# Application Review of Clearance for Metallic Waste After Decommissioning

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## 1. Introduction

It is estimated that the amount of metal waste generated by decommissioning nuclear facilities in the next 50 years will be about 30 million tons. Currently, Low Level Waste (LLW) repositories are insufficient to accommodate metal waste that will be generated when decommissioning worldwide. In addition, the amount of metal waste accounts for about 90% of total waste. Much of the radioactive waste generated during decommissioning of nuclear power plants is not highly polluted and can be recycled or reused. And separation according to radioactive waste levels can effectively solve the decommissioning cost according to waste management. Among the radioactive wastes, the radionuclides concentration is below the clearance permissible concentration.

If it is confirmed that the concentration of radionuclides in wastes is less than the allowable concentration, it is excluded from the application of Nuclear Safety Act and called self-disposal to manage by incineration, landfill, recycling, etc. as waste rather than radioactive waste.

## 2. Main Subject

### *2.1 Overseas Regulation for Clearance*

The best treatment is through unrestricted recycling of metal waste by disposal, domestic acceptable concentration standards are lower than overseas standards. So recycling targets are low and processing takes a long time. Also, there is no domestic standard for limited recycling of Very Low Level Waste (VLLW) metal waste. Table 1 shows the documents for overseas Clearance, and Table 2 shows the release criteria proposed by the European Commission (EC) and the International Atomic Energy Agency (IAEA).

Table 1. Overseas Regulation for Clearance

| Document | Content |
|---|---|
| NUREG-1640 | Clearance Level |
| Radiation Protection 89 | Metal Clearance Level |
| Radiation Protection 122 | General Clearance Level |
| IAEA RS-G-1.7 | Clearance Level |

Table 2. Radionuclides Release Criteria of EC and IAEA

| | EC RP89 (Metal Recycling) | EC RP122 (Clearance) | IAEA (RS-G-1.7) |
|---|---|---|---|
| Co-60 | 1 | 0.1 | 0.1 |
| Cs-137 | 1 | 1 | 0.1 |

Comparing the EC and IAEA standards for clearance, the RS-G-1.7 is more conservative. Because IAEA standard has set the release standard in consideration of both artificial and natural radioactivity.

In domestic case, IAEA RS-G-1.7 is applied.

### *2.2 Current Status*

The EC and IAEA provides a concentration standard for sum of limited reuse and metal recycling. But in Germany, different concentrations standards are provided for each scenario. Table 3 shows the clearance level standard in the world.

Table 3. Clearance Level Standard in the World

| | EC RP-89 | IAEA (RS-G-1.7) | German RPO | |
|---|---|---|---|---|
| | | | Unconditional | Recycling Metal |
| Co-60 | 1 | 0.1 | 0.1 | 0.6 |
| Cs-137 | 1 | 0.1 | 0.5 | 0.6 |

Germany's clearance regulation is stipulated in the Atomic Energy Act and Radiation Protection Ordinance (RPO). And certain substances may be excluded from conditional regulation depending on the scenarios. Even if the general regulatory clearance level of a specific nuclide is 0.1Bq/g, a different reference value may be applied for each scenario such as the clearance level for landfill or incineration is 4Bq/g, the clearance level for metal melting for recycling is 0.6Bq/g.

## 3. Overseas Metal Waste Melting Case

### *3.1 Germany*

Since 1989, Siempelkamp has been using CARLA melting facilities to melt a total of 25,000 tons of carbon steel, stainless steel, aluminum, copper and lead. And then released 9,000 tons, 14,500 tons to produce shielding blocks or KONRAD containers for reuse in the nuclear industry.

Siempelkamp's radiological limitations are Max 200Bq/g (for β, ɣ), Max 100Bq/g (for α) separate limits for uranium.

### *3.2 Sweden*

Over the past decade, 3,600 tons of WURGASSEN's decommissioning metal waste and

740 tons were unrestricted release among 143 tons of aluminum, 644 tons of carbon steel which were generated when the Siemens nuclear fuel plants was decommissioning. In 2009, Sweden built the Metal Recycling Facility (MRF) in Cumbria and has experience handling metal waste in 12 regions of England and Scotland. Currently, they are continuing to melt and decontaminate radioactive waste such as contaminated iron, aluminum, copper including large metal waste.

STUDSVIK's radiological limitations are varies with type of material and preparation to be done.

### *3.3 France*

From 1999 to 2005, France were melted and reused 12,000 tons of carbon steel and stainless steel in the nuclear field.

Currently, radioactive metal wastes such as structures, valves, pumps, non-ferrous metals, ferrous metals (stainless steel, carbon steel) generated during operation of nuclear facilities, process maintenance, dismantling and dismantling of facilities are disposal using facilities with an average capacity of up to 20 tons/day.

In particular, France has no exemption regulatory. France is introducing the concept of Zoning (Nuclear zone, Non-Nuclear zone). Zoning is a way of classifying between regulated wastes and wastes that are excluded from regulation.

CENTRACO's radiological limitations are Max 20,000Bq/g (for β, ɣ), Max 370Bq/g (for α).

### *3.4 Russia*

In 1996, 1,659Mg of metal waste composed of stainless steel and nonferrous metal was melted, and approximately 95% of the melted metal waste was reused and sent to industry.

ECOMET-S's radiological limitations are Max 100Bq/g.

## 4. Conclusion

When the radioactive waste concentration is slightly above the clearance level, it is necessary to reduce the radioactive concentration by decaying the radioactivity through a long-term storage depending on the type of radionuclide.

Many countries have now established their own standards for metal waste and operating. Therefore, it is necessary to analyze the criteria and characteristics of the IAEA and the countries who already implementing recycling, and establish a safe guideline for Korea situation.

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## REFERENCES

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