4.2 CASE STUDIES: WS 14.-15.6.2021

Storage and processing of wastes at COVRA‘s LOG facility, pending availability of a DGR

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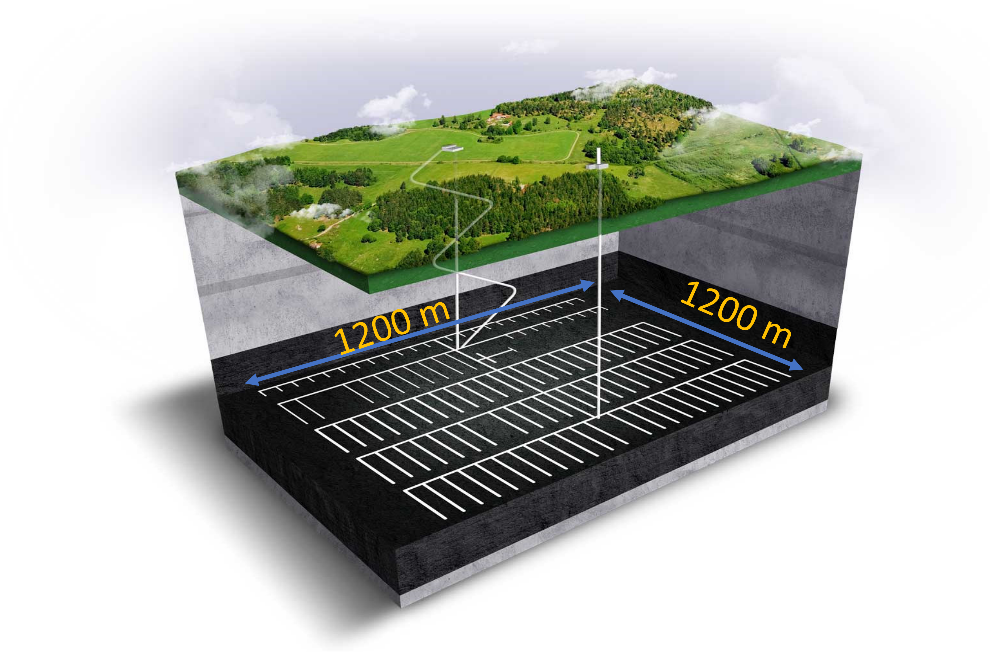
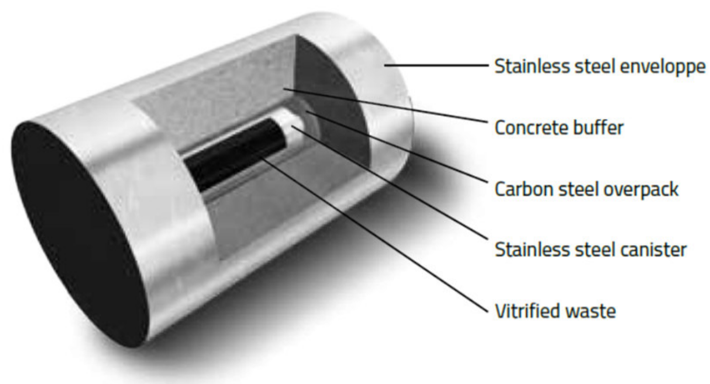
NATIONAL BACKGROUND

- All radioactive waste is stored at least 100 years in facilities above ground
- Cornerstone of the Dutch RWM policy is the IBC-criteria (“Isoleren, beheersen en controleren”) translated to isolation, control and monitoring

DEEP GEOLOGICAL DISPOSAL

- **Single deep geological repository is foreseen**
  - Waste categories separated in their own disposal areas
- **Dual-track**
  - National repository either clay or salt host rock, or
  - Multinational shared repository
- **Retrievability requirement**
  - Fraction of waste and period of disposal this applies, not clearly defined
- **Decision on disposal to be made around 2100**
- **New long-term research programme on geological disposal started 2020**
  - Will cover a period of at least 30-years
  - Revised every 5-years

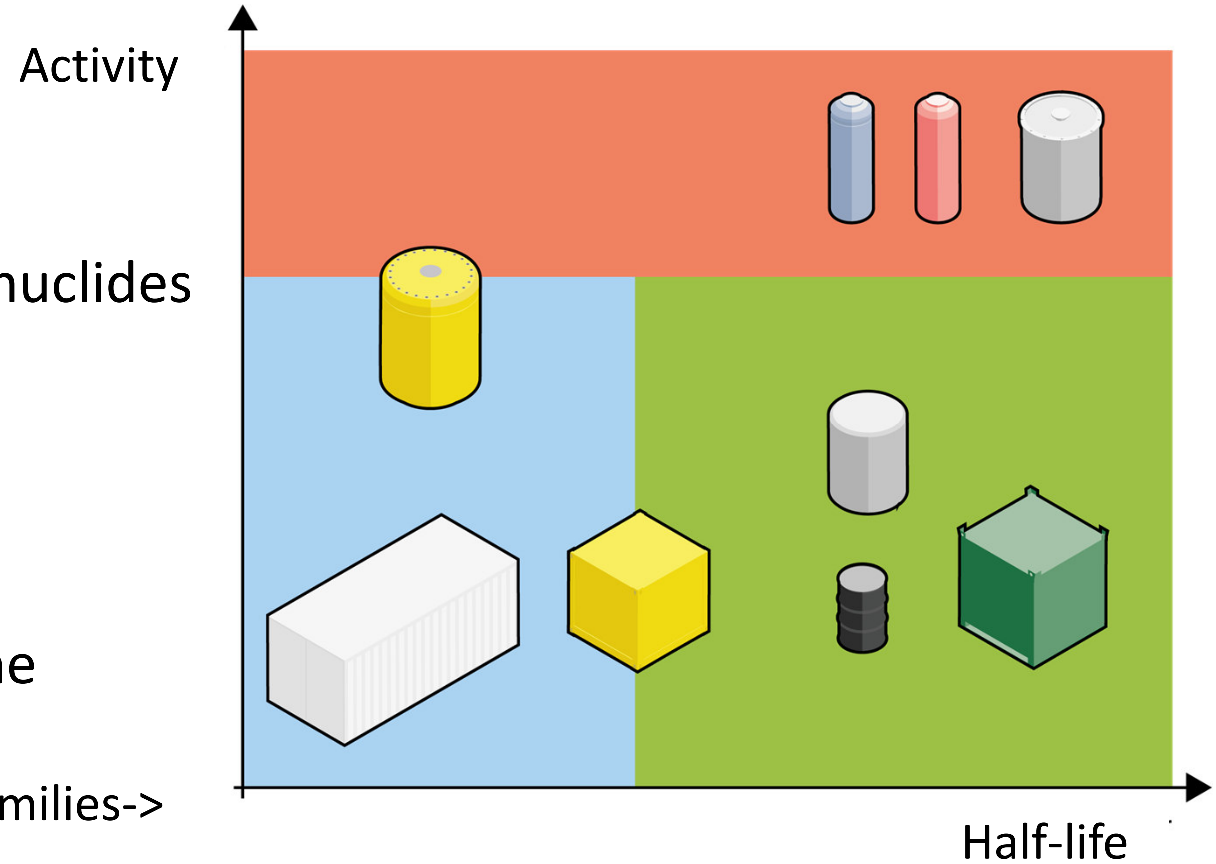




OPERA Safety Case, 2017

WASTE GROUPS

- Short-lived easy to determine nuclides
  - Transport (dose rate, activity)
  - Processing (weight, water -%)
  - Storage
- Long-lived difficult to determine nuclides
  - Disposal (Safety Case-> waste families-> disposability assessment)



DESCRIPTION OF THE WASTE IN CASE STUDY (LILW IN LOG)

- **There are (yearly) around 200 organisations producing LILW**
  - NPPs, research establishments, different industries and hospitals
- **Most of them produce small volumes of waste**
- **Waste forms vary**
  - Solids, liquids, slurries, animal carcasses, machines, equipments, sealed sources – **mostly solids**
  - Dismantling of nuclear and other installations (mostly concrete and metals)

WASTE ACCEPTATION

Waste acceptance process in four steps

From legacy waste there is not always enough information to determine the management route

https://www.covra.nl/nl/downloads/afval-aanmelden/

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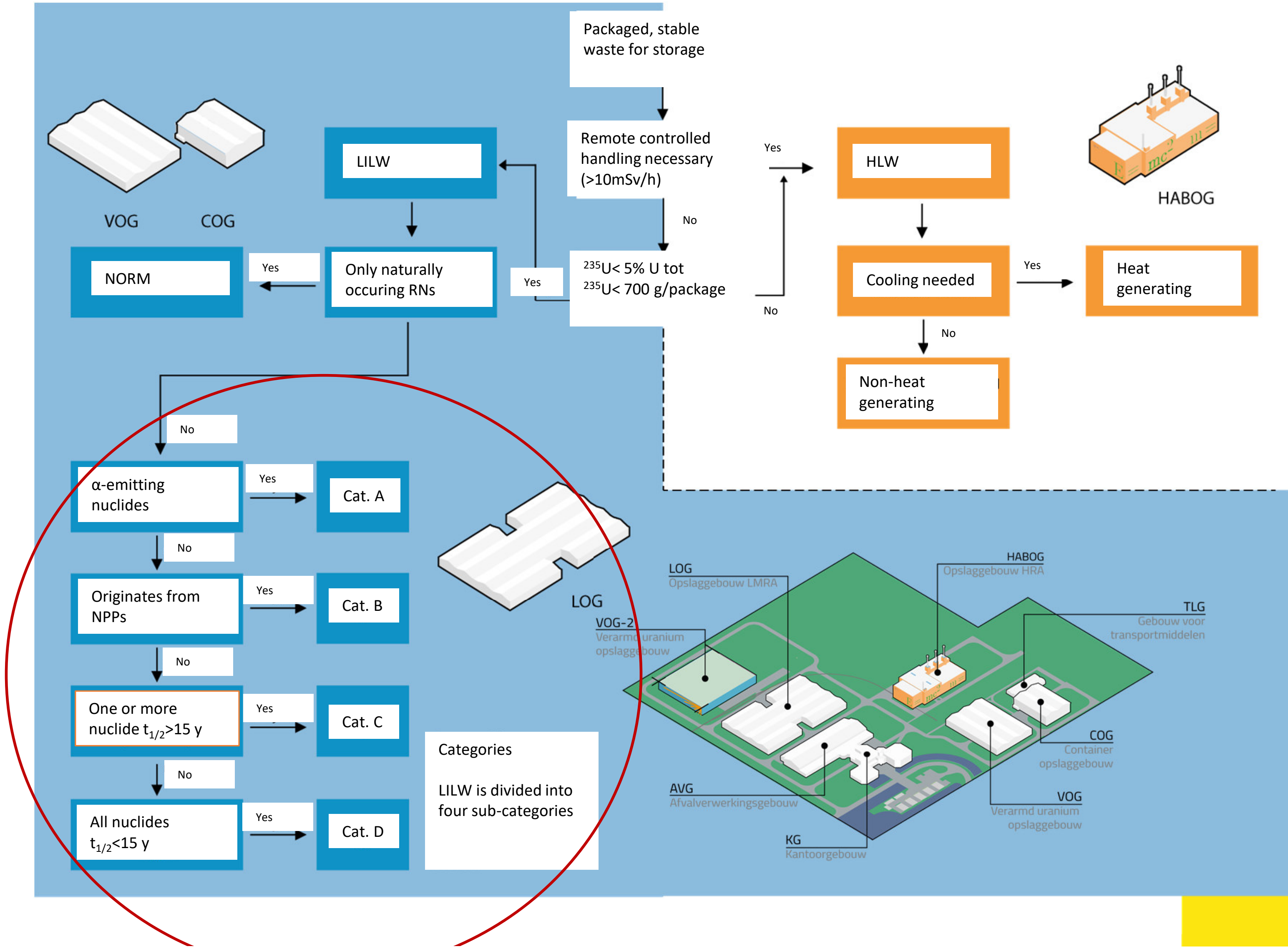
STORAGE

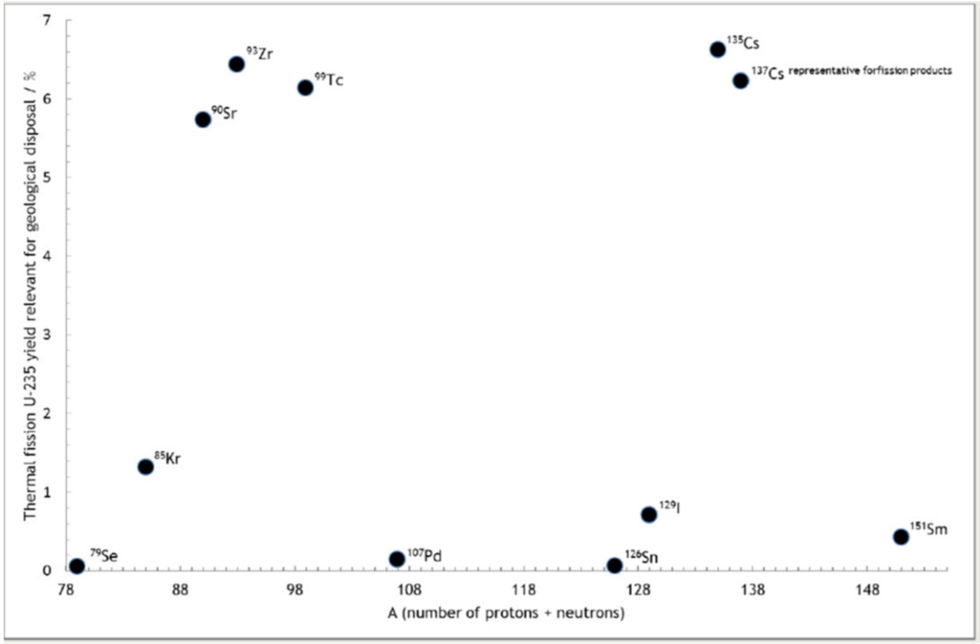
- Every waste type to their own facility
- LILW waste stored in LOG
- Four categories based on:
    - Political decision and
    - For transport, processing and storage purposes

COVRA: Het Oranje Boekje, 2017



LONG-TERM SAFETY OF DISPOSAL

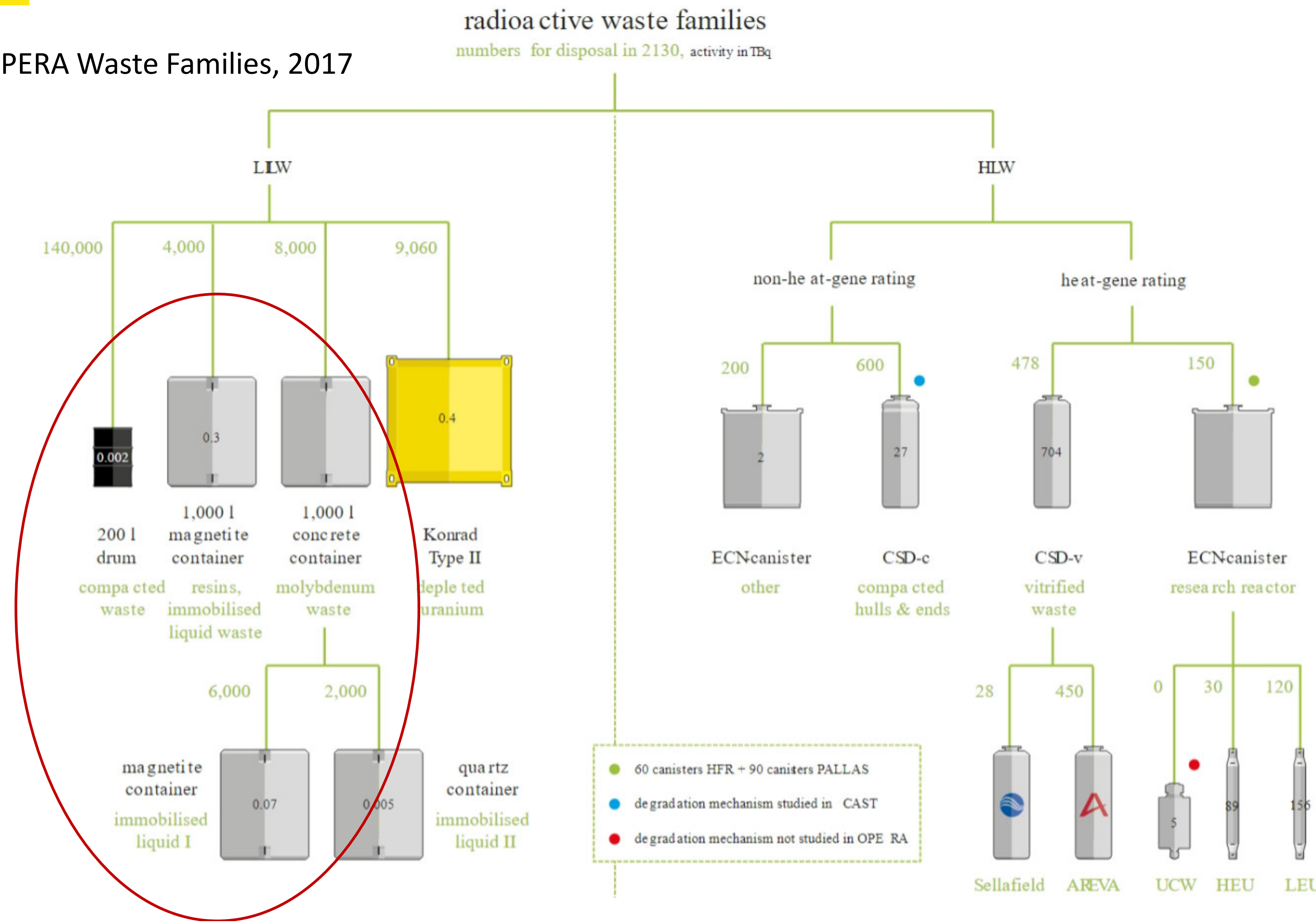
- **Safety functions are largely comparable with those from storage (isolate, contain, shield)**
- **An important difference is that for disposal also the long-lived, mobile nuclides (such as ^{129}I, ^{36}Cl, ^{79}Se, ^{14}C, ^{126}Sn, ^{99}Tc) should be characterized**
- **Also waste matrix has effect on RN solubility**
- **To estimate source term waste is divided into waste families, criteria of grouping includes**
  - Content or degradation mechanisms and
  - the potential contribution to the source term (grouping of small volumes of waste)



METHODOLOGY FOR DETERMINING THE SOURCE TERM FOR DISPOSAL

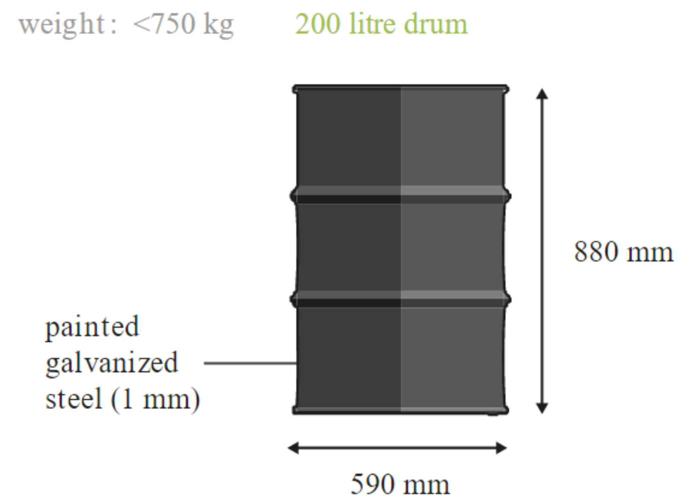
- **Waste is grouped based on**
  - The origin and similar nature
  - Identical or close conditioning characteristics
  - Waste classification category (H-I-L)
- **This grouping facilitates calculation of source term, but is necessarily simplification**
- **For each group standardised description is derived**
  - Based on needs of the safety assesment
  - **Available information ->** Input for WAC when needs identified
- **Standardised description includes**
  - Origin of waste (generation and processing)
  - Number of packages
  - Characteristics of the waste container (dimensions, steel and concrete type)
  - The waste matrix (chemical composition of the waste)
  - Radionuclides per waste container
  - If relevant the heat output

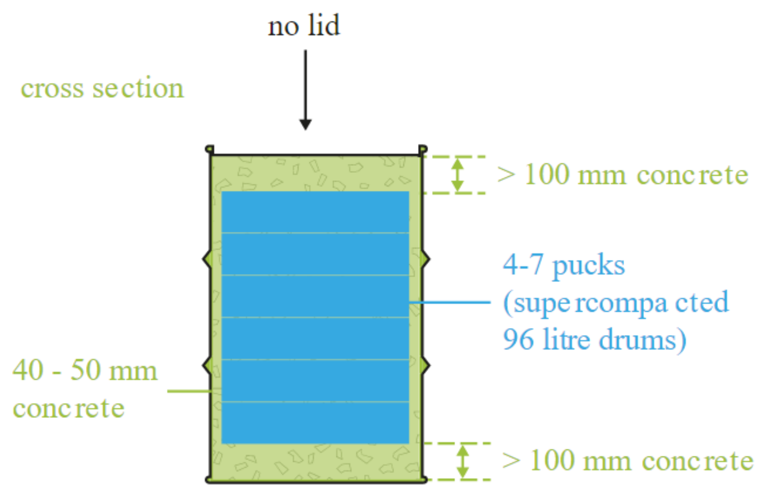
COVRA, OPERA Waste Families, 2017



EXAMPLE: COMPACTED WASTE

- **Most of the volume of LILW is solid compactable waste**
- **For OPERA safety assessment it was assumed that all the LILW is compacted waste family,**
  - with the exeption of depleted uranium and processed liquid waste (from molybdenium production or ion-exchangers)
- **Based on expert judgement a tentative composition is listed (organics, metals, plastics and others)**
- **Concrete for conditioning is made of blast furnace slag, cement, water agregates and plastisicers**
- **200 L galvanized steel drum**
- **Is ready for disposal after storage period**
  - No additional packaging





OBTAINING MISSING RADIONUCLIDES FOR COMPACTED WASTE

- **Waste producers information is based on gamma spectrometry measurements (e.g ^{137}Cs and ^{60}Co)**
- **Methodology for completing missing radionuclides is to consider**
  - ^{137}Cs representative for fission products
  - ^{60}Co representative for activation products
  - Using scaling factors

- **For compacted waste:**
  - A nuclide vector is made by quaterly reporting by COVRA
  - The vector is the average of over 10 000 drums of conditioned waste
  - As a first approximation the activity of each radionuclide is this summation divided by number of drums

SUMMARY OF THE LILW WASTE IN LOG

Questions	Answers
What type / degree of waste management was deployed? What was the resulting product?	*Waste is transported, processed and stored at COVRA premises* • The waste is stored under dry conditions in a stack. The stacking for storage conditions is considered to be higher than at disposal conditions i.e. the mechanical conditions are more severe. • All LILW waste is also processed to meet requirements for chemical and physical stability during flooding of the LILW storage facility. • Many of the precautions taken may also be suitable for disposal e.g. in clay host rocks. • Salt host rock disposability is currently reviewed
What subsequent management steps are envisaged?	Waste in question (for safety assessment purposes) is conditioned in galvanized steel drum Concrete for conditioning is made of blast furnace slag, cement, water agregates and plastisicers. At the moment LILW is considered to be disposed of as is.

SUMMARY OF LILW WASTE STORED IN LOG

Questions	Answers
In the timeframe relevant to the case study, what was the status of: ➢ The envisaged disposal route? ➢ WAC (or equivalent requirements) for waste management, transport (if applicable) and disposal? ➢ The technical solution / facility?	• Deep geological disposal is planned but no site has currently been identified. • WAC for transport and waste processing and storage have been established several decades ago. • WAC required for safe disposal of radioactive waste has recently lead to that additional information has been asked from the waste generators following the outcomes of the third national programme. • Further checking of compliance to WAC is in progress. • National (clay, salt host rocks) and shared solutions are studied in long-term research programme, disposability is an important driver for research

Were there any other uncertainties or challenges relating to management of the waste?
E.g. safety concerns, licensing issues, costs, use of non-proven techniques, stakeholder concerns, uncertain waste characteristics, issues with prior treatment,…
	• For disposability:
	  • Gas formation, complexing agents
	  • Research for clay further ahead than for salt

Why was a decision taken to implement this waste management initiative at this time, despite these uncertainties / challenges? What were the anticipated benefits? *E.g. passivation of waste; available space at storage site,…*	To safely manage storage above ground: There are several benefits of one responsible organisation for having all expertise for transport, processing, storage and disposal of the waste concentrated in a single organisation e.g. employee safety and costs become relatively low for small waste generators.

SUMMARY OF LILW WASTE STORED IN LOG

Questions	Answers

Please describe the approach(es) taken to manage / resolve issues or challenges associated with the case study. For example, how were ongoing uncertainties about the requirements for disposal and the scope of associated WAC addressed?
E.g. conservatism in approach? Not implementing final conditioning step? Limited scope of WAC?,…
	COVRA's waste management approach aims to condition waste for storage in a manner that will be bounding of many conditions expected in a repository. Approach is applied across a wide range of waste classes and categories (for all waste except VSLW and exempted waste).
	• Continue collecting and documenting information about waste forms
	• Improve COVRA's criteria for waste acceptance from disposal point of view
	  • Keep developing disposal concepts (and safety assessments)
	  • ->clarifying requirements (for disposal)
	  • -> input for WAC

What experience can be taken from this case study? *What went well / not so well? Were the anticipated benefits realised? Were there any unexpected challenges or additional benefits? What ongoing uncertainties persist?*	Learn and confirm: • Every 15-20 years waste packages are checked, • Possible failures repaired and • Changes in conditioning done if required
Will the decisions taken constrain future waste management activities? *If so, please describe how*	Aim is that they do not, and based on present knowledge they do not (OPERA Safety Case). But disposability is important driver in research programme and will be followed.
Based on this experience and/or more recent activities elsewhere, would anything be done differently if repeated?	System is designed so that we learn from it. More than 100 years above ground storage is national policy.

UNCERTAINTY MANAGEMENT SUMMARY (LILW IN LOG)

- Increase safety of storage by concentrating it for one place and organization
- Regular monitoring of waste package performance during storage, with provision for reconditioning if necessary
- Requirements for storage expected to be similar to (or higher than) for disposal
- Ongoing disposability research to support continued improvements in WAC
- Simple disposal system assumptions underpinning in the safety assessment while the site is not yet known
- Conservative assumptions for the safety assessment calculations

THANK YOU, ANY QUESTIONS?