

Proposed Regulatory Standards for the Industrial NORM Waste Management

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1. Introduction

NORM (Naturally Occurring Radioactive Material) can be artificially increased resulting in a higher radioactivity level during industrial manufacturing processes. Some domestic industries use Bauxite, Phosphate rock and TiO_2 as raw materials which include ^{238}U and ^{232}Th radioactive nuclide as well as their radioactive decay series, and they can be enhanced during manufacturing processes generating NORM wastes. Although radioactivity concentrations and radiation exposure levels for the workers or public are regulated by the "NORM Safety Management Law", currently there are no domestic regulations or guides for the safe management of the industrial NORM wastes.

Radiation characteristics are investigated for the industries using Bauxite, Phosphate rock and steel scraps to identify the industrial NORM wastes and their safety management practices to establish regulatory standards for the industrial NORM safety management.

2. Radiation Characteristics and Safety Management Practices of the Industrial NORM Wastes

In order to investigate the radioactivity and safety management of the NORM wastes, field detections were performed for the phosphate fertilizer, aluminum hydroxide manufacturing and the steel scrap industries. Tables 1 and 2 show the results of the field detections for the industrial NORM wastes.

Table 1. Radioactivity Concentration of the NORM Wastes

NORM Wastes	Nuclide	Concn. (Bq/g)	Remark
Pipe Scale A	^{238}U	0.857	Landfill
	^{232}Th	0.215	
Red Mud	^{238}U	0.182	open storage
	^{232}Th	0.318	
Phosphoric Gypsum	^{238}U	1.003	open storage
	^{232}Th	0.005	
Pipe scale B	^{238}U	0.269	separate storage
	^{232}Th	0.038	

Tables 1 and 2 also show that NORM wastes were found in the pipe scales of the manufacturing industries and large volumes of the NORM residues are generated such as red mud and phosphate gypsum.

Table 2. Radiation dose rate of the NORM wastes for the steel scrap industry

NORM Wastes	Nuclide	Dose ($\mu\text{Sv/hr}$)	Remark
Pipe scale C	^{232}Th	4.0	separate storage
Pipe scale D	^{232}Th	5.4	separate storage
Pipe scale E	^{232}Th	13.7	separate storage
Pipe scale F	^{232}Th	5.5	separate storage

3. Proposed Regulatory Standards for the Industrial NORM Waste Management

IAEA and the EU have recognized the need for regulatory guides for the safety management of the NORM wastes and some EU countries regulate the NORM wastes in accordance with the EU

recommendations. In Korea, industrial NORM wastes are regulated by the “NORM Safety Management Law”. Table 3 shows the NORM safety standards recommended by the IAEA and EU as well as the registration criteria of the NORM wastes in Korea. However, there are no specific regulatory guides regarding disposal and recycling of the industrial NORM wastes.

This study proposes regulatory standards for the NORM wastes to dilute below 1 Bq/g and 1 mSv/yr of the exclusion level, and may spread on the earth surface, landfill, or recycle. National NORM waste storage or landfill sites for the higher industrial NORM wastes should be considered.

Table 3. NORM safety standards

	Concentration (Bq/g)			Remark
	²³² Th	²³⁸ U	⁴⁰ K	
Korea	1	1	10	Exclusion level
IAEA	1	1	10	Exclusion level
EU	0.5	0.5	5	Clearance level
UK for landfill		5*	-	Exemption level

* Sum of ²³⁸U and ²³²Th concentrations

4. Conclusion

Regulatory standards have been proposed for the safe management, disposal and recycling of the industrial NORM wastes. Detailed safe management procedures should be further developed to implement proposed regulatory standards for the NORM wastes.

REFERENCES

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