

IAEA

International Atomic Energy Agency

Atoms for Peace

Report of

the International Post-Review Mission

on

the Radiation Safety Aspects of the

Operation of a Rare Earth Processing

Facility and Assessment of the

Implementation of the 2011 Mission

Recommendations

13 – 17 October 2014, Malaysia

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1. INTRODUCTION

On 3 May 2011, the Malaysian Government approached the IAEA with a request to organize an independent expert review of the radiation safety aspects of the rare earths processing facility that was being constructed in the country. That facility formed part of the Advanced Materials Project being developed by the Lynas Corporation Ltd. The IAEA's Director General Mr Yukiya Amano agreed to offer the IAEA's support. The Lynas Advanced Materials Project (LAMP) now includes the mining and concentration of rare earth ore at Mt Weld, Western Australia, followed by shipment of the concentrate to a rare earth processing facility at Gebeng, Pahang State, Malaysia, where further processing takes place to produce high purity rare earth compounds.

The mission was implemented in the period of 29th May to 3rd June 2011. The IAEA assembled a team of international experts using the mechanism established in terms of its technical cooperation programme. The review team was composed of experts on Radiation Protection (occupational, public and environment – including monitoring system, Waste Management, Decommissioning and Environmental Remediation, Transport and Safety Assessment, coming from Canada, India, the Netherlands, South Africa, the United Kingdom and the IAEA. Members of the review team had a wide knowledge of the IAEA safety standards and broad professional experience in their respective disciplines that allowed them to cover the overall scope of the mission. To preserve the international expert panel's impartiality, the review team did not include individuals whose participation could have led to a conflict of interest.

The review team provided a Mission Report that contained a total of 11 (eleven) recommendations divided into Technical, Public Communication Follow-up Recommendations. The full report has been made publicly available and can be found in [1].

One of these recommendations encouraged the Malaysian authorities to prepare an action plan and schedule for addressing the recommendations with the potential for organisation of a follow-up mission aimed at reviewing the fulfilment of recommendations 1–10 as depicted in the 2011 Mission Report, something that is common to other similar IAEA review missions.

In line with the aforementioned context, the IAEA received on 1st July 2014 a report from the government of Malaysia addressing the implementation status of the 2011 IAEA Review Mission recommendations and a request to undertake in the field a “Post-Review Mission on the Radiation Safety Aspects” of the facility and to assess the implementation of the prior mission's recommendations.

Therefore, the objective of the present mission was to review and evaluate the fulfilment of the recommendations 1–10 provided in the 2011 IAEA Review Mission [1] as implemented by the Malaysian authorities and/or Lynas Corporation Ltd.

The scope of the Post-Review Mission was particularly focussed to cover Safety and Operational Aspects that have been already addressed in the 2011 Mission as to include:

- Radiation Protection - occupational, public and environment - including monitoring systems;
- Safety Assessment;
- Waste Management; and
- Decommissioning and Environmental Remediation.

The review team assessed the adequacy and appropriateness of the implementations made toward the previous review mission recommendations, and based primarily upon documentation and data provided by the Malaysian Government and other stakeholders, as requested by the review team, prior to and during the Review Mission. Interviews, presentations, and discussions were held during the mission to Malaysia.

2. THE REVIEW PROCESS

As it happened in the 2011 mission, the review team was composed of experts from outside the IAEA and staff members. To preserve the international expert panel's impartiality the review team did not include individuals whose participation could have led to a conflict of interest. The review team members are listed in Appendix I.

The review process consisted of the following steps:

- A review of the relevant documentation provided in advance to the review team by the Malaysian counterpart
- The review mission to Malaysia, 13 – 17 October, which included:
 - Discussion with the relevant Malaysian officials, Lynas project staff and other stakeholders (during public submissions)
 - Site visit to Lynas facility
 - Assessment of the collected information by the review team and preparation of the preliminary conclusions that were subsequently presented to the Malaysian officials during a dedicated meeting

3. TECHNICAL BACKGROUND

Before presenting the review mission findings and general conclusions, it is useful to introduce the overall concepts on which the assessment and conclusions of the review team were based on. These are presented below.

Naturally occurring radionuclides are present in many natural resources. Elevated concentrations of these radionuclides can be found in certain geological materials and ores. Human activities that exploit these resources may lead to enhanced concentrations of radionuclides in products, by-products, residues and wastes derived from some industrial process. Such activities may include, for instance, the mining and processing of ores, the combustion of fossil fuels, or the production of natural gas and oil. This possibility led the scientific and technical community to investigate the radiological situation of a diverse number of industrial activities and assess the related potential occupational and environmental impacts.

The following industrial activities have been identified as being likely to require regulatory consideration because of the presence of NORM¹ [2]:

- Extraction of rare earth elements;
- Production and use of thorium and its compounds;
- Production of niobium and ferroniobium;
- Mining of ores other than uranium ore;
- Production of oil and gas;
- The zircon and zirconia industries;
- Manufacture of titanium dioxide pigment;
- The phosphate industry;
- Production of iron and steel, tin, copper, aluminum, zinc and lead;
- Combustion of coal;
- Water treatment.

As per its statute, the IAEA is mandated to develop safety standards and provide for their application. These safety standards reflect an international consensus on what constitutes a high level of safety for protecting people and the environment from harmful effects of ionizing radiation. Its adoption to industrial practices involving NORM and associated residue management is important for ensuring the necessary level of protection and safety of workers and members of the public.

The IAEA Basic Safety Standards [3] in its paragraph 3.4 lead to the understanding that:

- If, in every process material, the activity concentrations of all radionuclides in the ²³⁸U and ²³²Th decay series are 1 Bq/g or less and the activity concentration of ⁴⁰K is 10 Bq/g or less, the material is not regarded as NORM and the requirements for existing exposure situations apply.
- If, in any process material, the activity concentration of any radionuclide in the ²³⁸U or ²³²Th decay series exceeds 1 Bq/g, or if the activity concentration of ⁴⁰K exceeds 10 Bq/g, the material is regarded as NORM and regulatory requirements for planned exposure situations apply.

Important to notice that these same criteria of 1 Bq/g for ²³⁸U and ²³²Th series radionuclides and 10 Bq/g for ⁴⁰K may also be used as clearance² criteria for removal of material from an industrial activity involving NORM. These values represent, to the nearest order of magnitude, the upper bounds of the ranges of activity concentration found in normal rocks and soil. This is illustrated in Figure 1 for radionuclides in the ²³⁸U and ²³²Th decay series.

¹ The mining and processing of uranium ores have not been included in this list as in some countries these activities are regulated as being part of the nuclear fuel cycle.

² Removal of *radioactive material or radioactive* objects within authorized *practices* from any further *regulatory control* by the *regulatory body*. Removal from control in this context refers to *control* applied for *radiation protection* purposes. Various terms are used in different countries to describe this concept, e.g. 'free release'.

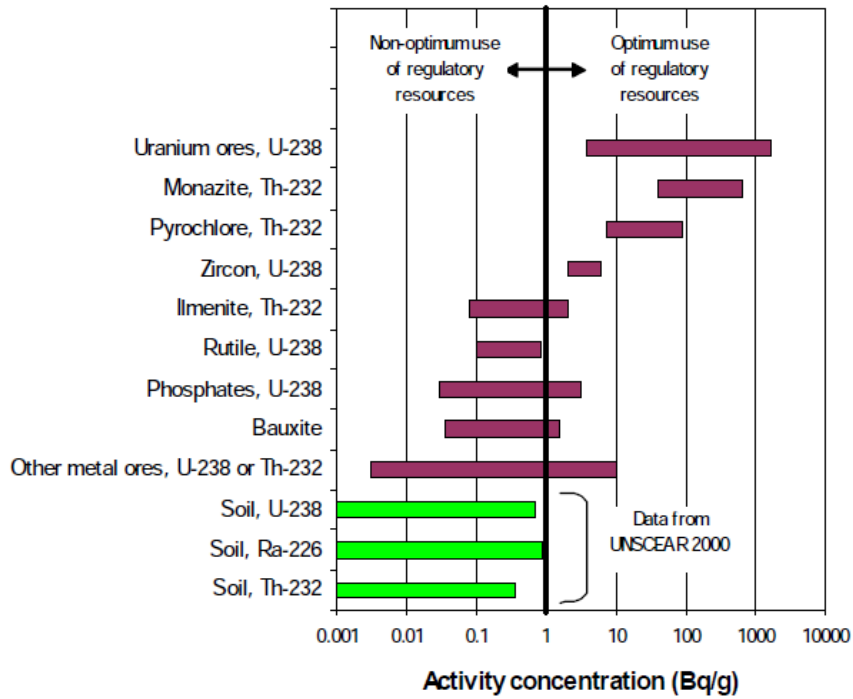


Figure 1: Radionuclide activity concentrations in some natural materials [4].

The IAEA TECDOC 1660 [5] discusses the exposure of the public from large deposits of mineral residues. One of the objectives of the publication was to establish the consequences of applying the recommended activity concentration criterion of 1 Bq/g in situations where individuals are exposed to large mine residue deposits. As stated above, the derivation of the activity concentration criterion was not based on dose considerations. It was found that a knowledge of the doses likely to be received in such situations would help to establish whether or not the use of the 1 Bq/g criterion for determining the scope of regulatory control could, in any reasonable circumstances, lead to an exposure situation that would be regarded as unacceptable. The results coming from the dose calculations for a representative NORM residue deposit and the supporting information based on actual measurements in the field led to the conclusion that the dose received in a year by an individual living next to a bulk mine residue deposit would, in all reasonable situations, be significantly less than 1 mSv/a per unit activity concentration (in Becquerel per gram) in the residue.

In order to determine the optimum regulatory approach, the regulatory body has to consider an initial assessment of exposure or dose and the costs of regulation in relation to the benefits achievable. Clearly a detailed understanding of the industrial activity concerned is essential for proper implementation of a graded approach that consists of four levels of regulatory control.

These levels are, in ascending order of stringency of control:

- Exemption³;
- Notification;
- Notification plus authorization in the form of registration;
- Notification plus authorization in the form of licensing.

In the context of NORM residues management, opportunities for recycling these materials or using them as by-products may be considered. In this case a variety of factors, including the type of residue, the rate at which it is generated, the location of the facility and, in the case of by-product use, local market conditions are to be considered. Some countries are now making specific provision in their regulatory systems for NORM residue recycling and use.

If recycling or use as by-product is not an option, then the disposal as waste should be acceptable and designed in such a way that long term safety can be assured — this should be demonstrated as part of a site specific dose and risk assessment. A diagram of a proposed classification scheme for radioactive waste and its method of disposal is shown in Figure 2. The classification scheme reflects the general principle that the higher the activity concentration, the greater the need to contain the waste and isolate it from the biosphere. NORM waste, which generally contains radionuclides with very long half-lives, would generally be classified as low level waste, very low level waste or exempt waste. On this basis, non-exempt NORM waste could therefore be expected to be disposed of in surface or near surface disposal facilities.

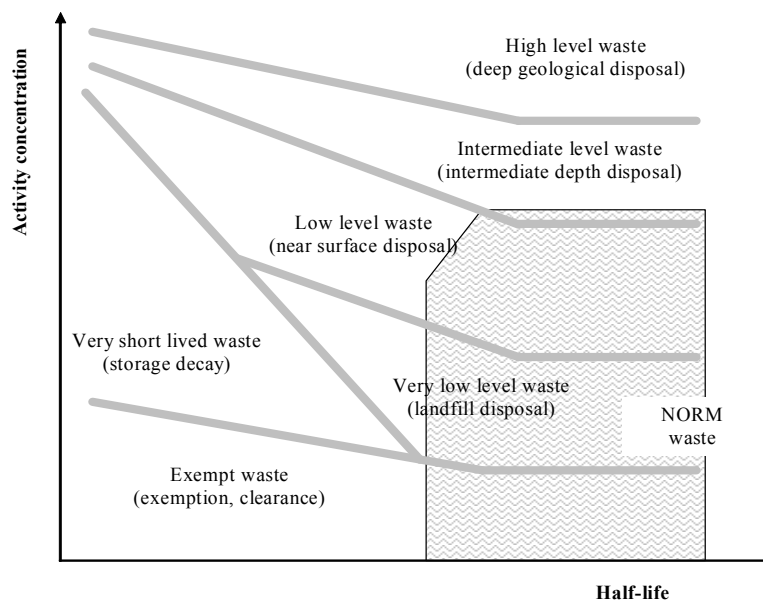


Figure 2: Classification scheme for radioactive waste — Application to NORM waste [6].

³ The determination by a regulatory body that a source or practice need not be subject to some or all aspects of regulatory control because the exposure related to that industrial activity is too small.

4. MISSION RESULTS

As already stated, the scope of the mission was restricted to the analysis of how the recommendations formulated by the review team in the 2011 mission have been implemented. Therefore this section will introduce each one of the formulated recommendations, provide the findings related to each one of them and the overall assessment. Whenever it was found appropriate by the review team follow-up recommendations were formulated.

4.1. Recommendation 1

The AELB should require Lynas to submit, before the start of operations, a plan setting out its intended approach to the long term waste management, in particular management of the water leach purification (WLP) solids after closure of the plant, together with a safety case⁴ in support of such a plan. The safety case should address issues such as:

- (a) Future land use (determined in consultation with stakeholders);*
- (b) The dose criterion for protection of the public;*
- (c) The time frame for the assessment;*
- (d) Safety functions (e.g. containment, isolation, retardation);*
- (e) The methodology for identification and selection of scenarios — this must include the scenario in which the residue storage facility at the Lynas site becomes the disposal facility for the WLP solids;*
- (f) Any necessary measures for active and/or passive institutional control.*

As the safety case is developed, the radiological impact assessment (RIA) for the facility as a whole should be updated accordingly.

4.1.1. Findings

As directed by AELB, Lynas submitted a Safety Case, a Radioactive Waste Management Plan (WMP) and a Radiological Impact Assessment supporting a Temporary Operation Stage License (TOL) application. The initial application made in August 2011 was returned by the AELB's Special Standing Sub-Committee (SSC, established August 2011) as incomplete. Lynas amended the documentation to the SSC satisfaction and resubmitted for license review in December 2011. The AELB approved the application in January 2012 but withheld the issuance of the TOL until September 2012.

Subsequent to the TOL issuance Lynas prepared and submitted updated documentation supporting the application for a Full Operation Stage License. The revised Long-Term Waste Management Plan (last update August 2014), a Safety Case (last update August 2014), and a Radiological Impact Assessment (last update August 2014), and other required documents were submitted for license applications to AELB in May 2014⁵, and a Full Operation Stage License for Class A, C, G, and E (AELB definitions at

⁴ In terms of the IAEA Safety Glossary, a safety case is a collection of arguments and evidence in support of the safety of a facility or activity. This will normally include the findings of a safety assessment and a statement of the confidence in these findings.

⁵ Documents submitted for license application 6 months before the license expired (March 2014). Second submission after revision in May 2014. Final revision submitted in August 2014.

<http://www.aelb.gov.my/aelb/engv/text/licence.asp>) was issued on September 2014 for a period of 2 years.

With regard to the recommendation for particular attention to the WLP residues in the waste management plan and supporting Safety Case, it is noted the August 2014 Update 1 of the Safety Case for Radioactive Waste Disposal submitted by Lynas does consider the “disposal of Water Leach Purification (WLP) residues generated from the Lynas Advanced Materials Project and radiological waste arising from the future decommissioning of the facility at an off-site Permanent Disposal Facility (PDF)”.

With regard to Recommendation 1 to address specific points (a) through (f) in the Safety Case, the review team concludes that items a), b), c), d) and f) are adequately reflected in the August 2014 Update 1 of the Safety Case for Radioactive Waste Disposal submitted by Lynas. Regarding Recommendation 1 Item (e) to “include a scenario in which the residue storage facility at the Lynas site becomes the disposal facility for the WLP solids”, the review team notes this specific scenario was excluded from the Safety Case and as explained it was due to the prevailing AELB’s land use requirements.

With regard to providing an updated Radiological Impact Assessment (RIA), the review team notes the RIA was revised in August 2014 and submitted by Lynas as part of the documentation supporting the application for a Full Operation Stage License. Further discussion of the RIA is provided in the section dedicated to Recommendation 3 below.

4.1.2. Assessment

The Safety Case, Radioactive Waste Management Plan and Radiological Impact Assessment and their updates supported the review and approval by the AELB in their issuance of the Temporary and Full Operations Stage licenses and the respective license conditions.

The review team noted that a methodology exists for the identification and criteria to be used in site selection for a Permanent Disposal Facility, as reported in the PDF Site Selection Plan Document for a Permanent Disposal Facility (PDF). As pointed out earlier in the findings, a scenario in which the on-site residue storage facility becomes the disposal facility has not been considered. Therefore, the team is of the opinion that for the sake of completeness, a scenario in which the residue storage facility (as presently executed) becomes the disposal facility for the WLP solids, should be addressed and included in an update to the Safety Case and reflected in other supporting documents as appropriate.

The review team notes the Radiological Impact Assessment is appropriate in structure and approach methodology. Suggestions for the treatment of parameters are discussed in the section for Recommendation 3.

4.1.3. Follow-up suggestion

A scenario in which the Residue Storage Facility (as presently executed on-site) becomes the Permanent Disposal Facility for the WLP solids should be addressed by Lynas and included in an update to the Safety Case and reflected in other supporting documents as appropriate

4.2. Recommendation 2

The AELB should require Lynas to submit, before the start of operations, a plan for managing the waste from the decommissioning and dismantling of the plant at the end of its life. The RIA and decommissioning plan should be updated accordingly.

4.2.1. Findings

The mission team found evidence that the licensee presented, as required, a Waste Management Plan consisting of the first update of the Radioactive Waste Management Plan (RWMP) which has been prepared for submission to the AELB in compliance to Condition 26 of the TOL. The document has been prepared in accordance with the “Guidelines for Decommissioning of Facilities Contaminated with Radioactive Materials known as the LEM/TEK/56 (AELB, 2008)”. In the team’s view this plan should include the management procedures to be applied to the waste streams derived from the decommissioning activities. In the analysis of the RWMP it became clear that activities related to the management of wastes associated with decommissioning are in fact not detailed in the RWMP but under the “Decommissioning Plan (Update 1) (2014)” which was submitted to the AELB.

4.2.2. Assessment

In the Decommissioning Plan the waste management activities related to decommissioning are vaguely described. One example of this is the statement that “all possible waste streams that might be generated as a result of the decommissioning activities are yet to be identified”.

In general terms, the wastes will be segregated and packaged (as necessary) upon generation. The waste packages will be transported to the PDF⁶. In the event the wastes need to be stored onsite for an extended period (prior to offsite removal), a safe and secured storage place is to be made available prior to commencement of the decommissioning activities.

The procedures for monitoring, assaying and characterizing these wastes will also be presented in the Final Plan as required under the Guidelines for the Decommissioning of Facilities Contaminated with Radioactive Material issued by the AELB (LEM/TEK/56).

4.2.3. Follow-up suggestions

As it has already been highlighted in the 2011 mission, consideration for decommissioning and environmental remediation shall begin early in the design stage and continue through the termination of the practice or the final release of the facility from regulatory control. It is well known that both decommissioning and environmental remediation activities generate wastes that will further need to be disposed-of.

Therefore the review team suggests that a more thoroughly approach to the quantification and definition of the management options for the waste to be generated in the decommissioning activities is taken. The disposal routes for these wastes should be more consistently defined.

⁶ As noted in the assessment of recommendation 1 the absence of a clear solution for the location of the PDF also brings concern regarding the disposal of the wastes to be generated during the decommissioning phase.

4.3. Recommendation 3

The AELB should require that the results of exposure monitoring and environmental monitoring once the plant is in operation be used to obtain more reliable assessments of doses to workers and members of the public and the RIA updated accordingly. The AELB should also require that dose reduction measures be implemented where appropriate in accordance with the international principle of optimization of radiation protection.

4.3.1. Findings

Environmental radiological monitoring programs (ERMP) are conducted by LAMP as the operator and AELB as the regulatory authority. The environmental parameters studied are external radiation, radon and thoron gases, airborne dust, suspended dust, water, soil and sediment. The ERMP include the LAMP industrial area (36 on-site points of measurements) and four off-site zones, encompassing areas defined by radial distances of 1 km, 5 km, 10 km and 20 km respectively around the LAMP (altogether 26 measurement points). Measurements have been carried out at an established frequency both by Lynas and AELB that also includes the collection of environmental samples. In line with the Full Operating License issued in September 2014 measurements by LAMP are now partly carried out at higher intervals.

The results of the first nine months of implementation of the environmental monitoring conducted by the operator are reported in the Radiological Impact Assessment (RIA) as ranges of measured data (minimum/maximum values) as well as average/median values.

Regarding the monitoring program conducted by the AELB, the review team learned that the general public has access to the monitoring results via the AELB Website (<http://portal.aelb.gov.my/sites/aelb/awam/maklumat-lynas>). In addition, the review team was informed by AELB that at the entrance of the LAMP site as well as near the police station in Kuantan on screens on-line monitoring data are presented (external gamma dose rate, long-lived alpha activity in the airborne dust, and radon/thoron concentrations).

The results of the environmental monitoring and the occupational surveillance programs have been used, as recommended by the 2011 review team, in the updated Radiological Impact Assessment (RIA) to obtain a more reliable assessment of doses to workers and members of the public. It has been assessed by the review team that the RIA is clearly structured, following the steps: source characterization, description of ways of radionuclide dispersion, identification of critical groups of exposure, definition of exposure scenarios and dose as well as risk estimation. Dose estimations for off-site exposure have been carried out by the use of the RESRAD code (<https://web.evs.anl.gov/resrad/home2/resrad.cfm>). Risks are reported as maximum excess fatal cancer risk numbers for workers and members of the public (incidences per million).

Emphasis in the RIA is given to exposure along the air and soil pathways (external radiation, dust and radon/thoron inhalation) while dose estimations related to exposure along the aquatic pathway are limited to the scenario of fish consumption. In the absence of measurable values of a specific parameter, the minimum detectable activity (MDA) was used to estimate doses by fish consumption and dust inhalation. This leads to a conservative estimate of the dose in present situation.

For members of the public living in the vicinities of the plant, a maximum annual dose of 0.0131 mSv has been reported in the RIA. This dose was estimated for a member of the

public with permanent inhabitation beyond a 5 km radial distance from the LAMP. It is noted in the RIA that the largest contributor to this dose is inhaled dust. As mentioned above the overestimation of the dose results from the use of dust MDA values as RESRAD input parameter values. For staff-members working at LAMP in offices and other areas where workplaces are not classified as controlled and supervised areas (non-radiation workers) a maximum dose of 0.003 mSv/a was estimated in the RIA. For the fish consumption scenario a maximum dose of 0.0075 mSv/a was calculated.

Since 2012 Lynas has been operating an occupational exposure monitoring program. It includes monitoring of external exposure (by use of individual thermoluminescent (TL) dosimeters as well as Geiger-Müller detector based dose rate meters) and monitoring of internal exposure (dust and radon/thoron inhalation) on the basis of working place measurements taking into account the occupancy factors. Review team noted that measurements of thoron progenies have not been carried out during the period.

The occupational monitoring program currently covers 160 workers on a monthly frequency. The TL dosimetry service is provided by the Nuclear Malaysia who operates an accredited Secondary Standards Dosimetry Laboratory. Estimates of the external radiation dose to workers varied in the range of 0.06–0.67 mSv/a at different LAMP workplaces. The estimated dose incurred by truck drivers transporting the Lanthanide concentrate was 0.001 mSv/a. Measurements of radon and thoron indicated insignificant concentrations with an estimated dose of 0.04 mSv/a. Dose due to the inhalation of long-lived alpha emitters was also negligible (0.004 mSv/a) compared to the occupational dose limit of 20 mSv/a.

Lynas operational monitoring data obtained from the AELB for the year 2013 showed workers average individual dose of 0.021 mSv/a. In almost all cases doses were below 1mSv/a, with two cases of exceptions recording 2 and 3 mSv/a. The latest monitoring report showed that the maximum radiation dose to the workers at the Water Leach Purification-Residue Storage Facility is 0.67 mSv/a. This value has also been used in the RIA.

Lynas has established a radiation protection program with local rules and procedures. Controlled areas and supervised areas have been established and approved by the regulatory authority. A qualified radiation protection adviser (RPO) and four supervisors trained in radiation protection are available in the plant. It is noted that AELB has a site office with qualified officers (4 staff) for regulatory surveillance. Lynas operational radiological monitoring data have been routinely verified by the on-site AELB staff.

Lynas carries out periodic health surveillance of radiation workers in accordance with AELB stipulations.

Regarding the recommendation made by the 2011 review mission on AELB to require Lynas to implement dose reduction measures for optimization, the review team found that many actions have been taken at LAMP such as; effective engineering controls, use of conveyors for Lanthanide Concentrate discharge into the cracking tanks, discharge of WLP filtered sludge directly into the transport truck from the filter avoiding manual handling, dust suppression methods at the residue handling sites etc. The use of personal protective equipment is enforced in the processing plant and residue handling areas.

Measures have also been implemented to keep the environmental impact as low as reasonably achievable. This includes treatment of water before it is discharge into the river system, establishment of a double-layer technical barrier at the RSF to avoid seepage into

groundwater (including a detector system which indicates potential barrier failure), dust suppression measures by moisturizing of material, vehicle tire washing, i.e. measures which are called internationally accepted good practices.

It is also noted that Lynas has developed a Radiological Emergency Preparedness and Response Plan approved by the AELB.

4.3.2. *Assessment*

The recommendation that the results of exposure monitoring and environmental monitoring once the plant is in operation are used to obtain more reliable assessment of doses to workers and members of the public has been fulfilled. The occupational exposure of workers is well below the dose constraint of 6 mSv/a set by AELB for optimization of radiation protection, and it is much lower than the annual exposure limit for radiation workers of 20 mSv/a stipulated by the Malaysian regulations as well as in [3]. Analogously, the doses reported for members of the public are well below the AELB dose constraints of 0.3 mSv/a and the dose limit of 1 mSv/a given in the Malaysian regulations.

Nevertheless, regarding the design of the ERMP which are operated by Lynas and AELB, the IAEA mission review team sees potential for further optimization. Taking into account the limited range of dispersion of air-borne radioactivity, the measurement of external dose rates, airborne long-lived alpha emitters, radon/thoron and specific radionuclide activities in soil samples in distances greater than 1 km from the LAMP is from a technical point of view idle. Measurements taken in off-site areas beyond 1 km from the facility could be limited to a very few number of dose rate determinations, to provide for public reassurance. More focus should be given on source monitoring at LAMP. In particular, monitoring of radioactivity in the water released from water treatment plant to the Balok river should be intensified. Also, monitoring of the dispersion of the radioactivity downstream the river should be improved. Therefore it is necessary to seek for laboratory capacity in the country to analyze ^{226}Ra , ^{228}Ra , gross alpha and gross beta in environmental samples in levels close to the natural background, i.e. capacity should be made available to determine the above mentioned parameters in activity concentrations lower than the MDA especially in the analysis of water samples. This applies also for the monitoring carried out by AELB.

Although no significant impacts on the human health and the ecosystems are expected, potential for improvement of the RIA is also seen. The review team came to the conclusion that the assessment of impacts of the release of radioactivity into the surface water can be better described. There is also lack of appropriate consideration of potential impacts on groundwater. Therefore, exposure-related scenarios in addition to fish consumption should also be taken into account. For such an evaluation input data on water activity concentrations below the actually reported MDA values are needed to better characterize the aquatic pathway of exposure.

The review team suggests not reporting the numbers of cancer incidences per million persons as done in the actual RIA because the assumptions underlying those estimations are too conservative. Integration of very small doses over a large cohort of exposed persons is out of international practice [7].

The review team concludes that the recommendation related to occupational monitoring have been complied with. In the future, routine monitoring of occupational exposure could be limited to external gamma radiation, inhalation of dust containing long-lived alpha activity

and inhalation of thoron progeny nuclides. AELB may review the controlled and supervised areas based on the two years' operating experience and enforce the personal monitoring requirements in accordance with the magnitude and likelihood of exposures.

Finally, the review team concludes that the requirement in Recommendation 3 regarding dose reduction measures being implemented for optimization of radiation protection is fulfilled. The review team appreciates the good radiation protection practices followed at the LAMP facility.

4.3.3. Follow-up suggestions

- Lynas should optimize its environmental monitoring program in line with the IAEA Safety Standard Series RS-G-1.8 (IAEA 2005) [8], with more emphasize on the aquatic pathway.
- The present RIA should be amended with regard to a more detailed modeling of the ecological and public health impacts of radioactive effluents to the Balok river.
- Lynas should continue the occupational exposure monitoring as per the AELB requirements. In addition, at indoor workplaces where lanthanide concentrate is stored and handled and in less ventilated spaces measurement of the PAEC (potential alpha energy concentration) due to thoron and its progenies is recommended. This is to take into account potentially enhanced concentrations of $^{212}\text{Pb}/^{212}\text{Bi}$ which are the main contributors to internal dose while handling thorium based sources.

4.4. Recommendation 4

The AELB should develop criteria that will allow the flue gas desulphurization (FGD) and neutralization underflow (NUF) residues to be declared non-radioactive for the purposes of regulation, so that they can be removed from the site and, if necessary in terms of environmental regulation, controlled as scheduled waste.

4.4.1. Findings

In terms of the Atomic Energy Licensing (Radioactive Waste Management) Regulations, 2011 (P.U.(A) 274), the AELB established a clearance criterion for the FGD and NUF residues. This criterion is specified as an activity concentration of 1 Bq/g or less for both ^{238}U and ^{232}Th . The results of activity concentration measurements on these two residues made at regular intervals over the two year period of the temporary operating license were examined by the review team. In the FGD residue, the measured activity concentrations of ^{238}U and ^{232}Th remained below 0.0062 and 0.002 Bq/g, respectively. In the NUF residue, the measured activity concentrations of ^{238}U and ^{232}Th remained below 0.0062 and 0.02 Bq/g, respectively. The activity concentrations in the FGD and NUF residues are thus well below 1 Bq/g. The AELB declared the FGD and NUF residues to be non-radioactive and the residues were released from regulatory control under the Atomic Energy Licensing Act 1984 (Act 304). They are still controlled as scheduled waste in terms of environmental regulation.

4.4.2. *Assessment*

The clearance criterion of 1 Bq/g or less for ^{238}U and ^{232}Th is identical to that specified in the IAEA International Basic Safety Standards [3]. The FGD and NUF residues clearly meet this clearance criterion and therefore qualify for release from regulatory control. It is concluded that the AELB has fully implemented Recommendation 4.

4.5. **Recommendation 5**

The AELB should implement a mechanism for establishing a fund for covering the cost of the long term management of waste including decommissioning and remediation. The AELB should require Lynas to make the necessary financial provision. The financial provision should be regularly monitored and managed in a transparent manner.

4.5.1. *Findings*

The review team notes that pledges (letters of commitment) by Lynas to provide the Malaysian government payments totalling US \$50M have been established, and begun to be executed. The review team received verbal comments regarding the schedule and the basis for payments to be made (e.g. 5 vs.7 years, linear or production based), and recognizes such adjustments are the purview of the Malaysian authorities.

The fee adequacy for covering the cost of the long term management of waste including decommissioning and remediation is undetermined.

4.5.2. *Assessment*

The purpose of the funding recommendation is to provide reasonable assurances that the financial resources to cover the costs of the long term management of waste, including the waste generated by decommissioning and remediation activities, will be available. In order to assess the reasonableness of the fund relative to the waste management burden it is necessary to understand both the anticipated waste management burden and the financial basis of the fund target. With an understanding of the anticipated waste management burden and the financial basis for the fund, it is possible to assess the overall adequacy of the fund to cover potential future liabilities.

The potential waste management burden in terms of volumes and waste streams is largely defined in the waste management plan and safety case reviewed. The review team was provided verbal explanations on the financial basis of estimate used to derive the US \$50M figure, which suggested it was based largely on a single experience with a similar waste management project.

4.5.3. Follow-up suggestion

Given the limited understanding of the fund's financial basis, the fee adequacy of the US \$50M to cover worst-case disposal costs and decommissioning and environmental remediation measures costs could not be assessed by the team as appropriate or not. The review team suggests that the fund's financial basis and adequacy be assessed against an appropriate estimate of the potential future liability e.g. an engineering estimate of projected WLP and decommissioning/environmental remediation waste volumes, PDF construction, etc. Further, documentation of the fund's basis, and any changes to its receipt schedule should be made publicly available consistent with other key licensing documentation.

4.6. Recommendation 6

For regulating the Lynas project, the Malaysian Government should ensure that the AELB has sufficient human, financial and technical resources, competence and independence.

4.6.1. Findings

Since 2011, the Government of Malaysia and AELB have promoted and implemented a good number of actions aimed to reinforce AELB as an independent and competent regulatory body. The allocation of additional financial and human resources has enabled the AELB to effectively play its role in the licensing process and in supervising the operation of the Lynas plant.

Some relevant actions to reinforce the AELB have included among others the following ones:

- The creation of a new AELB office in the Lynas site, which started its activities at the same time that the Lynas plant started its operation under the Temporary Operation License (TOL).
- The creation of 5 new technical positions for supervising the operation of the plant and to conduct independent operational and environmental monitoring activities. All of them are based at the AELB office in Lynas site. At the time of the mission visit to Malaysia, 4 out of 5 positions were already filled and 1 new technical officer was expected to join also the AELB's site office in January 2015, as the recruitment process was already completed. The new AELB's officers recruited for its Lynas site office are graduated in nuclear engineering or in nuclear or environmental sciences.
- The procurement of logistic and scientific equipment, such as vehicles, radiation monitors and sampling devices and the rental of a new AELB's site office, etc.

In addition, AELB created a Special Sub-Standing Committee (SSC) to review the Safety Case and relevant supporting documents submitted by Lynas as part of the application for the TOL and afterwards the updated documents submitted by Lynas for the Full Operation License (FOL). Other relevant actions carried out by AELB, since the IAEA mission in 2011, included among others the following ones:

- Establishment of a Public Relation Committee (JKPA) to deal with all public engagement issues;
- Establishment of a technical committee to appoint “3rd Party Assessor”;
- Establishment of a Parliament Select Committee (PSC) to assess the safety of Lynas operation;
- Malaysian Nuclear Agency has been tasked to give support to AELB as a Technical Support Organization (TSO), especially in the areas of environmental monitoring, equipment calibration and personal dosimetry.

The review team met the three officers of AELB’s Lynas site office. During this meeting the young AELB’s officers exhibited a high level of professionalism, commitment and dedication as independent regulators. Their education and training well fit to the requirements for their assigned regulatory supervisory position and the development of independent environmental and on-site monitoring, and they also used a number of check-lists, guidance and procedures to accomplish their assigned tasks. They had a good understanding of their role as regulators, as well as good knowledge of the Lynas plant situation. They also gave to the review team some relevant information and data on both the on-site and the environmental monitoring program.

The review team also met the Director General of AELB, who explained the regulatory process applied to Lynas in consistency with the Atomic Energy Law and subsidiary regulations and also the experience accumulated by AELB in the regulation and control of other 5 plants processing NORM materials in Malaysia. He also explained the actions implemented to enhance AELB resources and competences in line with the recommendations made by the IAEA mission of 2011 and gave an explanation on how, in his opinion, the AELB effectively exercises its role as an independent regulatory authority.

The on-going revision of the Law of the Atomic Energy Licensing Act is expected to be completed by 2015⁷. The new version of the Law will enhance AELB’s powers of enforcement as well as its visibility and public communication procedures (see Recommendation 7).

4.6.2. *Assessment*

The review team considers that all actions already adopted or under implementation or planned to enhance human, financial and technical resources, as well as competence and independence of the AELB are in line with the background of Recommendation 6 and the IAEA relevant standards. It is concluded that the Government of Malaysia and AELB have fully implemented Recommendation 6.

The review team is of the opinion that the AELB might consider to further optimize the allocation of its resources at the site in the future, taken into consideration the low radiological risks at the plant arisen from the very low level of radioactivity of the materials handled, the possible future optimization of the environmental monitoring programme (see

⁷ The current Atomic Energy Licensing Act 1984 will be repealed and replaced by the new Act; Atomic Energy Act.

Recommendation 3), as well as the need to keep a high level of public visibility of its independent regulatory supervision.

The review team also considers that, given that all the AELB officers at the Lynas site are very young professionals, it is convenient to keep a high level of support and coordination with them from the senior officers at the AELB headquarters.

4.7. Recommendation 7

The AELB and the relevant Ministries should establish a programme for regularly and timely updating the Regulations in accordance with the most recent international standards. In particular, regulations pertinent to NORM activities relevant to the proposed rare earths processing facility should be considered and updated.

4.7.1. Findings

Various activities associated with this recommendation have taken place since the first IAEA review mission in May 2011. As mentioned above, the revision of the Atomic Energy Licensing Act, 1984 (Act 304) is currently underway and is expected to be completed by 2015. The AELB informed the review team that it now has a policy to review the regulations, and revise as necessary, every 3–4 years. The Atomic Energy (Radioactive Waste Management) Regulation was enacted in August 2011 and is consistent with the IAEA Safety Standards. The Basic Safety Radiation Protection Regulation (P.U.(A) 46), 2010, which is consistent with the 1996 version of the International Basic Safety Standards (the BSS), will be revised during the coming year to bring it in line with the latest version of the BSS [3]. The development of a new version of the Transport Regulation was started during 2011–2012 and the draft is currently being considered for approval by the Ministry of Science, Technology and Innovation (MOSTI). The draft is consistent with the 2009 version of the IAEA Transport Regulations (this being the current version when the draft was developed).

4.7.2. Assessment

A programme for regularly updating the regulations is in place. The updated regulations developed since May 2011 are consistent with the IAEA Safety Standards. The regulations are well up to date considering the lead time needed for their establishment. It is concluded that the AELB has fully implemented Recommendation 7.

4.8. Recommendations 8 and 9

- *The AELB should enhance the understanding, transparency and visibility of its regulatory actions in the eyes of the public, particularly those actions related to inspection and enforcement of the proposed rare earths processing facility.*
- *The AELB should intensify its activities regarding public information and public involvement. In particular, it should:*
 - a) *Develop and make available easily understandable information on radiation safety and on the various steps in the licensing and decision making processes;*

- b) *Inform and involve interested and affected parties of the regulatory requirements for the proposed rare earths processing facility and the programme for review, inspection and enforcement;*
- c) *Make available, on a routine basis, all information related to the radiation safety of the proposed rare earths processing facility (except for security, safeguards and commercially sensitive information) and ensure that the public knows how to gain access to this information.*

4.8.1. Findings

The AELB monitoring, data up to 20 km from the plant, are published on the AELB website (<http://www.aelb.gov.my>), alongside comparative background radiation levels in a range of Malaysian cities.

The AELB has also set up a corporate communication unit. In addition to the monitoring data, a substantial ‘Lynas Information Pack’ on the AELB website includes ‘Frequently Asked Questions’ to explain regulatory requirements and other issues relating to the Lynas plant, as well as to radiation safety issues in general.

The AELB began holding regular weekly news conferences on the Lynas issue in early February 2012, changing to monthly intervals from the end of April that year until September 2013, when regular briefings were halted because of falling media attendance. The AELB also issued a number of media statements on the licensing process during the 12 months leading up to the issuance of the TOL.

The Safety Case, Radioactive Waste Management Plan and Radiological Impact Assessment documents were made available for public viewing and comments between 3–26 January 2012. During this ‘public viewing exercise’, 334 people reviewed the documents and 1,123 items of feedback were received. An expert Public Consultative Committee (JKPA) evaluated the feedback, of which 200 items were deemed to have a technical and legal basis, resulting in additional requirements being placed on the TOL.

The Government of Malaysia has also been active in promoting greater public understanding of the Lynas plant operation related issues, producing a range of written information materials in key languages and organizing public and media briefings, particularly around the time the TOL was issued. In February 2012 it organized a scientific visit for local communities and journalists to a similar rare earth project in the People’s Republic of China. The Government also set up meetings for a broad range of stakeholders with the present IAEA review team as part of the International Post-Review Mission.

4.8.2. Assessment

The AELB has intensified its public information activities since the first IAEA mission, providing a range of material online and making documents available for public viewing and comment in order to enhance transparency and the visibility of its regulatory actions.

The Government has also developed a range of easily understandable public information materials on the Lynas plant and, more generally, on radiation-related issues, and has actively engaged with the media and other stakeholders. At the same time it has shown an understanding of the appropriate separation of communication roles between itself and Lynas

Malaysia Sdn. Bhd., and has actively encouraged the company to extend its stakeholder engagement.

Although the AELB adequately provides basic public information, there is room for it to develop more attractive materials in plain language to aid wider understanding of technical issues. These would explain basic facts not only about its regulatory activities and Lynas operations, but more generally about radiation and related issues of public interest. This would enhance perception of the AELB as an independent regulator and would be a source of credible information on radiological issues.

The IAEA review team notes that the AELB is taking active steps to enhance its capacity in public information, and that there are plans to include issues such as public acceptance and risk communication in the current revision of licensing legislation.

There is evidence that public comments made during the time-limited ‘public viewing exercise’ were analyzed and fed into the decision-making process before the TOL was issued. However, AELB explained that it no longer provides public access to key documents in the licensing process, because they belong to Lynas Malaysia Sdn. Bhd. Although the window for active public consultation may be legally limited, it is normal practice in many other countries for such documents to remain publicly available on an ongoing basis in the interests of transparency.

4.8.3. Follow-up suggestions

- The AELB is encouraged to reinforce and expand its communication activities, in order both to address continuing widespread misconceptions and to enhance its position as an authoritative and neutral source of public information on radiation safety. This would include keeping its online materials fully up-to-date and developing its own, easily understandable materials on radiation safety, radioactive waste management and other technical issues. It should also maintain an ongoing, proactive approach to relations with the media, public and other stakeholders, with a low threshold for engagement.
- The AELB and Lynas are encouraged to enhance further the transparency of the licensing process by making key documents publicly available on an ongoing basis, in line with common practice in many other countries. Transparency would be further reinforced by providing all key documents in both Bahasa Malaysia and English, to aid overall comparison.

4.9. Recommendation 10

Lynas, as the party responsible for the safety of the proposed rare earths processing facility, should be urged to intensify its communication with interested and affected parties in order to demonstrate how it will ensure the radiological safety of the public and the environment.

4.9.1. Findings

Lynas Malaysia Sdn. Bhd. has instituted a wide range of public information and stakeholder engagement activities since the first IAEA mission. These include:

- More than 50 local town-hall meetings in 2012, addressing over 10 000 people;
- Visits to the plant for nearly 3000 stakeholders so far, including politicians, academics, NGOs and local residents, to address misconceptions and provide information on Lynas operations in Malaysia, the rare earth industry, products produced, safety measures and monitoring data;
- A Visitors' Centre to provide information on Lynas and the rare earth industry;
- Media engagement including television, newspapers, online news portals and blogs;
- Outreach to schools, in collaboration with the State Education Department of Pahang, to inform students about the rare earth industry in Malaysia and associated career opportunities;
- Location of Environmental Management System (EMS) display real-time readings on radiation levels at AELB site office at the plant and at Kuantan Police Headquarters and real-time readings of air and water quality at Gate 1 of the plant.

The company has also established corporate social responsibility programmes with local communities, notably a pilot Hockey Development Programme for young people and an Ivory Tower Academy Programme providing financial support for academically gifted students to attend university locally or abroad.

Lynas says it plans to expand and improve these initiatives in future through monthly round-tables and get-togethers with journalists, including senior editors, and invitations to Members of Parliament (MP) to visit the plant. The company website states that 'Lynas' engagement with the Malaysian community will continue for the life of the plant.'

4.9.2. Assessment

The mission team noted a clear and substantial increase in Lynas' public information activities and engagement with stakeholders since the first IAEA mission in 2011. The company has carried out a broad communication programme including plant tours, media briefings and display panels showing real-time monitoring data, as well as launching corporate social responsibility projects with local communities.

The company website is geared mainly to investors, and although it carries information on the uses of rare earths, it does not appear to provide monitoring data or explanations of processes and safety procedures at the plant. If the company does not post such materials online — for example, through social media — they are not easy to locate.

Some stakeholders who met the IAEA review team expressed the request that the company publish monitoring data for liquid discharges as well as air monitoring data.

The IAEA mission team observed, during the public submissions, that public opposition to the LAMP appears to have eased considerably since the first review mission, and that most stakeholders now seem to be better informed about the plant. Nevertheless, there is evidence that opposition to the plant remains strong in some sectors of the public, and that at least part of this is based on persistent misconceptions about radiation safety and the nature of the materials at the plant.

4.9.3. *Follow-up suggestions*

- Lynas Malaysia Sdn. Bhd. is encouraged to maintain an ongoing, proactive approach to relations with the fullest possible range of stakeholders, including active opponents of the plant, keeping a low threshold for engagement and ensuring maximum transparency to address continuing widespread misconceptions.
- Lynas is encouraged to include more information about plant processes and safety on its corporate website, and should consider publishing discharge monitoring data as well as air monitoring data, to help further allay public concern.

5. CONCLUSIONS

The review team concluded that the Malaysian Counterparts (AELB, Government of Malaysia and Lynas Malaysia Sdn. Bhd.) have satisfactorily implemented all the recommendations formulated by the review team of the 2011 mission. After the analysis of all documentation provided by the relevant counterpart and examined by the review team and in addition to the observations collected during the site visit and the dialogue sustained with different stakeholders, it became evident that the radiological risks to members of the public and to the environment associated with the operation of Lynas Advanced Material Plant are intrinsically low. This finding does not come as a surprise as this is the case already observed in many industries that process NORM. The protection measures provided to the workers were considered satisfactory and need to be continuously improved by the operator.

On the side of the AELB, it has been seen that the organization has reinforced its presence at the site by establishing an on-site office with a number of staff members that is appropriate to the tasks that need to be accomplished. AELB as well as Lynas have also improved their relationship with different stakeholders by means of the implementation of a diverse range of communication and engagement activities.

The review team wants to highlight the atmosphere under which the review mission took place emphasizing the open, cooperative and transparent attitude sustained during the entire visit by all parts that interacted with the team. That has favored the maintenance of a cordial — but still very professional — working environment.

The review team wants to express that it took note of the fact that opposition to the implementation of the LAMP operations still exist amongst some stakeholders. In almost all the cases the fears demonstrated by those who oppose the continuation of the operations did not find any support on scientific evidence. Still some misconceptions exist and it has been requested that the IAEA could help in providing scientific based information to clarify any remaining issue that could contribute to sustain these fears. Those arguments that escaped the pre-established scope of the analysis the review team was tasked to perform according to the Terms-of-Reference of the mission were not object of consideration.

Although the review team mission was to check the extent of implementation of the recommendations made by the 2011 mission, it was found appropriate to formulate some follow-up suggestions. That is a normal practice in such missions and is also in line with the modern principle of continuous improvement that shall guide the activities of any industrial operation in the world. References to these suggestions were made in the body of this report and are summarized below:

1. A scenario in which the on-site residue storage facility becomes the disposal facility has not been considered. A scenario in which the Residue Storage Facility (as presently executed) becomes the Permanent Disposal Facility for the WLP solids, should be addressed and included in an update to the Safety Case and reflected in other supporting documents as appropriate.
2. The review team recommends that a more thoroughly approach to the quantification and definition of the management options for the waste to be generated in the decommissioning and remediation activities is taken. The disposal routes for these wastes should be more consistently defined.
3. The review team sees room for Lynas optimize its environmental monitoring program giving more emphasis on the aquatic pathway. In this regard the present RIA should be amended with results derived from a more detailed modeling of the ecological and public health impacts of radioactive effluents released into the Balok river.
4. At indoor workplaces where lanthanide concentrate is stored and handled and in less ventilated spaces, measurement of the PAEC (Potential Alpha Energy Concentration) due to thoron and its progenies is recommended.
5. The review team suggests that the fund's financial basis and adequacy be assessed against an appropriate estimate of the potential future liability e.g. an engineering estimate of projected WLP and decommissioning/environmental remediation waste volumes, PDF construction, etc. Further, documentation of the fund's basis, and any changes to its receipt schedule should be made publically available consistent with other key licensing documentation.
6. The AELB is encouraged to reinforce and expand its communication activities, in order both to address continuing widespread misconceptions and to enhance its position as an authoritative and neutral source of public information on radiation safety.
7. The AELB and Lynas are encouraged to enhance even more the transparency of the licensing process by making key documents publicly available on an ongoing basis, in line with common practice in many other countries. Transparency would be further reinforced by providing all key documents in both Bahasa Malaysia and English, to aid overall comparison.
8. Lynas Malaysia Sdn. Bhd. is encouraged to maintain an ongoing, proactive approach to relations with the fullest possible range of stakeholders, including active opponents of the plant, keeping a low threshold for engagement and ensuring maximum transparency to address continuing widespread misconceptions. It is also encouraged to include more information about plant processes and safety on its corporate website, and should consider publishing discharge monitoring data as well as air monitoring data, to help further allay public concern.

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APPENDIX I. LIST OF PARTICIPANTS

I.1. Review Team

IAEA STAFF MEMBERS	
Juan Carlos Lentijo Mission Leader	Division of Nuclear Fuel Cycle and Waste Technology
Horst Monken Fernandes Mission Coordinator	Waste Technology Section Division of Nuclear Fuel Cycle and Waste Technology
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Gill Tudor	Media and Outreach Section Office of Public Information and Communication
Eduardo Daniel Herrera Reyes	Incident and Emergency Centre Division of Nuclear Security
INTERNATIONAL EXPERTS	
Dennis Gordon Wymer	Private consultant, South Africa
Peter Schmidt	Wismut GmbH, Germany

I.2. Official Liaison Officer

Dr Mohd Mokhtar bin Tahar Undersecretary
Industry Division,
Ministry of Science, Technology and Innovation (MOSTI)

I.3. Attendance at the kick-off meeting between the Ministry of Science, Technology and Innovation (MOSTI) with International Atomic Energy Agency (IAEA) — Post Review Mission Members

9.30 a.m. – 4.00 p.m.

13 October 2014

Kuala Lumpur Room, Level 1, IOI Marriot Hotel, Putrajaya

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I.4.Attendance at the Stakeholders Consultation Session by the Ministry of International Trade & Industry (MITI)

2.00 – 6.00 pm

14 October 2014

Hyatt Regency Hotel, Kuantan

Group 1 (2:00 – 3:00 pm)

NO	NAME	ORGANIZATION	CONTACT / EMEL
2.00 - 2.15 pm			
1	Mr Rusli Che Husin, <i>Director</i>	Department of Environment (DOE)	Tel. 019-382 7146 Email. rch@doe.gov.my
2	Ms Noor Shahniyati Ahmad Shukri' <i>Principal Assistant Director</i>		Tel. 017-302 9862 Email shahnie@doe.gov.my
3	Mr Rozaimi Mat Zain, <i>Assistant Director</i>		Tel. 019-279 7606 Email. rmz@doe.gov.my
2.15 – 2.30 pm			
4	Ms Rosnizawati Baharom, <i>Deputy Director</i>	Department of Occupational Safety and Health (DOSH), Pahang	Tel. 012-476 1904 Email. rosnizawati.mohr@l.govuc.gov.my
5	Mr. Mohd Fahmi Mohammad, <i>Assistant Director</i>		Tel. 019-288 5479 Email. mdfahmi.mohr@l.govuc.gov.my
6	Mr Mohd Faezie Mahat, <i>Assistant Director</i>		Tel. 19-777 5633 Email. mfaeizie.mohr@l.govuc.gov.my
2.30 – 2.45 pm			
7	Dato' Mashal Ahmad, <i>Managing Director</i>	Lynas Malaysia Sdn. Bhd.	Tel. 019-388 8699 Email. Mashal.Ahmad@lynascorp.com
8	Prof Dr Ismail Bahari, <i>Radiological Safety Advisor</i>		Tel. 019-918 5261 Email. Ismail.Bahari@lynascorp.com
9	Mr Mike Vaisey, <i>VP Research & Technology</i>		Tel. 03-2726 6100
2.45 – 3.00 pm			
10	Ms Hamiza Hamzah, <i>Director</i>	Kuantan Municipal Council (MPK)	Tel. 013-933 6487 Email. hamiza@mpk.gov.my
11	Mr Muhammad Azha Abdul Rani, <i>Director</i>		Tel. 013-930 5957 Email. azha@mpk.gov.my
12	Mr Wan Zaid Wan Ahmad, <i>Asst. Engineer</i>		Tel. 019-986 2960 Email. wanzaid@mpk.gov.my

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3.00 – 3.15 pm			
13	Mr Mohd Zufadli Ramli, <i>Assistant Director</i>	Atomic Energy Licensing Board (AELB)	Tel. 019-955 2466 Email. zulfadli@aelb.gov.my
14	Mr Abdul Shukor Abdul Aziz, <i>Assistant Director</i>		Tel. 017-725 9945 Email. shukor@aelb.gov.my
15	Ms Lim Ai Phing, <i>Assistant Director</i>		Tel. 017-587 6781 Email. aplim@aelb.gov.my
3.15 – 3.30 pm			
16	Dr Ahmad Zufadli Mohamed Noor, <i>Medical Officer</i>	Pahang State Department of Health	Tel. 019-9801097 Email. drzulfadli@moh.gov.my
17	Dr Nur Aiza Haji Zakaria, <i>Senior Principal Assistant Director</i>		Tel. 012-921 0331 Email. drnuraiza@moh.gov.my

Group 2 (3:10 – 5:00 pm)

NO	NAME	ORGANIZATION	CONTACT / EMEL
3.40 – 3.55 pm			
1	Mr Mohd Rosdi Abd. Halim, <i>Assistant Secretary</i>	Pahang State Government	Tel. 013-991 4759 Email. mohd.rosdi@pahang.gov.my
2	Mr Razihan Adzharuddin, <i>Principal Assistant Director</i>		Tel. 019-3449965
3.55 – 4.10 pm			
3	YB Fuziah Salleh, <i>Member of Parliament (Kuantan)</i>	Member of Parliament (Kuantan)	Tel. 09-513 7970 Email. fuziah99@gmail.com
4.10 – 4.25 pm			
4	YB Lee Chean Chung, <i>State Assemblymen (Semambu)</i>	State Assemblymen	
4.25 – 4.40 pm			
5	YB Sim Chon Siang, <i>State Assemblymen (Teruntum)</i>	State Assemblymen Office	Tel. 09-513 8300 / 012-981 8819 Email. dunteruntum@gmail.com Email. adunteruntum@pahang.gov.my

Group 3 (5:10 – 6:00 pm)

NO	NAME	ORGANIZATION	CONTACT / EMEL
5.10 – 5.25 pm			
1	Mr Wan Emril Wan Embong, <i>Senior Law Lecturer</i>	NGO	Tel. 019-950 9137 Email. pro@kipsas.edu.my
2	Mr Nasrul Isyam Abd Hamid' <i>Pengarah</i>		012-9631893
5.25 – 5.40 pm			
3	Mr Hazman Jaafar, Headman, Kampung Tengah	Villagers Association	Tel. 019-999 9037
4	Mr Mazlisham Mahi, Members of Village Association		
5	Mr Rashid Jusoh, Secretary of Village Association		
5.40 - 5.55 pm			
6	Mr Tan Bun Teet, Secretary of Village Association	Save Malaysia Stop Lynas (SMSL)	Tel. 017-973 0576 Email. bunteet52@gmail.com
7	Mr Ismail Abu Bakar, Member		Tel. 019-953 0921 Email. abisma82@yahoo.com
8	Ms. Rahiza Zulkifli, Member		Tel. 013-923 2892 Email. rahizazulkifli@gmail.com

I.5. Attendance at the Stakeholder Engagement Session

2.00 – 6.00 PM

15 October 2014

IOI Marriot Hotel, Putrajaya

NO	NAME	ORGANIZATION	CONTACT / EMEL
2.00 – 2.30 pm			
1	Mr Hamrah Bin Mohd Ali <i>Director General</i>	AELB	Tel. 03-89225777 Email. hamrah@aelb.gov.my
2	Mr. Halim Abdul Rahman <i>Assistant Director</i>		Tel. 017-6553486 Email. halim@aelb.gov.my
3	Ms. Siti Afidah Awang <i>Assistant Director</i>		Tel. 03-89225888 Email. afidah@aelb.gov.my
2.30 – 3.00 pm			
4	Dato' Dr Muhamad Bin Lebai Juri <i>Director General</i>	Nuclear Malaysia	Tel. 019-387 7603 Email. mlebai@nuclearmalaysia.gov.my
5	Dr. Mohd Abd Wahab Bin Yusof <i>Director</i>		Tel. 03-89112000 Email. wahab@nuclearmalaysia.gov.my
6	Dr. Mohd. Ashhar Bin Haji Khalid <i>Deputy Director General</i>		Tel. 019-276 1932 Email. ashhar@nuclearmalaysia.gov.my
3.00 - 3.30 pm			
7	Dato' Dr Ahmad Kamarulnajuib Bin Che Ibrahim <i>Deputy Director General</i>	Department of Environment (DOE)	Tel. 603- 88712046 Email. aki@doe.gov.my
8	Ms Norlin Binti Jaafar <i>Director</i>		Tel. 0192892257 Email. norlin@doe.gov
9	Mr Rosli Bin Zul <i>Principal Assistant Director</i>		Email. roz@doe.gov.my
3.30 – 4.00 PM			
10	Dr Haji Daud Hj Abd Rahim <i>Head of the Occupational and Environmental Health</i>	Ministry of Health (MOH)	Tel. 019-7200199 Email. drhjdaud@moh.gov.my
11	Dr Ahmad Riadz Bin Mazeli <i>Senior Principal Assistant Director</i>		Tel. 0133673877 Email. ahmad_riadz@moh.gov.my
12	Dr Nor Saleha Ibrahim Tarmin <i>Senior Principal Assistant Director</i>		Tel. 0122059554 Email. drnorsaleha@moh.gov.my
4.15 – 4.45 PM			
13	Prof. Ahmad Termizi Ramli <i>(Representing National Professor Council)</i>	University Technology Malaysia (UTM)	Tel. 019-7258470 Email. termiziramli@gmail.com

NO	NAME	ORGANIZATION	CONTACT / EMEL
4.45 – 5.15 pm			
14	Mr Ahmad Fauzi Bin Awang	Ministry of Human Resources (MOHR)	Tel. 09-5132906 Email. ahmadfauzi@mohr.gov.my
15	Ir. Abdul Aziz Bin Yahya		Tel. 56236401 ext. 551 Email. abdulaziz_y@mohr.gov.my
5.15 – 5.45 pm			
16	Mr See Chee Kong <i>Director</i>	Ministry of International Trade & Industry (MITI)	Email. cksee@miti.gov.my
17	Mr Mohd Khairi Mohd Hanafiah <i>Assistant Secretary</i>		Tel. 03-62000322 Tel. 012-6995243 Email. khairi@miti.gov.my
18	Mr Abdul Rashid Bin Omar <i>Public Relations Officer</i>		Tel. 012-3274245 Email. rashid.omar@miti.gov.my
5.45 – 6.15 pm			
19	YBhg. Prof. Dato' Ir. Dr. Badrulhisham Bin Abdul Aziz	University Malaysia Pahang (UMP)	Tel. 019-9325027 Email. badhrulhisham@ump.edu.my
20	Dr Anwaruddin Hisyam		Tel. 016-9736240 Email. ahisyam@ump.edu.my

I.6.Attendance at the preliminary presentation by IAEA on report findings of the International Post-review Mission on the Radiation Safety Aspects of the Rare Earth Processing Facility Operation and Assessment of the Implementation of the 2011 Mission Recommendations

2.00 – 3.30 PM

16 October 2014

IOI Marriot Hotel, Putrajaya

NO	NAME	Organisation	CONTACT/EMAIL
1	YBhg. Dato' Sri Dr Noorul Ainur Mohd. Nur <i>Secretary General</i>	Ministry of Science, Technology & Innovation (MOSTI)	Tel. 03-8885 8021 Email.dr.noorul@mosti.gov.my
2	YBhg. Datuk Dr Rebecca Fatima Sta Maria <i>secretary general</i>	Ministry of International Trade & Industry (MITI)	Tel. 03- 62000028 Email. rebecca@miti.gov.my
3	YBhg. Datuk Dr Noor Hisham Bin Abdullah <i>Director General</i>	Ministry of Health (MOH)	Tel. 03-8883 2545 Email. anhisham@moh.gov.my
4	YBhg. Dato' Halimah Hassan <i>Director General</i>	Department of Environment (DOE)	Tel. 03-88712173 Email. hhh@doe.gov.my
5	YBhg. Dato' Dr Mohd Zzhar Bin Hj. Yahaya <i>Deputy Secretary General (Policy)</i>	MOSTI	Tel. 03-8885 8176 Email. drazhary@mosti.gov.my
6	Ms Norlin Jaafar <i>Director</i>	(DOE)	Tel. 03-88712156 Email. norlin@doe.gov.my
7	YBhg. Dato' Dr Muhamad Lebai Juri <i>Director General</i>	Malaysia Nuclear Agency	Tel. 019 – 3877603 Email. mlebai@nuclearmalaysia.gov.my
8	Mr Hamrah Mohd Ali <i>Director General</i>	Atomic Energy Licensing Board (AELB)	Tel. 03-8922 5777 Email. kp@aelb.gov.my
9	Dr Mohd Mokhtar Bin Tahar <i>Under Secretary</i>	Industry Division, MOSTI	Tel. 03-8885 8056 Email. mokhtar@mosti.gov.my
10	Mr Abang Othman Abang Yusof <i>Deputy Under Secretary</i>		Tel. 03-8885 8055 Email. aothman@mosti.gov.my
11	Mr Keshminder Singh <i>Assistant Secretary</i>		Tel. 03-8885 8286 Email. keshminder@mosti.gov.my

NO	NAME	Organisation	CONTACT/EMAIL
12	Mr Wan Muhammad Hilmi Wan Abu Bakar <i>Assistant Secretary</i>		Tel. 03-8885 8223 Email. hilmi@mosti.gov.my
13	Ms Alice Suriati Mazlan <i>Head of Corporate Communication</i>	MOSTI	Tel. 03-888508084 Email. alice@mosti.gov.my
14	Ms Hiswani Binti Harun <i>Senior Director</i>	MITI	Tel. 03-62015246 Tel. 019-3574503 Email. hiswani@miti.gov.my
15	Mr See Chee Kong <i>Director</i>		Tel. 012-3291635 Email. cksee@miti.gov.my
16	Ms Khidayu Binti Hamzah <i>Principal Assistant Secretary</i>		Tel. 012-2928244 Tel. 03-62000271 Email. khidayu@miti.gov.my
17	Mr Abdul Rashid Bin Omar <i>Public Relations Officer</i>		Tel. 012-3274245 Email. rashid.omar@miti.gov.my
18	Mr Mohd Khairi Mohd Hanafiah <i>Assistant Secretary</i>		Tel. 03-62000322 Tel. 012-6995243 Email. khairi@miti.gov.my
19	Mr Muhammad Sabri Bin Salleh <i>Head of Corporate Communication</i>		Email. sabri.salleh@miti.gov.my
20	Dr Hj Daud Bin Abdul Rahman <i>Head of the Occupational and Environmental Health</i>	MOH	Tel. 019-7200199 Email. drhjdaud@moh.gov.my
21	Dr Ahmad Riadz Bin Mazeli <i>Senior Principal Assistant Director</i>		Tel. 0133673877 Email. ahmad_riadz@moh.gov.my
22	Ms Zuhainim Abd Ghaffar <i>Principal Assistant Director</i>	DOE	Tel. 017-3529298 Email. zag@doe.gov.my
23	Ms Siti Afidah Awang <i>Assistant Director</i>	AELB	Tel. 03-89225888 Email. afidah@aelb.gov.my
24	Mr Halim Abdul Rahman <i>Assistant Director</i>		Tel. 017-6553486 Email. halim@aelb.gov.my
24	Ms Siti Saleha Binti Sofian Suri <i>Assistant Director</i>		Tel. 013-7766509 Email. sitisaleha@aelb.gov.my
26	Ms Esther Phillip	Malaysia Nuclear Agency	Tel. 012-3084831 Email. esther@nuclearmalaysia.gov.my
27	Ms Roha Binti Tukimin		Tel. 013-2945954 Email. roha@nuclearmalaysia.gov.my

NO	NAME	Organisation	CONTACT/EMAIL
28	Ms Fairus Suzana Mohd Chachuli		Tel. 03-89112000 Email. fairuz@nuclearmalaysia.gov.my
29	Dr Mohd Abd Wahab Bin Yusof <i>Director</i>		Tel. 03-89112000 Email. wahab@nuclearmalaysia.gov.my
30	Mr Kodir Bin Baharom <i>Deputy Under Secretary</i>	Ministry of Natural Resources and Environment (NRE)	Tel. 03-8886 1126 Email. chekodik@nre.gov.my
31	Ms Cheryl Barr Kumarakulasinghe <i>Principal Assistant Secretary</i>		Tel. 012-278764 Email. cherylbk@nre.gov.my
32	Ybhg. Dato' Kamilan Maksom	Ministry of Foreign Affairs	
33	Ms Tan Tsu Yinn		Tel. 012-6947733 Email. tsiuyinn@kln.gov.my

APPENDIX II. LIST OF REFERENCE MATERIAL PROVIDED BY MALAYSIAN COUNTERPART

II.1. AELB's documents

- [1] Laws of Malaysia, reprint, Act 304, Atomic Energy Licensing, Act 1984, Incorporating all amendments up to 1 January 2006
- [2] Atomic Energy Licensing Act 1984, Atomic Energy Licensing (transport) regulations 200
- [3] Draft of the Nuclear Act under Review, Atomic Energy Act 201_
- [4] Checklist for Application of Class A (milling)
- [5] Checklist for Application of Class G License
- [6] Checklist for the Preparation of Decommissioning and Disposal (D&D) Plan [Application of Class A-milling (Temporary Operation Stage) Licence]
- [7] Checklist for the Preparation of Emergency Response Plan (ERP) [Application of Class A — Milling (Temporary Operation Stage) License]
- [8] Checklist for the Preparation of Radiological Impact Assessment (RIA) [Application of Class A – milling (Temporary Operation Stage) License]
- [9] Checklist for the Preparation the Safety Case for Waste Disposal [Application of Class A-milling (Temporary Operation Stage) License]
- [10] Checklist for the Preparation of Radioactive Waste Management Plan [Application of Class A-milling (Temporary Operation Stage) License]
- [11] AELB inspection and monitoring for Lynas Advanced Material Plant (LAMP)
- [12] Results for Environmental and Radiation Monitoring Program (Pre-Operational and Temporary Operating License) carried out by AELB Inspectors
- [13] Guidelines for the application of license from the Atomic Energy Licensing Board for milling of materials containing or associated with radioactive materials (LEMTEK 28)
- [14] Guidelines on radiological monitoring for oil and gas facilities operators associated with Technologically Enhanced Naturally Occurring Radioactive Materials (TENORM) (LEMTEK 30)
- [15] Guidelines for the preparation of a radiation protection program for tenorm activities (LEMTEK 45E)
- [16] Guidelines for decommissioning of facilities contaminated with radioactive materials (LEMTEK 56)
- [17] Guidelines for decommissioning of facilities contaminated with radioactive materials (LEMTEK 58)
- [18] License's conditions for TOL

II.2. Documents submitted by licensee

- [1] Decommissioning Plan, Lynas Advanced Materials Plant, Gebeng Industrial Estate, Sg. Karang, Kuantan, Pahang, Malaysia D&D Plan
- [2] Environmental Monitoring Programme
- [3] Radiation Protection Programme
- [4] Radiological Impact Assessment of LAMP
- [5] Safety Case for radioactive waste disposal Lynas Advanced Materials Plant, Gebeng industrial estate, SG. Karang, Kuantan, Pahang, Malaysia
- [6] Radioactive Waste Management Plan, Lynas Advanced Materials Plant, Gebeng Industrial Estate, Mukim Sg. Karang, Daerah Kuantan, Pahang Darul Makmur, Malaysia

II.3. Other documents

- [1] Description and critical environmental evaluation of the REE refining plant LAMP near Kuantan/Malaysia. OEKO Report 2013 Prepared on behalf of NGO “Save Malaysia, Stop Lynas” (SMSL), Kuantan/Malaysia
- [2] A review on the OEKO-Institute Report
- [3] Analysis of public review of Lynas documents, Atomic Energy Licensing Board, Ministry of Science, Technology and Innovation (MOSTI), MALAYSIA
- [4] FAQ Related to LYNAS (M) SDN. BHD.’s Project
 - Press conference AELB on Lynas issue
 - Summary of the Committee (report of public engagement done by JKPA)
 - The 31 recommendations from the PSC

APPENDIX III. MISSION TERMS OF REFERENCE

International Post-Review Mission on Radiation Safety Aspects of the Rare Earth Processing Facility in Malaysia

1. Introduction

On 3 May 2011, the Malaysian Government approached the IAEA with a request to organize an independent expert review of the radiation safety aspects of the rare earths processing facility that was being constructed in the country. That facility formed part of the Advanced Materials Project being developed by the Lynas Corporation Ltd. The IAEA's Director General Mr Yukiya Amano agreed to offer the IAEA's support. The Lynas Advanced Materials Project (LAMP) now includes the mining and concentration of rare earth ore at Mt Weld, Western Australia, followed by shipment of the concentrate to a rare earth processing facility at Gebeng, Pahang State, Malaysia, where further processing takes place to produce high purity rare earth compounds.

The mission was implemented in the period of 29th May to 3rd June 2011. The IAEA assembled a team of international experts using the mechanism established in terms of its technical cooperation programme. The review team was composed of experts, on Radiation Protection (occupational, public and environment – including monitoring system, Waste Management, Decommissioning and Environmental Remediation, Transport and Safety Assessment, coming from Canada, India, the Netherlands, South Africa, the United Kingdom and the IAEA. Members of the review team had a wide knowledge of the IAEA safety standards and broad professional experience in their respective disciplines that allow them to cover the overall scope of the mission. To preserve the international expert panel's impartiality, the review team did not include individuals whose participation could have led to a conflict of interest.

The review team provided a Mission Report that contained a total of 11 (eleven) recommendations divided into Technical Recommendations, Public Communication Recommendations and Follow-up Recommendations. The full report has been made publicly available and can be found at <http://www.iaea.org/newscenter/news/pdf/lynas-report2011.pdf>

One of these recommendations encouraged the Malaysian authorities to preparing an action plan and schedule for addressing the recommendations with the potential for organisation of a follow-up mission aimed at reviewing the fulfilment of recommendations 1 – 10 as depicted in the 2011 Mission Report, something that is common to other similar IAEA review missions.

In line with the aforementioned context, the IAEA received on 1st July 2014 a report from the government of Malaysia addressing the implementation status of the 2011 IAEA Review Mission recommendations and a request to undertake in the field a "Post-Review Mission on the Radiation Safety Aspects" of the facility and to assess the implementation of the prior mission's recommendations.

This document, developed in consensus with the Malaysian authorities during a meeting in the IAEA Head Quarters in Vienna on the 26th and 27th of August 2014, provides for the Terms of Reference of the Post-Review Mission including the objective, scope and mutual responsibilities in carrying out the overall review process.

2. Objective

The objective of the present mission is to review and evaluate the fulfilment of the recommendations 1–10 provided in the 2011 IAEA Review Mission as implemented by the Malaysian authorities and/or Lynas Corporation Ltd.

3. Scope

The scope of the Post-Review Mission will be limited to cover Safety and Operational Aspects that have been already addressed in the 2011 Mission as to include:

- Radiation Protection - occupational, public and environment — including Monitoring Systems
- Safety Assessment
- Waste Management; and
- Decommissioning and Environmental Remediation

The review will assess the adequacy and appropriateness of the implementations made toward the previous review mission recommendations, and based primarily upon documentation and data provided by the Malaysian Government and other stakeholders, and as requested by the Mission Team, prior to and during the Review Mission. Interviews, presentations, and discussions will be held during the mission to Malaysia as appropriate.

4. Modus Operandi

The working language for the Post-Review Mission will be English.

Two coordinators will be appointed, one each respectively by the Government of Malaysia and the IAEA.

The appointed coordinator from the Malaysian Government will be responsible for:

- being the sole representative of the Malaysian Government to liaise on administrative matters with the IAEA Coordinator;
- providing supporting documentation in English to the IAEA Coordinator in a timely manner as per needs of the review team;
- ensuring that advance questions, if any, from the experts are passed to appropriate specialists within the Malaysian Government and its supporting organizations, and other stakeholders, where appropriate;
- making administrative arrangements within Malaysia for the review mission; and
- assisting to collate Malaysian comments related to the draft review report for factual accuracy, and to providing feedback on the experience of the review mission.

The IAEA Coordinator will be responsible for:

- liaising with the appointed coordinator from the Malaysian Government;
- coordinating all IAEA activities relating to the review mission;
- assembling the review team;
- supervising and coordinating the drafting and publication of the report.

The review process will include preparatory work of the Post-Review Mission itself and reporting. It will involve:

- Submission of any relevant documents by the Malaysian Government to the IAEA. All the documents will be reviewed vis-à-vis the appropriate Safety Standards that will be used by the Mission Team in the review process.
- Submission of advance questions and issues from the review mission team to the Mission Coordinator from the Malaysian side for discussion during the Post-Review Mission;
- Preparation of a detailed agenda for the Post-Review Mission by the IAEA Mission Coordinator in consultation with the Malaysian Mission Coordinator. The detailed agenda would include, open and closed working session (i.e. exclusive for the review Mission Team), presentations by the Malaysian stakeholders and their supporting organizations, follow-up question and answer sessions, etc.;
- The on-site component of the Post-Review Mission will take place from the 13th to the 17th of October ;
- Presentation by the Mission Team leader of the main findings and initial recommendations of the Post-Review Mission Team at the close of the on-site component in Malaysia.
- Editing and finalization of the report of the Post-Review Mission Team at the conclusion of the mission. The Malaysian Government will be asked to fact check the final draft report; and,
- Publication of the final report by the IAEA.

5. Review Team

The IAEA will select a team of recognized international experts to perform the review according to the present Terms of Reference. The post-review team will be comprised of the selected experts and IAEA staff with experience in the areas to be covered by the post-review mission. The IAEA may consult with the Malaysian Government regarding the composition of the proposed Post-Review Mission Team prior to conducting the mission. However, the final decision with regard to the selection of international experts rests with the IAEA. To preserve impartiality, the review team will not include individuals whose participation may lead to or suggest conflict of interests.

The review team leader will be Mr Juan Carlos Lentijo, Division Director of the Division of Nuclear Fuel Cycle and Waste Technology.

The expert specialists, selected from IAEA Member States, will have knowledge of IAEA Safety Standards and broad professional experience in their respective disciplines, in

particular those radiation safety aspects related to rare earth processing including the management of wastes and residues arising from this type of operation. The expertise of the review team may include, but not be limited to, the following topics:

- Regulatory control and radiation protection (occupational, public and environmental);
- Safety assessment;
- Waste management
- Environmental monitoring and surveillance;
- Decommissioning and environmental remediation; and,
- Public communications

6. Independent Observers

The Malaysian Government has the option to allow observers (for example, local community representatives, other agencies of the Government of Malaysia, Non-Governmental Organizations or persons from neighbouring countries) at any open-ended plenary sessions to be held between Malaysian Government representatives and the international post-review mission team. The Malaysian Government should provide the IAEA with names and contact information of observers who accept an invitation to participate in a specific activity of the post-review mission.

7. Reporting

The Post-Review Mission Team will prepare a report that documents its findings and recommendations. The report will reflect the collective views of the team members in the context of international Safety Standards. The Post-Review Mission report will be discussed with the Malaysian Government prior to its finalization for the purpose of fact-checking only.

8. Tentative Schedule

- Selection of the Mission Team by 31st July
- Preliminary Meeting with Malaysian Government representatives and Lynas Corporation staff at the IAEA to prepare the mission – 26 and 27 August 2014
- Documents to be sent by Malaysian authorities by 10th of September
- Submitting preliminary questions raised by the Mission Team to the Malaysia authorities by 30th September 2014
- Review meeting to take place in the period from the 13th to 17th October 2014
- Presentation of the main findings and initial recommendations at the close of the review mission in Malaysia by 17th October 2014
- Completion of the draft report by 30th October 2014
- Publication of the final report

9. Supporting Documentation

- The Final Update Status of 11 Recommendations by IAEA-1 July 2014.doc as submitted with the Post Review Mission request from the Malaysian government.
- Other specific documents and data to be requested and as referenced in Appendix IV.

10. IAEA Reference Documents

The findings and recommendations of the international Mission Team will be based upon the IAEA's Safety Fundamentals and applicable IAEA Safety Requirements. As appropriate, IAEA Safety Guides and other IAEA Technical Reports will also be used by the Mission Team in its assessment and derived recommendations⁸. The applicable IAEA reports are listed below:

1. Fundamental Safety Principles, IAEA Safety Standards Series No. SF-1 Vienna (2006),
2. Governmental, Legal and Regulatory Framework for Safety, General Safety Requirements Part 1, IAEA Safety Standards Series No. GSR Part 1 Vienna, (2010),
3. Radiation Protection and Safety of Radiation Sources: International Basic Safety Standards. IAEA Safety Standards Series No. GSR Part 3 (Interim) Vienna, (2011)
4. Predisposal Management of Radioactive Waste, IAEA Safety Standards Series No. GSR Part 5 Vienna, (2009),
5. Management of Radioactive Wastes from the Mining and Milling of Ores, IAEA Safety Standards Series No. WS-G-1.2 Vienna, (2002),
6. Release of Sites from Regulatory Control on Termination of Practices, IAEA Safety Standards Series No. WS-G-5.1 Vienna (2006),
7. Environmental and Source Monitoring for Purposes of Radiation Protection, IAEA Safety Standards Series No. RS-G-1.8 Vienna, (2005),
8. Occupational Radiation Protection in the Mining and Processing of Raw Materials, IAEA Safety Standards Series No. RS-G-1.6 Vienna, (2004).
9. Application of the Concepts of Exclusion, Exemption and Clearance Safety Guide, Safety Standards Series No. RS-G-1.7, Vienna, (2004)
10. IAEA Safety Report Series No.49 "Assessing the Need for Radiation Protection Measures in Work Involving Minerals and Raw Materials" Vienna, (2006)
11. Radiation Protection against Radon in Workplaces other than Mines, Safety Reports Series No. 33, Vienna (2003)
12. Monitoring and Surveillance of Residues from the Mining and Milling of Uranium and Thorium, Safety Reports Series No. 27, Vienna, (2002)
13. Extent of Environmental Contamination by Naturally Occurring Radioactive Material (NORM) and Technological Options for Mitigation, Technical Reports Series No. 419, Vienna (2003);
14. Radiation Protection and NORM Residue Management in the Production of Rare Earths from Thorium Containing Minerals Safety Reports Series No. 68, Vienna, (2011)

⁸ The international experts may draw upon various supporting documents to supplement their findings and recommendations, such as IAEA technical reports.

15. Management of NORM Residues. IAEA TECDOC 1712, Vienna, (2013)

11. Funding of the Post Review Mission

The Follow-up review mission will be funded through the relevant IAEA TC Project.

**APPENDIX IV. REQUESTED DOCUMENTS TO BE SENT BY MALAYSIAN
AUTHORITIES PRIOR TO THE MISSION ACCORDING TO ITEM 8 OF THE TOR
— TENTATIVE SCHEDULE**

- 1) All elements of the TOL issued on September 3, 2012
- 2) Recommendations given by the Parliament Select Committee containing 31 topics (after the appreciation of the public comments on Lynas Project)⁹
- 3) Copy of the monitoring data - also to include the report from Lynas on its monitoring program. Any pre-operational monitoring data collected by Lynas up to December 2012 would be helpful. AELB order requesting this information would also be useful¹⁰
- 4) Waste Management Plan prepared by Lynas prior to the TOL and plan for siting the PDF (Permanent Disposal Facility) after TOL (accompanied by the AELB order that requested the waste management plan and RIA for the TOL)
- 5) Improved RIA i.e. updated one
- 6) Waste Management Plan for the decommissioning phase
- 7) Expert responses to the OKOS Report
- 8) Document provided by Lynas on Decommissioning costs (with, if possible, calculations or comparisons for establishing financial; deposits to cover long-term waste management and D&D). The Decommissioning plan accompanied by the AELB order requesting the D&D plan should also be presented. The schedule of payments expected until the fund is completed should also be made available.
- 9) Draft of the Nuclear Act under review¹¹
- 10) Radioactive Waste Management Legislation
- 11) Inspection procedures used by AELB inspectors on-site and a sample of a report produced by an inspection. It would also be useful to have a description of organisation charts (AELB) with titles, qualifications of personal, training plans etc. that support the assertion that sufficient competent human resources are available for AELB controlling(monitoring) and enforcement responsibilities.
- 12) Application by Lynas to release NUF and FGD residues from regulatory control and AELB order of October 17, 2013 discharging these residues from further regulatory control.
- 13) A list of recognized stakeholders and — if any — a program for monitoring the effectiveness of communications.

⁹ Only the Executive Summary is needed

¹⁰ Data should be readily identified as to location, sampling and assessment methodology

¹¹ Relevant articles/paragraph dealing with NORM would be enough