Content

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| Title： | Regulations on Final Disposal of Low Level Radioactive Waste and Safety Management of the Facilities Ch |
| Date： | 2012.07.09 |
| Legislative： | Promulgated on September 10, 2003 by the Atomic Energy Council per its decree<br><br>No. Hui-Wu-Tzu -0920023657<br>Amendment of Articles 2, 4, 6 and 7 on February 22, 2005 by the Atomic Energy<br>Council per its decree No. Hui-Wu-Tzu-0940041783<br>Amendment of Articles 8 on January 24, 2008 by the Atomic Energy Council per<br>its decree No. Hui-Wu-Tzu-0970001429<br>Amendment of Articles 4 and 6 on October 22, 2008 by the Atomic Energy Council<br>per its decree No. Hui-Wu-Tzu-0970016962<br>Amendment of Articles 2, 4, 7, 12-1. 14 and 17 on November 24, 2010 by the Atomic Energy Council per its decree No. Hui-Wu-Tzu-0990017026<br>Amendment of Articles 2 and 6 on July 9, 2012 by the Atomic Energy Council per<br>its decree No. Hui-Wu-Tzu-1010010789 |
| Content： | **Article 1**<br>These Regulations are enacted pursuant to Article 21 of the Nuclear Materials and Radioactive Waste Management Act.<br><br>**Article 2**<br>The terms used in these Regulations are defined as follows:<br>Solidifying & Packing: refers to transforming the waste into stable solidified waste and encapsulating them into the containers, so as to making the operation of waste packages suitable for loading, unloading, transportation, storage, and disposal.<br>Leaching index: refers to the index of radioactive nuclides' leaching from the solidified waste.<br>Final disposal facilities of low level waste (hereinafter shortened as "low level disposal facilities"): refer to the lands, buildings, structures, and equipments used to dispose the low level waste.<br>Multiple barrier: refers to the combination of solidified waste, containers, buffering and backfill materials, engineering structures, and stratums as well as natural barriers used by the radioactive waste disposal facilities of to delay the leaching, leakage, and migration of the radioactive nuclides.<br>Disposal control area: refers to the surface and underground space within the range of the disposal facilities of radioactive waste. Permanent monuments or markers shall be set to indicate the borderlines of the disposal control area.<br>High-Integrity Container: refers to the low level waste container which can maintain its structural integrity and prevent the radionuclide release in at least three hundred years.<br>**Article 3**<br>According to the concentration of the radioactive nuclides, low level waste is classified as follows:<br>Class A waste: refers to the low level waste the concentration of nuclides of which is not higher than 1/10 of the concentration value in the Annexed Table 1 and not higher than the concentration value in the column 1 of the Annexed Table 2, or the nuclides contained in |

which are not listed in Annexed Tables 1 and 2.
Class B waste: refers to the low level waste the concentration of nuclides of which is higher than 1/10 of the value listed in the column 1 and not higher than that listed in the column 2 of the Annexed Table 2.
Class C waste: refers to the low level waste the concentration of nuclides of which is higher than 1/10 and not higher than the value in the Annexed Table 1, or higher than the value listed in the column 2 but not higher than that listed in the column 3 of the Annexed Table 2.
Greater than Class C waste: refers to the low level waste the concentration of nuclides of which is higher than the value in the Annexed Table 1, or higher than the value in the column 3 of the Annexed Table 2.

Article 4

The final disposal of low level waste shall meet the following provisions:
Class A waste shall meet the provisions of Article 5. Where Class A waste is disposed together with Class B or C waste, the relevant provisions for Class B or C waste shall be observed.
Solidifying & packing shall be performed for Class B waste, and the waste shall meet the provisions of both Article 5 and Article 6. Where Class B waste is disposed together with Class C waste, the relevant provisions for Class C waste shall be observed.
Solidifying & packing shall be performed for Class C waste, and the waste shall meet the provisions of both Article 5 and Article 6. Additionally, the engineering design of the disposal area shall be strengthened to ensure the safety of those inadvertent intruders after institutional control period.
Grater than Class C waste may not be disposed in the low level disposal facilities waste unless it is approved by the competent authority.

Not suitable for solidifying or disqualified solidified Class A waste shall be packed in the competent authority approved container which design life can maintain its structural integrity in at least one hundred years or emplaced in the repository' s engineering barriers which has the same function of integrity or disposed by the competent authority approved method for disposal.

Not suitable for solidifying or disqualified solidified Class B and C waste shall be packed in the competent authority approved high-integrity container or disposed by the competent authority approved method for disposal.

Article 5

The waste of the low level disposal facilities shall meet the following provisions:
The volume of free standing water may not be more than 0.5% of the total volume.
Explosion will never occur under normal temperature and normal pressure.
Fire endurance shall be provided.
No toxic, corrosive or infectious substance is contained.
No harmful toxic gas, steam or fume is contained or will be produced.

Article 6

The homogeneous solidifying waste shall meet the following provisions:
Use the single-axis compression strength method to test the mechanical strength of cement-solidified or high-temperature melting waste which shall be more than 15kg/$cm^2$; the mechanical strength of bituminous waste shall be measured by penetration test, and the value of penetration shall be less than 100.
The leaching index shall be greater than 6.
After the process of water resistance test, the provisions of Subparagraph 1 shall be observed.
After the process of weather resistance test, the provisions of Subparagraph 1 shall be observed.
After the process of radiation resistance test, the provisions of

Subparagraphs 1 shall be observed.
After the process of bacteria-resistance test, the provisions of Subparagraph 1 shall be observed.

The items, methods, and standards of the tests referred to in the Subparagraphs 1, 3 of Article 5 and above Subparagraphs are shown in the Annexed Table 3.

Article 7

A site of low level waste disposal facility must not be located in any of the following areas:

Area where active faulting or geological conditions could endanger the safety of the disposal facility.
Area where the geochemical conditions are unfavorable for effectively suppressing the diffusion of radioactive nuclides, and it is likely to endanger the safety of the disposal facility.
Area where the hydrologic conditions of surface water or groundwater are likely to endanger the safety of the disposal facility.
Area of high population density.
Areas that cannot be developed according to the law.

Article 8

The design of low level disposal facilities shall ensure the annual effective dose caused to a general public outside the facilities are not more than 0.25mSv, and confirm to the as low as reasonably achievable principle.

Article 9

Multiple barriers shall be designed in the low level disposal facilities, and the waste shall be disposed in different sections according to their class.

Article 10

The design of the safety system and component of low level disposal facilities shall meet the following provisions:

Inspection, maintenance, and test can be performed.
Protective measures can be taken for expectable natural disasters.
The function of emergency response shall be provided.
The function of mutual substitute or redundant shall be provided.

Article 11

Before the closure of low level disposal facilities, the drainage and anti-infiltration design shall be able to prevent the waste from contacting with the accumulated water or infiltrated water.

Article 12

The security and alarm design of low level disposal facilities shall be able to prevent any individual inadvertently intruding into the disposal site and occupying the site.

Article 12-1

Operation of low level disposal facilities shall meet the provisions of its safety analyses report and radiation protection.

Article 13

Once closure of low level disposal facilities, consideration shall be given to the land reuse after the active institutional controls are removed.

Article 14

After the low level disposal facilities are sealed, the disposal control area shall be observed and monitored of its stability for not less than five years and controlled by the competent authority approved institutional controls program.

Article 15

The design, manufacturing, installation, test, and maintenance records of

the important structures, system, and components of low level disposal facilities shall be retained permanently for reference.

Article 16

The operators of low level disposal facilities shall acquire the ownership of or the rights to use the lands in the disposal control areas before to construct the disposal facilities.

Article 17

The operators shall re-evaluate the disposal facilities once every ten years, and submit an evaluation report including the following contents to the competent authority for review and approval:

General description.
Examination and evaluation of the facility structures.
Examination and evaluation of the auxiliary equipment.
Evaluation of receive, treatment, storage and disposal operations.
Evaluation of the storage and disposal status of the waste.
Lesson learnt of the abnormal events
Evaluation of the impacts of radiation.
Closure and institutional controls plan.
Other matters designated by the competent authority.

Article 18

These Regulations will take effect as of the date of promulgation.

Annexed Table 1: Concentration Value of Single Long-lived Nuclides

| Radionuclide | Concentration |
|---|---|
| $^{14}C$ | 0.30 TBq/$m^3$ |
| $^{14}C$ (in activated metal) | 3.0 TBq/$m^3$ |
| $^{59}Ni$ (in activated metal) | 8.1 TBq/$m^3$ |
| $^{94}Nb$ (in activated metal) | 0.0074 TBq/$m^3$ |
| $^{99}Tc$ | 0.11 TBq/$m^3$ |
| $^{129}I$ | 0.0030 TBq/$m^3$ |
| TRU (Alpha emitting transuranic nuclides with half-life greater than 5 years) | 3.7 kBq/g |
| $^{241}Pu$ | 130 kBq/g |
| $^{242}Cm$ | 740kBq/g |

Annexed Table 2: Concentration Values of Single Short-lived Nuclides

| Radionuclide | Concentration (TBq/$m^3$) | | |
|---|---|---|---|
| | Col. 1 | Col. 2 | Col. 3 |
| Total of all nuclides with less than 5 year half-life | 26 | Note 1 | Note 1 |
| $^{3}H$ | 1.5 | Note 1 | Note 1 |
| $^{60}Co$ | 26 | Note 1 | Note 1 |
| $^{63}Ni$ | 0.13 | 2.6 | 26 |

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|---|---|---|---|
| $^{63}Ni$ (in activated metal) | 1.3 | 26 | 260 |
| $^{90}Sr$ | 0.0015 | 5.6 | 260 |
| $^{137}Cs$ | 0.037 | 1.6 | 170 |

Note 1: There are no limits established for these radionuclides in Class B or C wastes. Practical considerations such as the effects of external radiation and internal heat generation on transportation, handling, and disposal will limit the concentrations for these wastes. These wastes shall be Class B unless the concentrations of other nuclides in Table 2 determine the waste to the Class C independent of these nuclides.

Note 2: Classification of mixtures of radionuclides:
If there are mixtures of radionuclides in the low level waste, the following inequation shall used to classify them.

Where,
$C_i$: the concentration of the No.i nuclide.
$C_{i,0}$: the concentration of Class 0 of No.i nuclide (0=A,B,C).
n: the number of the nuclides contained.
If the above inequation is satisfied, then the waste can be classified into Class 0 (0=A, B, C).

Annexed Table 3 Test Items, Methods, and Standards of Homogeneous Solidified Low level Waste

| S/N | Test Item | Test Method | Standards |
|---|---|---|---|
| 1 | Free standing water | ANSI/ANS 55.1 | 1.The content of free standing water shall be less than 0.5% of the volume of the solidified waste.<br>2.The pH of free standing waster shall between 4 and 11, for cement-solidified waste which shall be larger than 9. |
| 2 | Fire resistance | 1.Cement or glass solidified waste may be exempted from this test.<br>2.ASTM-D92 method for bituminous waste.<br>3.ASTM-D2863 method for plastic solidified waste | 1.The fire point of bituminous waste shall be greater than 250℃.<br>2.The Oxygen Index of plastic solidified waste shall be greater than 28. |
| 3 | Mechanical strength | 1.Common solidified waste except bituminous waste shall employ the ASTM-C39 or CNS 1232 test.<br>2.The ASTM-D5 test shall be used to test the penetration of bituminous waste. | 1.The compression strength of common solidified waste except bituminous shall be larger than 15kg/cm$^2$.<br>2.The penetration of bituminous waste shall be less than 100. The weight percentage of asphalt in the bituminous waste shall not less than 50%. |

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| | 4 | Leaching rate | ANS 16.1 (cement-solidified waste may be tested for five days) | The leaching index of all kinds of nuclides in the solidified waste shall be greater than 6. |
| | 5 | Water resistance | Immerse the solidified waste in water for 90 days, and then test the mechanical strength (under normal temperature) | The test result shall meet the standard of Item 3. |
| | 6 | Weather resistance | Circularly change the temperature and humidity, and then test the mechanical strength. | The test result shall meet the standard of Item 3. |
| | 7 | Radiation resistance | Irradiating the solidified waste by Co-60 Gamma radiation, and then test the mechanical strength after the absorbed dosage reaches 1,000,000 Gy. | 1.The test result of compression strength shall meet the standard of Item 3. |
| | 8 | Bacteria resistance | Perform the ASTM G21, and then test the mechanical strength. | The test result shall meet the standard of Item 3. |