4 PROJECT OPTIONS

4.1 SELECTION OF PROJECT OPTION

This section provides the options which were evaluated as part of the proposed secure landfill Project planning process. The main options, i.e. the Build Out or No Build options which are based on rigorous internal process to identify technologically sound options which were weighed with respect to their site selection, alternative storage facility and treatment options are discussed in the sections below.

4.2 REVIEW OF OPTIONS

4.2.1 Site Selection

Several options were considered in the planning stages of the proposed Project including the site selection which are based on assessments of beneficial and detrimental environmental and social impacts brought about by the implementation of the proposed Project.

Onsite storage secure landfill is very much preferred for the following reasons:

- The LAMP site has sufficient available space storage area. Based on current NUF generation extrapolated into the future, 4.9 million m^3 of space is currently available, with in excess of 0.5 million m^3 remaining after 10 years.
- The NUF residue is stored in engineered cells that are designed, constructed and operated as approved by the DOE on the 11th of February 2015.
- There are readily available 5 – year monitoring data of current storage cell performances (groundwater and soil) to show that the operation of these cells has not resulted in any adverse environmental impacts.
- Lynas has in its staff, experienced personnel who have been trained and are conversant with the NUF management practices.
- The secure landfill area has been designed with a stormwater management system that ensures all surface runoff from the area is monitored and, if contaminated with NUF residue, the runoff is treated within the LAMP's IETS.
- The storage is dedicated only for NUF generated by Lynas, without any mixing with other forms of scheduled waste. This allows Lynas to use the NUF at a later time when approval for commercialisation is granted by relevant agencies.
- An onsite storage location will also eliminate social perception related to the offsite transportation of NUF to other disposal sites and more importantly "public outrage risk" to the perceived issues pertaining to the need to construct and operate a PDF.
- By storing the NUF onsite, Lynas will reduce its carbon footprint whereby no additional greenhouse gas emissions (in the form of exhaust emissions) will arise from the transportation activities.

4.2.2 Alternative Storage Method

Since the commencement of the operation in the first quarter of 2013, the NUF has been stored in 3 different methods which are described in the following sub-sections.

4.2.2.1 Residue Storage Facility (RSF)

In the original PEIA prepared for the LAMP in 2008, the engineered storage cells were referred to as the Residue Storage Facility or RSF. In the early years of LAMP operation, the NUF was stored in storage facilities engineered for slurry storage(semi-solid) within the RSF. However, this storage system wastes a significant volume of space and is not conducive for the removal and reuse of NUF for other industrial applications (commercialisation) in the future.

4.2.2.2 Geotube

This system is a high-volume dewatering solution without a need for filtrationThe system uses an engineered textile that is designed for dewatering of high moisture content sludge and does not involve any mechanical parts.

The Geotubes were used from 2013 to 2015. During this time, the NUF in slurry form was pumped into the Geotubes and the water passively allowed to flow out of the permeable surface of the Geotube.

Currently, there are two Geotubes storage areas at the LAMP (GT 1 and GT 2) stored in the area earmarked for DSF 2. Their locations are as shown in **Figure 4.1**. The Geotubes currently store a total of 155,000 MT of NUF (wet wt.) on a footprint of 24,300 m^2 (GT 1) and 8,300 m^2 (GT 2).

However, this method of storage was discontinued for the following reasons:

- The storage method although takes less space than the RSF, it is still deemed not space efficient, and therefore not optimal.
- The system results in very poor compaction of the NUF solids and a higher moisture content than NUF that has been filtered. This makies for an unstable long term platform. The Geotube area is currently undergoing extensive rework; the tubes are being removed, and the material recompacted and recontoured to provide a stable long term platform.
- Most importantly, the Geotubes do not allow for easy removal of the NUF for commercialisation. This is because the NUF is contained within a barrier (the tube) which must be removed, and the poor compaction and poor dewatering means that the material requires further processing before it can be considered for re-use.

4.2.2.3 Dry Storage Facility (DSF)

A more costly and effective measure is the option Lynas currently uses. This process involves thickening, filtration and dry stacking.

Filtration and dry stacking is recognised as world's best practice for storage of phosphogypsum tailings residues for the following reasons:

- The dry stacked residues provide a far more stable and robust platform for long term storage.
- The solids provide their own structural integrity, meaning that very large containment structures (e.g. embankments or dams) are not required for containment. This in turns reduces the area for storage of a given volume.
- If end uses can be developed for the residues, removal or extraction of the NUF is easier and less risky. The material can be easily accessed with heavy equipment.
- The risks of the structure of the RSF failing and spreading residue slurry over the LAMP site are eliminated as the NUF is stacked as dry solids.

4.3 BUILD-OUT v NO-BUILD OPTIONS

This section provides the options which were evaluated as part of the proposed secure landfill Project planning process. The main options, i.e. the Build Out or No Build options which are based on assessments of beneficial and adverse environmental and socio-economic impacts brought about by the proposed Project are discussed in the sections below:

4.3.1 Build-Out Option

The Build-Out option would entail the continued use of DSF 1 implementation of the proposed secure landfill Project and the construction of four (4) new DSF will complement and support the ongoing development to store NUF residue within the LAMP site while awaiting approval from relevant agencies and the DOE on the commercialisation. The benefits discussed under Section 4.2.1 will be realised.

The potential concerns arising from the implementation of the Project are with respect to environmental impacts. In the event where adequate mitigation measures are not properly implemented, the following *potential* impacts are envisaged (which are assessed and discussed in detail in Chapter 7 & 8):

- Geotechnical stability of the DSF;
- Surface Water pollution;
- Groundwater contamination;

- Reduced ambient air quality;
- Increased Ambient Noise Levels;
- Disruption in socio-economic wellbeing; and
- Deterioration in public health

4.3.2 No-Build Option

Under the No-Build option, the current NUF residue will run out of storage space by June 2019. Based on current NUF generation rate, at 1145 metric tonnes per day, the need of secure landfill is critical. Without the Project, the NUF residue storage in a safe place will be compromised.

4.4 CONCLUSION

Developments which lead to economic progress for the nation and the people are necessary to enable Malaysia to achieve its aspiration of becoming a developed nation by year 2020. It is also the vision of the Government of Malaysia to make Malaysia a high-income society and the Sixth Malaysia Plan (1991) has been promulgated based on Vision 2020. Although development is inevitable for the growth of a nation, it must be sustainable to ensure that environmental, social, and health aspects are not compromised. A balanced and sustainable development is possible when Project Proponents understand their roles and responsibility to the environment and society; and when government regulatory bodies actively enforce the requirement of the laws.

The rare earths industry is a strategic sector that will lead to the establishment of other downstream industries that use the rare earth products as their raw material. The successful operation of the LAMP will ensure continued economic contribution to the state and the nation as a whole.

The findings of this report will demonstrate that the predicted environmental impacts arising from the proposed Project can be effectively mitigated and reduced to levels which complies with regulations and guidelines on environmental protection enforced by DOE Putrajaya with the appropriate mitigation measures. In addition, upon approval of this EIA by DOE Putrajaya, an Environmental Management Plan, which includes periodical environmental monitoring and audits for the construction phase of the Project will be developed and implemented. This is to ensure that all recommendations of this EIA and the requirements of DOE Putrajaya are executed by the Project Proponent. In considering the above options and the significant positive economic and social benefits of the Project, it is strongly recommended that the *Build-Out* Option should be adopted.