3.6 Radioactive Waste Management (RWM) in Malaysia

MINT was established in 1972 as the Tun Ismail Atomic Research Center (PUSPATI). Infrastructural development on the 27-hectare at Bangi commenced in January 1979, culminating in its coming into full operation in June 1982 with the commissioning of its nuclear research reactor. PUSPATI was later renamed the Nuclear Energy Unit (UTN) in June 1983 on being placed under the auspices of the Prime Minister's Department. In October 1990, the UTN was retransferred to the Ministry of Science, Technology and the Environment, and assumed its new identity as MINT in August 10, 1994.

In the quest for a distinct separation of roles between promotional and regulatory functions, Act 304, the Atomic Energy Licensing Act of 1984 was formulated, paving the way for the establishment of the Atomic Energy Licensing Board (AELB) as a separate entity, in February 1985. A second 81-hectare complex, about 3km apart, Kompleks Dengkil site was acquired in 1984. A new organization name for UTN, the Malaysian Institute for Nuclear Technology Research (MINT) (see Figure 3.6-1 MINT Organizational Chart), was approved by the cabinet on August 10, 1994.

3.6.1 RWM Policy

The setting up of PUSPATI in 1972 was a catalyst for the use of nuclear technology in various fields in Malaysia. Currently, there is only a 1 MW TRIGA Mk II research reactor in operation. With regard to nuclear power program, the Government has reaffirmed that the national energy policy will continue to be based on four conventional fuels, which excludes nuclear energy as one of the option. With this decision, the amount of radioactive waste in future is not expected to increase significantly. Currently, Malaysia has no plans to embark on a nuclear power program, and our nuclear activities are limited to the applications of such technologies in the industrial, medical, agricultural, and environmental sectors.

The country also has a long history of tin mining activities. These mining activities generate a sizable volume of radioactive waste. Certain minerals, such as monazite, illminite, and zircon - which contain natural radioactive elements such as uranium, thorium and radium - coexist with tin ore or cassiterite in the ground. In the process of extracting tin, these radioactive elements become more concentrated and become by-products of mineral processing industries.

In 1997, a special Committee on the Foundation of National Policy for the Safe Management of Radioactive Waste has been set up to recommend the government of the content of the policy. The Committee consists of various groups of people, including those from non-government agencies, who may have interest on radioactive waste. A draft policy has been submitted to the Ministry of Science, Technology and the Environment for comments and approval in early 1999.

Since Malaysia does not have any specific regulation on disposal and management of radioactive waste, AELB (see Figure 3.6-2 AELB Organizational Chart) enforced the waste management policy through its licensing procedure and conditions of license issued to the licensee. Details of the process are shown in Table 3.6-1.

Table 3.6-1 Radioactive Waste Management Policy

Waste Generator	Industry	Hospital/University/ Research Institute		Activities Related to TENORM	
Types of Waste	Sealed sources	Sealed sources	Liquid waste	Solid waste	Liquid waste
Policy	Returned to the supplier	Returned to the supplier	Sent to National Radioactive Waste Management Center	Stored by the user	Stored by the user
Licensing requirement	Undertaking letter from the supplier to accept back the waste	Undertaking letter from the supplier to accept back the waste	Undertaking letter from the center to accept the waste	Waste storing facility which must be comply with AELB criteria	Waste storage tank
License conditions	Waste shall be returned to the supplier.	Waste shall be returned to the supplier.	Waste shall be sent to National Radioactive Waste Management Center.	Waste shall be stored in the waste storing facility. For disposal purpose, the licensee are require to carry out a risk assessment to any proposed disposal site as to demonstrate that the discharge will not exceed the limit for the member of the public (1 mSv/yr)	Can be discharged to the environment if the radioactivity for liquid below the discharge limit, for example 1 Bq/L

3.6.2 RWM Practices

3.6.2.1 Legislative Framework

The first law concerning atomic energy was Radioactive Substances Act 1968, which governed radioactive materials or ionizing radiation in medical field. Under the Act 1968, there are two regulations: Radiation Protection Rules (1974) and Radiation Protection (Medical X-Ray Diagnosis) Rules (1983), which are basically for medical field.

This Act was repealed by the Atomic Energy Licensing Act 1984 (AELA 1984, Act. 304), gazetted on February 1, 1985, and enforced on the same date.

Since the enforcement of AELA 1984, a major part of the responsibility was transferred to MOSTE. However, the control of application in medical field is still under the MOH. One provision under Act 304 is the establishment of the Atomic Energy Licensing Board (AELB) on February 1, 1985. The regulatory body for radioactive waste management is the Atomic Energy Licensing Board (AELB). Legislation regarding waste management is in Part VI of AELA 1984. These provisions (Sections 26-30) provide for control of radioactive wastes, and empower the AELB to enforce the Act and introduce guidelines.

Under Act 304, radioactive waste is defined as follows:

"Radioactive waste means any wastes which contains all or part of:
a) Substance or item which if it is not waste is considered as radioactive material, or;
b) Substance or item which has been contaminated during production, storage or use of any radioactive material, nuclear material or prescribed substance, or by contact with or proximity to any other waste within the meaning of paragraph (a) of this definition."

3.6.2.2 Regulatory Framework/Body

There are two ministries involved in matters related to usage of radioactive materials or nuclear technology: the Ministry of Science, Technology and the Environment (MOSTE) (see Figure 3.6-3 MOSTE Organizational Chart) and the Ministry of Health (MOH). MOSTE is responsible for most of the activities related to usage of radioactive materials and nuclear technology except medical, which is under the jurisdiction of the MOH.

Under MOSTE, the Atomic Energy Licensing Board (AELB) is the regulatory body, whereby among the main functions are to exercise control and supervision over production, application and usage of radioactive material and nuclear technology and advising the Minister and the Government on related matters. The role of the Malaysian Institute for Nuclear Technology Research (MINT) is on promoting the use of nuclear technology for peaceful purposes and provides waste management services at institutional and national level.

All users of radioactive materials are required to be responsible for the wastes they produced. They are required to be registered and be licensed by the competent authority, Atomic Energy Licensing Board (AELB). Malaysian Institute For Nuclear Technology Research (MINT) has been given the responsibility to provide services in the management of the radioactive wastes produced in Malaysia. Users without facilities and waste management expertise can request assistance from MINT regarding their problems. All services are chargeable depending on the type and characteristics of the wastes.

Waste Management Policy (AELB)

- Users of radioactive materials are responsible for the waste.
- Required to be registered and licensed by AELB
- Store or return to supplier
- Users without infrastructure and expertise can request third party organization for services that are licensed/recognized by AELB.

3.6.2.3 Responsibility of License Holder

The Act. 304 covers basically all fields of application and several regulations have been formulated, namely:

- Radiation Protection (Licensing) Regulation 1986
- Radiation Protection (Basic Safety Standard) Regulation 1988
- Radiation Protection (Transport) Regulation 1989
- Radiation Protection (Transport)(Amendment) Regulations 1991

A draft on the regulation concerning radioactive waste management is still under review. Currently, matters regarding radioactive waste are in Part VI of the Act 304 (Section 26-30):

- Control of disposal of radioactive waste
- Control of accumulation of radioactive waste
- Appropriate authority may direct licensee to rectify situation where facilities are not adequate
- Appropriate authority may order licensee or any other person to adopt measures to protect life, health and property
- Transport of radioactive waste with prior authorization of the appropriate authority

The current regulations enforced by AELB covers only the activities related to the management of radioactive waste in general and there is no provision specifically mention on the disposal of radioactive waste. Since there is no specific regulation on disposal of radioactive waste yet, the AELB adopts an interim policy whereby radioactive waste shall be managed, but not disposed into the environment, in three ways:

- Stored by the user
- Returned to the supplier for sealed sources
- Sent to National Radioactive Waste Management Center at the Malaysian Institute for Nuclear Technology Research (MINT)

As far as discharge or release of radioactive material/waste to the environment is concern, section 51 of the Radiation Protection (BSS) Regulations 1988 authorizing the Board to specify a release limit having taking into account the following:

- Pre-operational environmental monitoring
- Determination of critical pathway
- Selection of critical group of population
- Assessing radiation exposure to members of the public

On the other hand, the licensee has the obligation to carry out effluent monitoring of the discharged material.

Although present legislations are continuously being reviewed and improved with an aim to be at par with international standards, they nonetheless provide an adequate basic mechanism aimed at controlling responsible people to deal with radioactive material and hence radioactive waste in a safe manner. Figure 3.6-4 shows the flow chart of processing the license application.

3.6.3 Criteria Used to Define and Categorize Radioactive Waste

There is no official classification for radioactive wastes in Malaysia. From the source of origin, radioactive wastes may be grouped into three categories: a) the low specific activity NORM/TENORM waste from mineral processing and oil exploration, b) from the application or usage of radioactive sources in various fields, and b) spent fuels from the operation of research reactor.

These wastes may exist in different physical forms (solid, liquid or gaseous) and content, hence they need to be segregated accordingly. Basically, classification of radioactive waste is based on activity level, half-lives and the presence of alpha emitters. It is therefore appropriate at this time to adopt a classification system as recommended by the IAEA. The NORM-bearing waste is defined as Low Specific Activity (LSA) as indicated in the Radiation Protection (Transport) Regulations 1989.

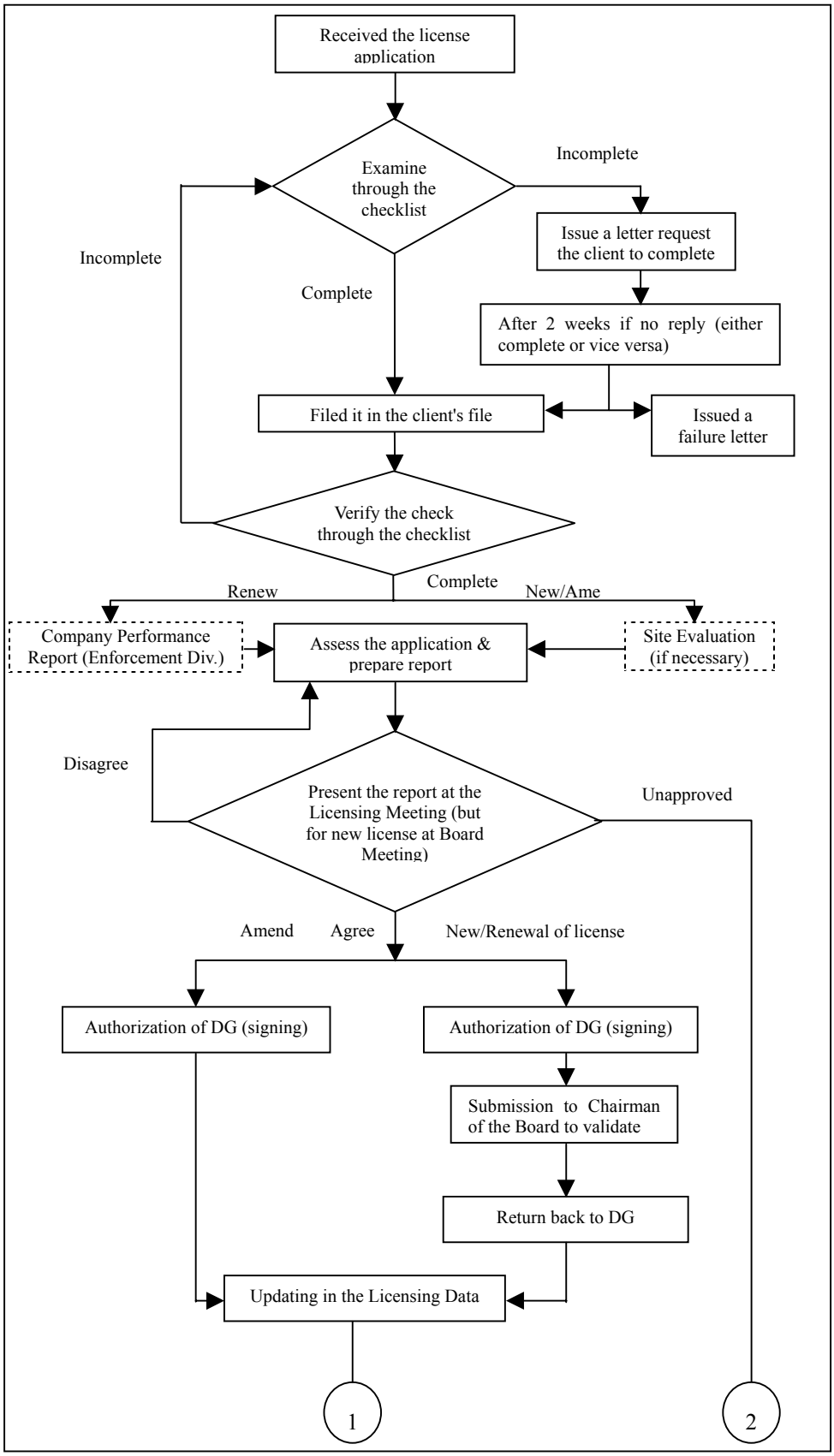
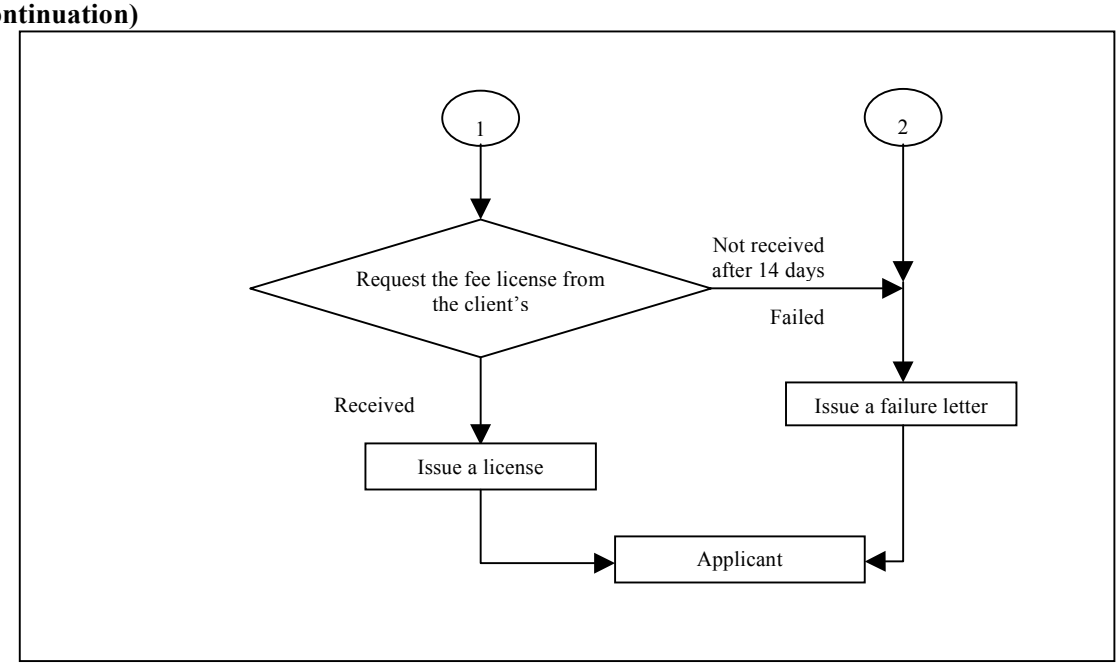


Figure 3.6-4 Flow Chart for Processing the License Application

(continuation)



3.6.4 RWM Facilities

There are various facilities available for managing the various type of waste received by the NRWMC. Facilities that are available at NRWMC includes (see Figure 3.6-6 Waste Management Facilities):

- Low-Level Waste Treatment Plant (LLWTP)
  The treatment of the mainly low-level aqueous liquid waste is by chemical process (coagulation-flocculation). Compartments are also available for handling and storage of liquid organic waste on mild steel racks.
- Laundry facility
  two heavy-duty washing machines, one dryer, one unit press-ironing equipment
- Laboratory for analysis and research
  Related Equipments for necessary effluent analysis and research work. Gross beta-gamma counter and gamma spectrometer
- Solid waste processing area
  Solid wastes are collected, segregated, decay storage is applied where possible and further treatment done accordingly - including cementation and compaction. A segregation cabinet is available for waste segregation.
- Decontamination area
- Conditioning area
  Conditioning of waste including spent sealed sources in cement matrix is done using a batch cement mixer. Currently, only 200-liter steel drums are used in the conditioning process.
- Waste Compactor

An in-drum compactor for volume reduction of solid waste in 200-liter drum was acquired in the first quarter of 2000.

- Transport
  two vehicles for transporting waste
- Waste Storage Facility
  A pretreatment storage facility and an interim long-term storage facility are available at the center. The construction of the long-term storage facility was completed in August 2000. The facility was designed to cater for two 400 drums of 200-liter waste package after treatment and immobilization. Stacking of the drums is limited to three drums high - and further expansion of storage area is possible.

3.6.5 Inventory of Radioactive Wastes

3.6.5.1 Inventory of RW in Storage

Low-level Radioactive Waste.

Most of the wastes produced in Malaysia are from small uses of radioactive material. The mostly low-level aqueous liquid radioactive wastes generated at research laboratories are processed so that their radioactivity is reduced to a level below the standards prescribed by law. Organic liquid wastes are stored in suitable containers before absorption and further treatment. The solid wastes are placed in 200-liter drums for processing (decay storage, volume reduction, etc.) before temporary storage. The current storage facility is located nearby the waste processing area.

3.6.5.2 RW in Disposal

Currently, there is no disposal facility/repository for radioactive waste in Malaysia. Considerations are being made for future waste management programs and repository for radioactive waste are given priority. Current processed wastes are stored at RWMC, while TENORM related waste is stored at the generator's premises.

3.6.6 Nuclear Facilities in the Process of being Decommissioned and the Status of Decommissioning Activities at those Facilities

None being decommissioned.

Table 3.6-2 The Amount of Waste Collected for the Period 1983-2000

Year	Aqueous (m3)	Organic (m3)	Solid (m3)	Sealed Sources (unit)
1983	0.005	0.108	0.312	1
1984	-	0.207	-	-
1985	0.071	0.299	1.400	64
1986	0.098	0.219	5.120	1
1987	985.110	1.080	18.576	24
1988	1115.928	0.527	8.380	267
1989	1081.210	1.033	7.992	2
1990	979.225	0.132	7.928	223
1991	822.625	1.291	16.130	424
1992	1488.022	0.630	9.328	58
1993	1080.775	0.670	9.976	269
1994	657.275	1.158	11.229	45
1995	717.925	1.303	8.656	50
1996	350.223	0.298	14.290	91
1997	280.150	0.863	7.590	53
1998	297.52	0.336	5.166	214
1999	105.000	0.194	6.149	182
2000	350.000	0.090	19.970	49

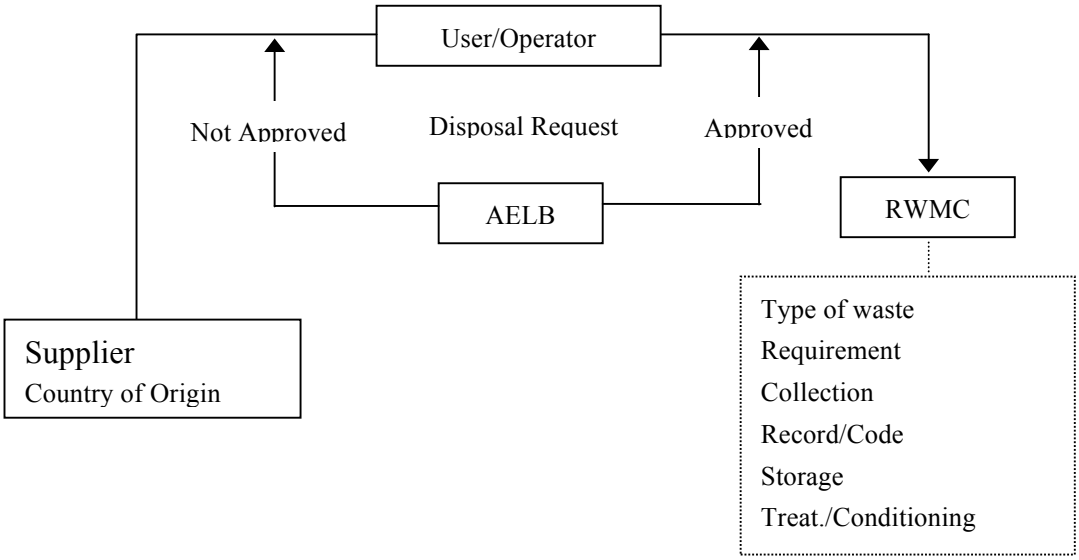


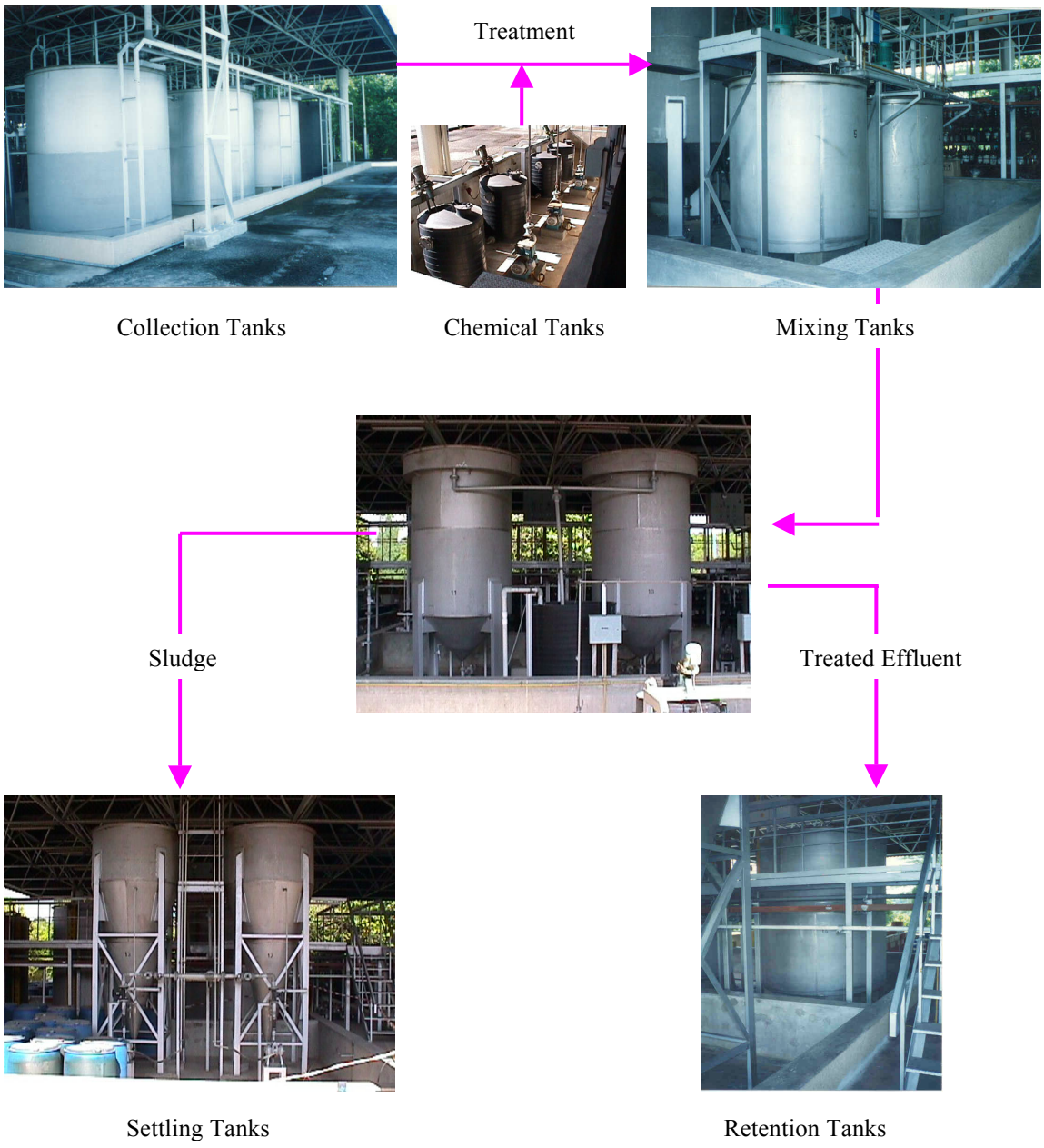
Figure 3.6-2 Outline of Spent Sources Waste Management

WASTE MANAGEMENT FACILITIES

A. Laboratory

B. Transport

C. Treatment Plant



D. Compactor

E. Storage Facility

Storage 1 (Initial Storage)

Storage 2 (Treated/Conditioned Waste)

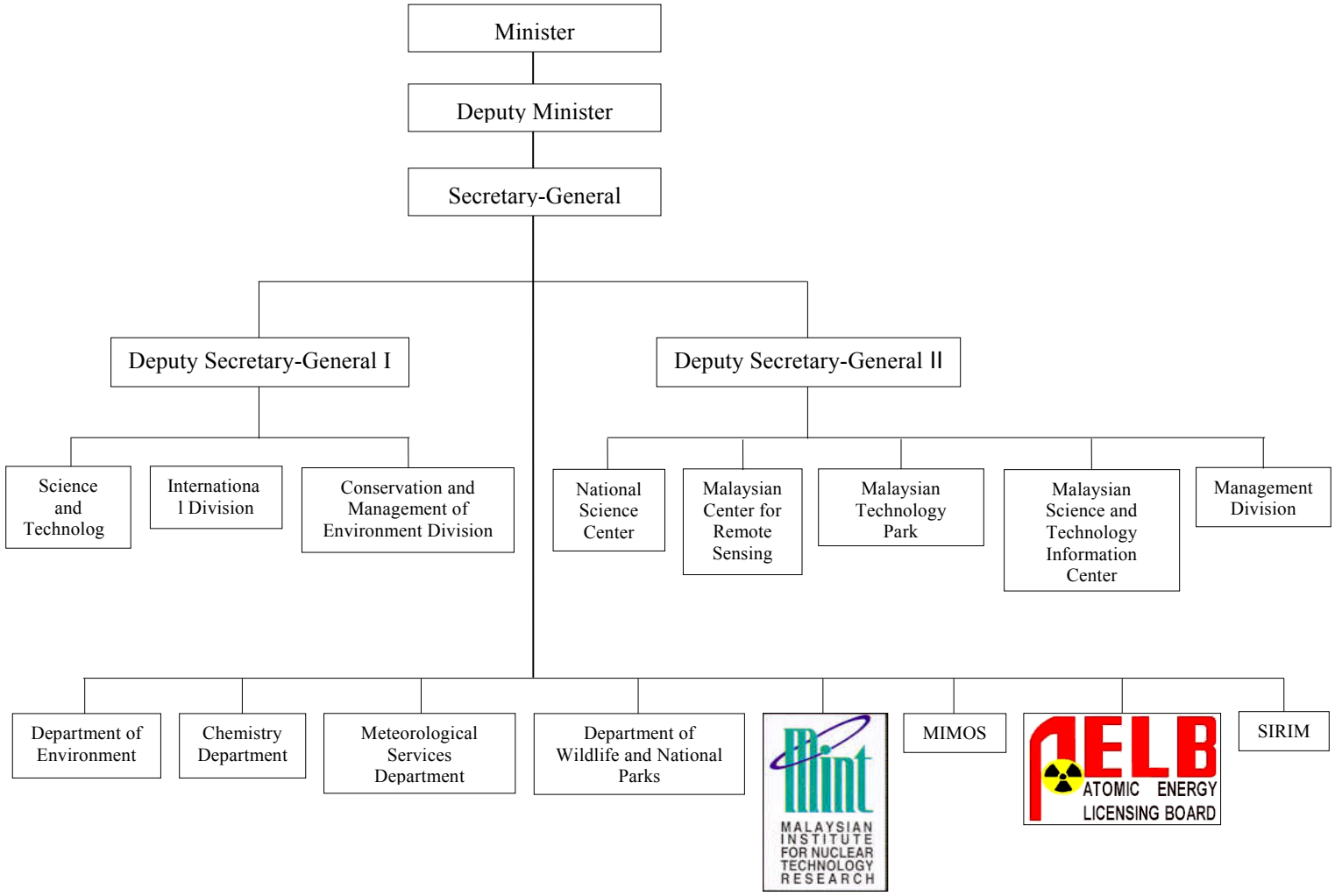


Figure 3.6-3 MOSTE Organizational Chart

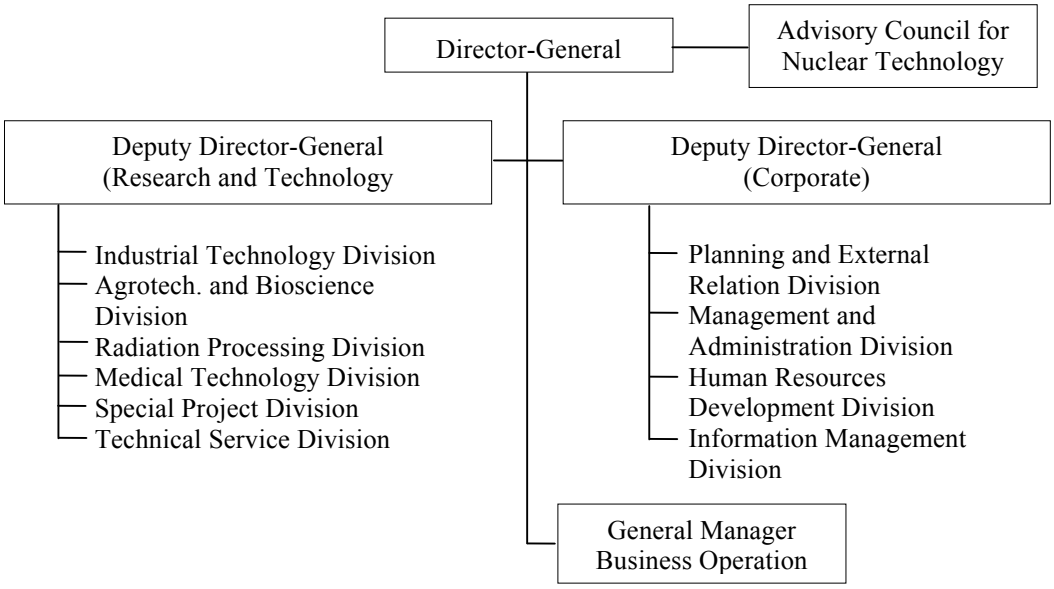


Figure 3.6-4 MINT Organizational Chart

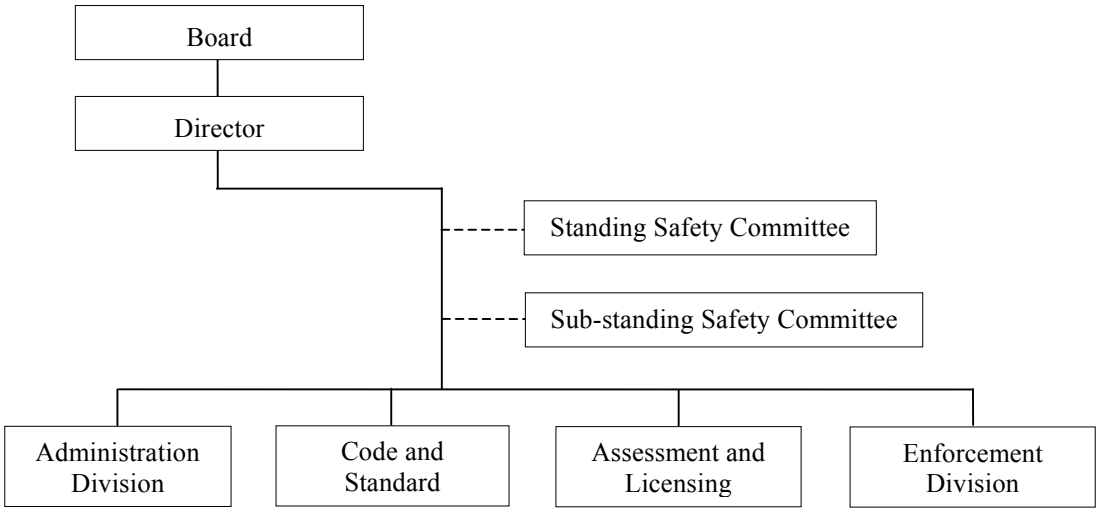


Figure 3.6-5 AELB Organizational Chart