

The Chairman,  
Datuk Seri Mohd Khalid Nordin  
Parliamentary Select Committee,  
Malaysia.

Dear Sir,

Re: The Lynas Refinery in Gebeng, Kuantan

On behalf of the Senior Citizen's Group, I would like to present this Memorandum on the above matter for your review and suggestion for your consideration.

2. The following refrain may give you a better understanding of our fears and concerns:

If you prick us, do we not bleed?

If you tickle us, do we not laugh?

If you poison us, do we not die?

And if you wrong us, do we not fight?

3. This group sincerely hope that the PSC will be absolutely impartial in your report to Parliament after you have completed your findings.

Thank you.

Your Truly,

b/p TAN CHIN HUA  
Senior Citizens' Group  
Date : 10/05/2012

## An Understanding of the Lynas Refinery, Gebeng

1) Lynas was issued a Class A Milling License valid until 18-09-2012 by AELB. Essentially Lynas is involved in the processing of rare-earth, or LANTHANIDES, to obtain rare earth oxides. It will use a lot of sulphuric acid necessary for its production, besides other acids, and, of course, water.

What are rare earths or LANTHANIDES? Listed below is the list of rare earth

Elements	Atomic Number	Atomic Weight
LANTHANUM	57	138.9
CERIUM	58	140.1
PRASEODYMIUM	59	140.9
NEODYMIUM	60	144.5
PROMETHIUM	61	147.0
SAMARIUM	62	150.4
EUROPIUM	63	152.0
GADOLINIUM	64	156.9
TERBIUM	65	159.2
DYSPRYSIUM	66	162.5
HOLMIUM	67	164.9
ERBIUM	68	167.2
THULIUM	69	169.4
YTERBIUM	70	173.0
LUTETIUM	71	175.0

These are naturally occurring radioactive elements which are of immense commercial value.

During the processing of rare earth using sulphuric acid to produce rare earth oxides, radiation is irradiated. Under high temperature the atoms of all elements will certainly react with one another. Their nuclei will split and integrate creating new isotopes, and in the process, emit radiation – in the form of alpha, beta and gamma rays. A seemingly non-radioactive element eg. IODINE-30, can become radioactive when the isotopes of Iodine-129 and Iodine-131 are created. They are particularly harmful to humans as they can cause cancer to the bone (marrows) and leukemia.

2) Now I would like to quote an article published in The Sun, March 09, 2012 by a Dr. Looi Hong Wah. He said:

a) Potassium – 40, when absorbed, is distributed more uniformly throughout the human body, mostly in the muscle tissue, which is among the least sensitive of the body's tissues (the most sensitive tissues are the lymphoid glands, bone narrows, blood, testes, ovaries and intestines.)

b) Thorium – 232 is poorly absorbed from the gastrointestinal tract, but much more readily via an Inhalation Route, 70% of thorium entering the blood stream localizes in the bones where it is retained with a biological half life of 22 years, all that while irradiating the blood-forming tissues with alpha particles which are 20 times more damaging than beta or gamma radiation. The half life of Thorium – 232 is 14 billion years.

3) (i) Below regulatory dose limit of 20 mSv/yr for workers and 1 mSv/yr for the public imposed by the Atomic Energy Protection Regulations 2010 enforced by AELB.

(ii) During LAMP operations, Lynas will enforce a more stringent dose constraint of 6 mSv/yr for workers and 0.3 mSv/yr for the public.

(iii) The analysis concluded that Handling Transport Storage of the residues will not cause undue radiological risk to workers and members of the public.

When, Where and How was the analysis concluded ? How many people were involved using what parameters of comparison to conclude that ' it will not cause undue radiological risk to workers and members of the public'. Please clarify with proof of data. But this statement also admits and confirms without a shadow of a doubt that there is radiological risk to members of the public!

4) Lynas also stated in its Revision 3 Documents which were made public and displayed at SUK Kuantan. I refer, in particular, to the following:

Ref : 3.3.4.1 Radiation Safety

Critical Individual / Group	Calculated Dose received (mSv/yr)
1. Process Operator (WLF residue filtration process at the pressure filter area)	0.86
2. RSF Operator (WLF residue handling at the RSF)	3.07
3. Truck Driver (save as (2) above)	2.96
4. Public Residing off-site (1 km radius of Lynas)	0.002 (Fencing Area)

- WLF : Water Leach Purification

It is obvious, then, that the threat of radiation which can cause deformities in unborn babies and cancer to the living is very REAL and merits fear and grave concern.

5) (i) The safe level/thresholds of the public and 20 mSv/yr for occupational workers quoted by Dr Looi Hoong Wah, AELB and IAEA are derived from ICRP risk models which are currently under close scrutiny and challenge, in the wake of excess childhood leukemia near nuclear power plants that can't be explained by radiation exposures which are much below the 'safe threshold'. A UK expert panel, for instance (2004, [www.cerrie.org](http://www.cerrie.org)) could not arrive at a consensus regarding the health risks of low level exposure to internal emitters (inhaled or ingested radioactive particles). Opinions among the UK panel members ranged from negligible adverse effects to an underestimation of risk by at least a 100 - fold.

Hence, nobody really knows at this point how hazardous, toxic and dangerous the Lynas refinery may turn out to be.

Assurances and reassurances are needed to dispel the concerns and fears of the public and to calm the citizenry.

By way of illustration, what is Radiation? To radiate means to produce heat and/or light. And radiation is a burst of energy that comes from a nuclear reaction and that can be very dangerous to health. Radiation is also energy from heat or light source that cannot be seen.

The Lynas refinery uses rare earth to produce rare earth oxides necessary for the production of certain goods like magnets which are highly sought after by the electronics industry etc.

The rare earth or lanthanides are naturally occurring radioactive elements. When sulfuric acid and water is added to these elements radiation is produced. The waste is also radioactive yet it has been re-categorized as chemical residue by AELB.

Does it mean, then, that was made public displayed at SUK; Lynas has irrevocably stated that the lanthanide oxides/waste generated radiation.

That in processing rare earth a small amount of Thorium-232 is produced in the waste product. Is thorium-232 harmful? Let me digress a little.

Radiation comes from the Latin word, RADUS, meaning a beam of ray. It can mean one of the ways in which energy is transmitted or spread through space. In heat, energy can be transmitted by conduction, convection and by radiation. Radiation can also mean one of the kinds of energy transmitted. Thus light, radio waves, X-rays, the rays given off by radiations are alpha and beta rays given off by radium and also cosmic rays which are gamma rays known also as electro-magnetic rays.

What are these rays?

1. Alpha rays are particles comprising of a pair of protons bound together with a pair of neutrons to form a HELIUM nucleus. Their double positive charge makes them interact strongly with atoms in their path, so they dump all their energy very quickly whenever they

encounter matter. Once inside the human body, they can be very damaging to living cells in their close proximity.

2. Beta rays are simply fast electrons, being negatively charged, are ejected by a radioactive nucleus seeking to improve its positive charge for better stability. Beta decay therefore complements alpha decay, and is more penetrating than alphas. Of lighter mass, they lose less energy per collision with matter and travel further, dispersing the damage they cause. Beta burns suffered by humans are caused by carbon-14, the major beta emitter in the body.
3. Gamma rays are highly energetic electro-magnetic waves, emitted by radioactive nuclear processing too much energy for their long term stability. Gamma rays carry no electric charge but are very penetrating. Several cm of lead or meters of concrete are needed to shield it.

Excessive exposure to gamma rays can overwhelm the body's defenses. A good example is the radioisotope <sup>99m</sup>Tc used in body scans for medical diagnostics.

4. Another kind is NEUTRON radiation being uncharged, neutrons are very penetrating and intensely harmful to human tissues. Being radioactive, they decay with a half life of 12 minutes when they are outside an atomic nucleus.
5. Muons, also radioactive, decay in microseconds into Beta rays.
6. Every radioactive element or isotopes has its own half life. If an isotope has a half life one hour and a second isotope has a half life of half hour, its second isotope will decay more rapidly than the first isotope. Hence, its radioactivity is twice as great. This leads to the rule that "the activity of radioactive elements is inversely proportional to its half life".

7. The two most important radioactive isotopes in the human body are carbon-14 with a half life of 5730 years, and potassium-40, with a half life of 1.28 billion years. Hence potassium-40 is less active than carbon-14.

The danger with beta radiation is that betas are accompanied by gamma rays. They cause damage at any point where there is enough matter to absorb them so they can irradiate others. But not all radiation is alike. The clouds of radioactive particles released from the Japanese reactors in Fukushima are spent fuel pools containing dozens of fission by-products with distinct properties and effects on humans.

At very low doses, health risk is negligible. But cumulative exposure can cause radiation sickness and increase the risk of cancer.

8. Let me quote another case

On Tuesday 03 January 1961, three men : RICHARD LEGG, JOHN BYRNES, RICHARD MCKINLEY, were directed to pull out the control rod of reactor SL-1, located at the National Reactor Testing station in Eastern Idaho, but BYRNES pulled it up by about two (2) feet whereas it should be about 4 inches causing the reactor to blow –up. (Human error)

This was the deadliest nuke disaster that took place in the US at that time. The US government tried to hush up but failed.

This tragedy highlights to us that the best laid plans may go astray because of human error or non-compliance with procedure.

9. So, what are the radioactive by – products of the lanthanide wastes/residues? We would like Lynas to come clean and tell the public. How do they intend to contain the irradiation of the radioactive wastes/residues? We expect an answer to these unanswered questions: from Lynas, from the relevant authorities like AELB and DOE.



## **A brief acquaintance with radioactive / radiation**

The word 'atom' is derived from the Greek word 'atomos' which means indivisible, a theory of Democritus (400 BC)

One atom can be converted into another. It is only 1millionth of a millimeter across.

The numbers are so unwieldy atoms have their own mass scale. The standard is taken from a particular atom of carbon and gives the atomic weight of exactly 12. For example, the atomic weight of hydrogen is 1 and that of oxygen is 16.

The nucleus of an atom is made up of protons and neutrons. Protons have electrical charges; neutrons do not. The number of protons in a nucleus is always the same as the number of electrons moving round the nucleus and making up the rest of the atom. How an atom behaves depends on its electrons and protons and not on neutrons, in a chemical reaction. The number of electrons and protons makes up an atom of one element rather than another.

For example:

- a) Uranium – 238 has 146 neutrons and 92 protons making up its atomic weight 238.
- b) Uranium – 235 has 143 neutrons and 92 protons making up its atomic weight 235.

An electron can jump from an inner to an outer shell if there is collision with another atom.

Lynas did admit the mineral concentrates contain radioactive material, but that it is at very low level.

Lynas also admit that the rare earths contain very low levels of THORIUM and that they are naturally occurring radioactive. Lynas is extracting USEFUL elements from rare earths i.e. Lanthanides.

During processing of rare earths, what actually happens? What are the waste products? Kuantan residents especially and the public have the right to know and be told the truth.

A doctor said THORIUM 232 is safe, that the 0.09 MeV of gamma radiation detected comes from THORIUM 228's decay to Radium 224 to Radon 220 to Polonium 216 to lead 208.

But he also stated that in processing the rare earth a small amount of THORIUM-232 is produced in the waste product.

Please clarify admit or refute based on facts, not speculation to alleviate the doubts and concerns of the public.

Why talk about gamma rays only? What are alpha and beta rays? Are they non-radioactive? Can they not aggravate?

What is the danger level of radiation when processing rare earths? Why is there no mention that radioactive is penetrative or accumulative in the human body?

To recap: radiation comes from the Latin word RADUS, meaning a beam of ray. It can mean one of the ways in which energy is transmitted or spread through space. On heat, for example, energy can mean one of the kinds of energy transmitted in the last of these rays.

Thus light, radio waves, X-rays, the rays given off by radioactive substance like radium and cosmic rays and all forms of radiation.

Some forms of radiation are tiny particles of matter. Others have no solidarity and are called electro-magnetic rays. Among the particle radiations are the alpha and beta rays given off by radium and also cosmic rays, which are atomic particles travelling through outer space. Among the several kinds of electro-magnetic radiations are gamma rays, X-rays, ultra-violet rays/lights, ordinary visible lights, infra-red lights, micro waves used in radar and radio waves.

The radiation waves differ from water waves or sound waves in two ways: they can travel through empty space and at enormous speed, about 300 million kilometers a second. The only difference between the different kinds of electro-magnetic radiation is that they have different wave lengths. The wave length may be measured in nanometers. A nanometer is  $\frac{1}{1\,000\,000\,000}$  of a metre; or an angstrom unit which is equivalent to  $\frac{1}{10}$  of a nanometer. Gamma rays are given off by radioactive substances such as Uranium and Radium, and also when atomic nuclei are split. Radioactive substances shoot out tiny particles or rays; some of these substances occur in nature but others are made artificially.

## **RADIOACTIVE MATERIALS – ISOTOPES**

Isotopes have atoms with the same number of protons but with different number of neutrons. Isotopes can be man made. Isotopes of the same element have the same atomic number. This number identifies the characteristic chemical properties of an element. For example: Joliot-Curies created a new substance with 15 protons and 15 neutrons weighing 30. Chemically, the new substance (man-made) is also PHOSPHOROUS, created from Aluminums bombarded with Alpha particles. This new isotope of phosphorous is also radioactive.

Alpha rays are the nuclei of helium atoms. Each particle consists of 2 neutrons and 2 protons. The complete helium atom has 2 electrons moving around the nucleus. The nuclei of radioactive elements are unstable because they are so heavy. Beta rays consist of electrons. These are tiny particles of electric charge.

Gamma rays are electro-magnetic waves of very short wave length. They are like X-ray except that they have higher energies, and this increases their penetration i.e. their ability to go through matter. The rays given off by radioactive substances are ionizing rays which means they are able to break up the molecules of gases to pieces which bear electric charge.

## Waste or Residues?

- 1. FGD : relative PURE GYPSUM material termed GYPSUM, Synthetic
  
- 2. NUF : magnesium-rich product processed unto magnesium-rich GYPSUM
  
- 1.1 FGD : Flue Gas Desulphurisation Residue
- 2.1 NUF : Neutralisation underflow Residue
  
- 3.0 WLF : Water Leach Purification Residue

According to the Atomic Energy Licensing Radioactive waste Management Regulations 2011, FGD and NUF can be classified as materials containing levels of radionuclide at activity concentrations less than those specified under the Second Schedule of regulations which can be removed from the Board.

Lynas also claimed that FGD and NUF can be classified as scheduled wastes under Scheduled One of the Environmental Quality (Scheduled Waste Regulations) 2005.

Hence, these waste residues will potentially be governed under the Environmental Quality Act 1974 (EQA 1974) and subsidiary regulations enforced by the department of Environment (DOE).

At the beginning FGD and NUF were classified as radioactive waste regulated under Act 304 enforceable by AELB.

In May 2011 IAEA reclassified FGD and NUF as non-radioactive waste streams for the purpose or regulations.

The residents of Kuantan and the public call upon the relevant authorities to admit, which in fact they have, that the rare earths produce radioactive waste.

No amount of hiding behind technical classification can negate the existence of radiation and the emission of radiation during the processing of rare earths. So, what really is the matter?

## **We refer to Lynas**

Lynas considers its operation as 'residues' because waste streams can be processed and commercialized in a variety of applications.

It is alleged that 28% of Lanthanide oxide of high purity is produced. Are these oxides radioactive, toxic and hazardous? How do they impact on us humans?

In its document made public, Lynas has stated that the waste is radioactive though the refinery has been re-categorised as a Normal Chemical Plant.

In fact, the documents stated thus:

Quote:

The applicable regulations under the Act which govern the management of radioactive materials include –

1. Radiation Protection (Licensing)
2. Atomic Energy Licensing 2002
3. Atomic Energy Licensing 2011



The Regulations comprise 15 sections which include –

1. Preliminary requirements
2. License to dispose
3. Responsibilities of License
4. Appointments of Radioactive Waste Management Officer
5. Control of Radioactive Waste Generation
6. Reuse and recycle of radioactive materials.
7. Management of used sealed source
8. Discharge and disposal of radioactive waste
9. Management of radioactive waste
10. Transport radioactive waste
11. Physical protection and security
12. Quality assurance
13. Records and reports
14. Emergency plan and procedures
15. Cessation of operations – decommissioning or abandonment of Licensed Facility

<Some remaining residues which cannot be fully commercialized. Lynas will acquire a suitable plot of land within the State of Pahang for the construction of a PDF.

It is to ensure safe management of disposal of the radioactive residues over a period of 300 years under international control.>

What is the stand of the authorities on this issue? Isn't the crux of the matter the radioactive waste and its safe disposal?

It is incumbent upon Lynas and the relevant authorities to dispel the fears and concerns of the public and the residents of Kuantan in particular.

Those concerns and fears are real, not perceived nor imagined, not subject to ridicule and demand an objective and rational feedback.

Our Concerns :

- 1) That our environment will be polluted and contaminated with radioactive, toxic gas and liquid hazardous wastes/residues arising from the use of concentrated sulfuric acid and other acids.
- 2) That these radioactive, toxic gases and hazardous wastes/residues can cause severe and permanent damage to the environment.
- 3) That our future generations will suffer due to our inability to prevail upon the Government to reconsider imposing other extraneous conditions as follows:-

Extraneous conditions:-

- 4.1 Lynas will discharge its treated waste matter considered safe by Lynas, to the open sea. Since Lynas will be using huge amounts of water necessary for its refining process, the possibility that the communities in Kuantan will face a water shortage situation is real and imminent.
- 4.2 Hence, we would like the government and Lynas to consider, why not use the recycled and treated waste water considered safe to reduce its dependence on public water meant for the residents of Kuantan?
- 4.3 Additionally, the Federal and State Government should consider and build more dams to address the problem of water shortage.
- 4.4 The fear of radiation is very real. The public expects that Lynas, in discharging its duties as a socially responsible corporation, invest a small portion of its profit to set up clinics, made accessible, free of charge to all bona fide residents in Kuantan, to its services like taking

their level of radioactive reading due to radiation contamination and or pollution.

- 4.5 That these clinics would treat and dispense medicines to those residents confirmed to have suffered sickness due to exposure to radiation, contamination or pollution.
- 4.6 That in the event Lynas refuses to give or offer free medical services and treatment thereof the victims are enabled by law to sue Lynas for damages to health and life and other ancillary inconveniences.
- 4.7 That, to be fair to everyone operating in the Gebeng area, a survey and reading to measure and record all data pertaining to the extent of contamination and pollution to the environment including all radioactive pollutants and contaminants in the area due to the disposal of chemical dispersants and scheduled chemical wastes by these plants must be carried out with immediate effect.

Listed below is the list of some of the chemical plants and other industries that could have required more stringent and vigilant monitoring, viz:

- 1 Basf-Petronas
- 2 BP Chemical
- 3 Cargill
- 4 Eastman
- 5 MTBE
- 6 Kaneka
- 7 W R Grace
- 8 Proctor-Gamble
- 9 Solutia/Flexsys Chemicals
- 10 Polyplastics Asia Pacific
- 11 PPSC

12 Bredero Shaw

13 Kinsteel

According to some experts, rare earth oxides are inherently harmless. But two elements said to bond with lanthanides i.e. thorium and uranium, are extremely radioactive and hazardous. And, even among experts, there are two divergent views: one says that radiation from lanthanide wastes is relatively safe whereas the other says otherwise. Now, whom do we believe?

Kuantan is an idyllic place to stay. We do not want its pristine beauty to be polluted and destroyed. Please let us and the future generations continue to enjoy life's natural beauty..