications is a wasteful and not aligned with the principles of industrial ecology.

Since the NUF has high potential for commercialisation, it is best that the residue be stored within the LAMP site and not another licensed third-party site to avoid cross-contamination of the NUF with other hazardous materials.

Therefore, it can be concluded that an onsite secured landfill at LAMP will:

- Allow LAMP to implement one of the basic principles of industrial ecology ('*cradle to cradle'* as opposed to '*cradle to grave'*) which has been adopted by the Scheduled Waste Division in DOE Putrajaya.
- Ensure that NUF can easily and immediately be reused or recycled without the need for decontamination; and
- Ensure the continued good practice of ensuring the NUF remains uncontaminated by scheduled wastes generated from other sources which will occur in the event the NUF is disposed at an offsite DOE-licensed *Prescribed Premise* for the disposal of scheduled wastes;

### 3.2.6 Unavailability of Suitable Licensed Offsite Secure Landfills

Disposal of the NUF as waste material without exhausting all available opportunities for commercialisation as alternative raw material or alternative fuel is not an option that is aligned with the principles of industrial ecology and prudent waste management. However, should this be the situation, the details provided below will demonstrate that the is no suitable disposal facility in Malaysia for the NUF.

To date Lynas has generated a total of 0.867 MT dry weight of NUF, and at a generation rate of about 1000 MT of NUF per day, a very large offsite secure landfill will be required to dispose of all the NUF generated.

**Table 3.2** shows all licensed offsite schedule waste (SW205) facilities in Malaysia (for recovery, treatment and disposal). There are only 14 licensed prescribed premises in Malaysia, out of which only 4 are licensed offsite storage facilities for SW205 with 3 of the facilities located in W.P Labuan and East Malaysia.

**Table 3.2: List of companies licensed to occupy and operate a prescribed premise in Malaysia**

| No | Company's name | State | Licensed Activity |
|---|---|---|---|
| 1 | Premier Bleaching Earth Sdn Bhd | Johor | Secured landfill |
| 2 | Pahang Cement Sdn Bhd | Pahang | Offsite Recovery |
| 3 | Taiko Bleaching Earth Sdn Bhd | Kedah | Secured landfill |

| No | Company's name | State | Licensed Activity |
|---|---|---|---|
| 4 | Kualiti Alam Sdn Bhd | N. Sembilan | Incinerator |
| 5 | Kualiti Alam Sdn Bhd | N. Sembilan | Offsite storage |
| 6 | LaFarge Malayan Cement Sdn Bhd | Perak | Offsite recovery |
| 7 | Perak Hanjoong Simen Sdn Bhd | Perak | Offsite recovery |
| 8 | Tasek Corporation Bhd | Perak | Offsite treatment |
| 9 | USG Boral Sdn Bhd | Perak | Offsite recovery |
| 10 | LaFarge Cement Malaysia | Selangor | Offsite recovery |
| 11 | Tioxide (M) Sdn Bhd | Terengganu | Secured landfill |
| 12 | KA Petra Sdn Bhd | W.P. Labuan | Offsite storage |
| 13 | Petrojadi Sdn Bhd | Sabah | Offsite storage |
| 14 | E-concern (M) Sdn Bhd | Sarawak | Offsite storage |

The only option for disposal is the Integrated Waste Management Centre operated by Kualiti Alam Sdn. Bhd. in Bukit Nenas, Negeri Sembilan which is located at a distance of 330 km from the LAMP site. Transporting the NUF over this distance is economically not feasible. Also, the facility has a total capacity of about 100,000 MT annually for the treatment, landfilling and incineration activities. With the current generation rate of the NUF, storage and disposal at this facility is not possible.

Further, in compliance with the Environmental Quality (Prescribed Conveyance) (Scheduled Wastes) Order 2005, Lynas is required to have a license to use prescribed transporters or conveyances to transport the NUF to offsite for the movement, transfer, placement or deposit of the NUF. To engage licensed transporters to transfer the NUF from the LAMP site to the site operated by Kualiti Alam Sdn. Bhd. is also highly cost prohibitive.

In line with the aspirations of Lynas to reuse NUF in other suitable industrial application, Lynas in collaboration with Pahang Cement Sdn Bhd are planning to submit an application to the DOE for use of the NUF as a raw material for cement production. Further details and the status of the application will be deliberated in the EIA report.

Similarly, Lynas can explore the possibility of working with other offsite recovery facilities to ensure the NUF is not disposal but reused in an environmentally safe manner. The findings of the research undertaken by Lynas also show that the NUF has potential for use as a soil enhancer and conditioner that can replace similar material that is being imported.

Pending such commercialization, in the interim, the best option for storage would be in the proposed secure landfill within the LAMP site.

### 3.2.7 Compliance to the Requirements of the Basel Convention

Malaysia became a party of Basel Convention in October 1993. The export of hazardous wastes is regulated under the Basel Convention. In 1996, Section 34B of the Environmental Quality Act 1974 was amended to include specific and stringent provisions on the control of export, import and transit of scheduled wastes. To further support the EQA 1974, the Custom Act 1967 formulated two Orders that came into effect in 1983. Under the above control mechanisms, the import / export of hazardous wastes, including schedule wastes, is prohibited unless prior written approval is obtained from the Director General of DOE.

The export of scheduled wastes can only be to other countries who are signatories of the Basel Convention as well. And this reduces the number of countries to which the NUF can be exported. Further, the application process to DOE Putrajaya, as well as the equivalent department of the importing country is long and tedious.

### 3.2.8 Conclusion

Hence, the storage of the NUF in the onsite secure landfill (existing DSF 1 and the future DSFs) is the best practical option.