CLASSIFICATION OF L&ILW RADIOACTIVE WASTES: CLEARANCE LEVELS

In Canada, low-and intermediate-level radioactive waste is defined by exclusion. In other words, if a waste is radioactive, but is neither used nuclear fuel waste (high-level waste, (HLW)) nor uranium mine and mill tailings, it is classified as low level radioactive waste (LLW) or Intermediate Level Wastes (ILW).[1]

There are several problems with this "exclusion" approach. L&ILW is not restricted to wastes that contain relatively low concentrations of radionuclides compared with nuclear fuel wastes. These wastes can range from very low-level waste with low hazard to highly hazardous wastes with long time frames requiring much more secure containment than the very low-level waste.

The inherent ambiguity and interpretation as to what precisely is included in LLW and ILW, and why, has resulted in varying descriptions of these wastes that tend to be dependent on the context of the circumstances when these terms are applied and how they may be treated.

Classification and Descriptions of L&ILW

In general terms:

> LLW consists of mops, rags, paper towels, temporary floor coverings, floor sweepings, protective clothing, and hardware items such as tools. It also includes steam generator segments.
>
> ILW consists of ion exchange resins, filters and irradiated reactor core components. There is usually a caveat indicating that while the majority of LLW is processed through incineration or compaction for volume reduction, because of its physical condition and greater levels of radioactivity, ILW is "non-processible".

Ontario Power Generation (OPG) uses the following classification of Radioactive Waste in general and at its Western Waste Management Facility (WWMF) at the Bruce site.[2]

> **Low-Level Radioactive Waste (LLW)** is radioactive waste having a dose rate less than 10 mSv/h (1 rem/h) at 30 cm (unshielded). LLW consists of minimally radioactive material that has become contaminated with radionuclides during routine operations, cleanup and maintenance. This waste includes (but is not limited to) lightly contaminated metal objects and parts, incinerator ash, insulation, drummed wastes, solidified liquids and desiccant.
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> LLW received from the Bruce, Darlington and Pickering NGSs are received at the Waste Volume Reduction Building (WVRB) at the WWMF where it is processed through either incineration or compaction to reduce its volume, or stored as is.
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> **Intermediate-Level Radioactive Waste (ILW)** is radioactive waste having a dose rate greater than or equal to 10 mSv/h (1 rem/h) at 30 cm (unshielded). ILW consists primarily of used reactor core components, ion exchange columns, resins, and filters used to keep the reactor water system clean. ILW is more radioactive than LLW, and requires shielding to protect

[1] NWMO Background Papers 7-2 Rennick& Associates p. 22
[2] OPG Licence Renewal Document p. 12, or 4,5; OPG CMD 17- H.3.1 p. 4,5

workers during handling. This waste is not processed for volume reduction. It comprises about 5% of the total volume of non-fuel waste produced by the NGSs.

High Level Radioactive Waste (HLW) is defined as a CANDU fuel bundle that was irradiated in a reactor core. It is stored at the nuclear station in irradiated fuel bays for a period of typically ten years or more, and then transferred into dry storage containers (DSCs). The WWMF provides storage for the used fuel generated by the Bruce Power reactors.

Other variations in the terminology and classification of LLW&ILW[3]**:**

1. **LLW** consists of non-fuel waste in which the concentration or quantity of radionuclides is above the clearance levels and exemption quantities established by the Nuclear Substances and Radiation Devices Regulations [32], and which contain primarily short-lived radionuclides (i.e., half-lives shorter than or equal to 30 years). LLW normally does not require significant shielding for worker protection during handling and storage.

   ILW consists of non-fuel waste containing significant quantities of long-lived radionuclides. ILW often requires shielding for worker protection during handling.

2. **LLW** – Radioactive waste in which the concentration or quantity of radionuclides is above the clearance levels established by the regulatory body (CNSC), and which contains primarily short-lived radionuclides (half-lives shorter than or equal to 30-years).

   ILW – Radioactive non-fuel waste, containing significant quantities of long-lived radionuclides (generally refers to half-lives greater than 30 years). [4]

These classifications use the term “clearance levels” as a component of LLW. This term, conveys a message that the amount (and activity) of LLW can be, and in practice is being “reduced”, and therefore is not fully accounted.

Other “definitions”, “qualifiers” of radioactive waste in particular for ILW (e.g., OPG’s Predictive Environmental Assessment Document[5])

LLW is waste having a dose rate less than 10 mSv/h at 30 cm.

ILW is waste having a dose rate greater than or equal to 10 mSv/h at 30 cm.

This document has included additional types of waste under the category of ILW:

All alpha emitting waste that is not used fuel waste, LLW or high thermal spent cobalt waste; or all filters and ion exchange columns with long half-life radionuclides, and reactor core components and bulk ion exchange resins.

How are alpha-emitting radionuclides separated out of the ILW alpha-emitting waste? How is it stored (what type of containment)?

[3] DGR 2013: Environmental Impact Statement 2011(EIS Section 4.5) The classification is consistent with Canadian Standards Association (CSA) N292.3

[4] Ibid Vol. 1 Acronyms (p.15.27)

[5] OPG’s Predictive Effects Assessment (PEA) Page 17, 4.4.1

Can it be completely assured that no alpha-emitting radionuclides are processed via incineration?

With respect to filters and ion-exchange columns, what is considered to be **long half-life** radionuclides? Is it related to just the half-life itself and/or the specific radionuclide?

A further set of criteria (or classification) is used based on contact dose that applies to the type of storage required. These contact doses (i.e. radiation fields) refer to the state of the waste before any volume reduction is performed. The three types of wastes are as follows:

$$\text{Type 1} \leq 2 \text{ mSv/hr}; \quad 2 \text{ mSv/h} < \text{Type 2} \leq 150 \text{ mSv/hr}; \quad \text{Type 3} > 150 \text{ mSv/hr}$$

Comments

- How were these "types" (Types 1, 2 and 3) derived and when? Are they legal limits?
- How do these types relate to the classification of L&ILW?
- Why is there such a large range in the contact dose for Type 2?
- Is there an upper range for LLW based on these types? Is ILW classified only as Type 3?
- How do these dose rates relate to the classification of ILW and LLW?
- What level of protection is provided for workers exposed to these radiation fields?

STRATEGIES FOR "MINIMIZING" RADIOACTIVE WASTE

Clearance Levels: Free-Release of Radioactive Material

As a means of dealing with the sheer volume of materials contaminated with "low-level" radioactive waste (LLW), governments and nuclear agencies have implemented policies to reduce the quantity of this type of waste that would otherwise require safe storage. In particular, materials contaminated with low levels of radioactive (LLW) would be free from regulatory control if they meet designated criteria referred to as "clearance levels".

The deregulation of low-level radioactive waste material has been in place in Canada for several years. Amendments to the *Nuclear Substances and Radiation Devices Regulations* (NSRDR) that were made in 2008 included the addition of "clearance levels".

If LLW is considered to be no longer radioactive, i.e., it meets clearance levels, it can be "free-released", that is, transferred without any restriction or regulatory control, to municipal landfills, to recycling streams, metal recyclers, etc., and ultimately into commercial and consumer products, ranging from building materials, steel, roads, vehicles, tools, utensils, furniture, playgrounds, roads, fertilizers, etc. without public knowledge or consent, or any means of tracking it. No labelling is required. There is no way of knowing what portion of recycled material or a product contains "cleared" radioactive waste.

This practice allows the nuclear industry to claim that it has "minimized" or "reduced" its radioactive wastes, without any consequences. This is not reducing or minimizing waste but dispersing it in the public domain.

Free-releasing radioactive-contaminated material and dispersing it in products, landfills, and so on, without public knowledge or consent removes responsibility and liability from the nuclear

industry and the government. It is not a sound or safe practice but a rather dubious and devious means of reducing radioactive active waste as though such waste never even existed.

"Likely Clean" Waste

Other methods of minimizing L&ILW waste have evolved, such as the "Active Waste Program" which is designed to segregate this waste into categories of Active, Active Metal and "Likely Clean", that is, waste monitored for tritium, alpha, beta, and gamma emitters. If the non-radioactive or radioactive material of this waste is below acceptance waste criteria, it is sent for disposal at licensed landfills, in accordance with the *Nuclear Substance and Radiation Devices Regulations*.

The category of "Likely Clean" is an example where radioactive material would be free-released. However, there is no indication as to the approximate amount of the Likely Clean waste that is sent for disposal. The "acceptance waste criteria" are not specified. It is also not clear whether any of this cleared waste is sent for purposes other than disposal in landfills.

Are members of the communities where the Likely Clean waste has been disposed of aware or notified that these wastes may be present in landfills, etc.? For example, is groundwater by these landfills, monitored for radioactivity? Can these "clean wastes" end up in drinking water?

While "likely clean waste" is monitored for alpha emitters, active waste and active metal bags are not. Presumably, if alpha were in such waste, it would not be free-released, but that unknown.

What are the waste acceptance criteria (WAC) that determine whether LLW-containing material can be unconditionally or conditionally released (for recycling, disposal at landfills, etc.)? Does it depend on how such waste would be used in the marketplace (e.g., recycled metal in consumer products?)

Landfills often reveal nasty surprises in the future and resident stakeholders need to be aware that this risk might be present in the landfills accepting the Likely Clean radioactive wastes.

Commonly used merchandise, especially containing metals, are found in households, playgrounds, tools, etc. How much or radioactive material resides in the material used is unknown. What may seem "safe" today may prove fatal years later, a lesson that government, industry seem not to have learned.

As an example of Waste Minimization Practices, in 2013, OPG's WWMF instituted its "Likely Clean" waste segregation initiative to improve its waste minimization. Metals were segregated and either surveyed, decontaminated and free released, or if not able to be decontaminated, stored for future processing or interim storage. The volume of waste generated at the WWMF decreased by about 40% since this initiative was implemented.

This initiative is one more example of how widespread the practice of free-release is used as a means of "minimizing" the amount of radioactive waste (not including HRW), spent fuel) resulting from nuclear activities. Reducing the volume of waste that is stored merely shifts the burden of waste off of OPG and unwittingly into the public domain. Allowing such materials to enter the public domain without such identifiers is deceptive and is unacceptable.