

ROUTES Subtask 4.2 workshop

Notes taken for Case Study 1 (Ukrainian case) and Case Study 2 (Greek case)

After presenting the main goals and expected outcomes of the ROUTES project, the feedback from the WAC webinars jointly organised by PREDIS, ERDO and ROUTES projects have been shared and raised different needs among which:

- The particular case of legacy waste calls for **development of sampling/characterization methods**;
- The **harmonisation of WAC among countries** would be useful and coordinated approach in EC, IAEA, NEA projects would be helpful to gain this goal. *Methodology should be harmonised*

To illustrate those elements, two case studies have been presented and were related to (i) the reconditioning of bituminized wastes without available WAC in Ukraine and (ii) the characterization of historical cemented sludges in Greece.

Those presentations notably highlight various initiatives taken to **better characterize those legacy wastes** for which information and detailed characteristics have been lost. It can be mentioned that for the Greek case study, **destructive methods** have been implemented to sort out the most radioactive elements and prepare them for reconditioning.

With regard to the Ukrainian case study, chemical properties as well as physical ones such as explosiveness are deeply analysed to prepare repackaging and so, ensuring that new containers meet the WACs of the envisaged storage (ENSDF).

Following these two presentations, the discussions raised the following elements:

- Development of sampling and characterization methods need **consequent means** implying financial and human resources. It is interesting to note that for the Greek case, characterization process of cemented sludges has been stopped because of lack of financial resources;
- The Greek destructive method is **not transferable in all countries** within which, larger volumes of cemented sludges might be at stake;
- Criteria on which the processes are based **need to be coherent**. For the Greek case for instance, the general clearance of Cs-137 is 0.1 Bq/g, needs to be more specific, based on 10 microSv/y for the public. This particularity can draw some criticisms and it is needed to be more coherent or to provide clear justification;
- Ukrainian case study have shown that **beyond radiological properties, chemical and physical ones are equally important**. It turns that for the particular case of bituminized wastes, the real challenges lie in **treatment methodologies** that should be further developed;
- The case of **sharing**, whether in terms of common WAC or joint storage/disposal facilities, is a solution to be explored. **This is a difficult but not unrealistic option**. However, it seems interesting to first, envisage "common treatment and conditioning processes and even mobile dedicated facilities" before thinking about common and harmonized WAC among the countries; *cfr the feedback received on Directive 2011/70 (50% expressed need for sharing. Moreover, sharing is already a reality.*
- IAEA notably specifies that even for the methodology related to WAC development, the approaches stay country specific. Before thinking about joint WAC, it is rather necessary to **harmonize among the countries the frameworks related to management of radioactive wastes**: e.g., dose limits, clearances thresholds, etc.

ROUTES Subtask 4.2 workshop

Notes taken for Case Study 3 (Dutch case)

Waste management strategy in the Netherlands:

- Consolidation of all radioactive waste at COVRA's facilities, and processing into conditioned packages suitable for storage above ground for at least 100 years → unique strategy
- Dual track approach to disposal:
 - Planning for a national repository
 - Pursuing opportunities for a multinational shared facility
- Iterative, (now) continuous disposal research programme alongside periodic monitoring / inspection of stored packages
- LILW waste categories for storage are based on requirements for transport, processing and storage, as well as political decisions → established WAC are based on these categories, as applicable at each storage facility
- Groupings for disposal are currently based on behaviour in a disposal environment (a basis for estimating source terms in safety assessment) → disposal WAC in development

Key discussion points:

- Inspection every 15-20 years - effectively a rolling stewardship; each time by a new generation of the workforce
 - What provisions for knowledge management over 100 years(+) of storage?
- Small volumes of unusual wastes challenge existing WAC → targeted solutions required
 - May be cost-limited; thermal treatment may help
- Monitoring / inspection facilitated through storage approach (e.g. no lids on packages)
- Early processing facilitates safe storage while disposal route is unknown
 - Uncertainties managed via a range of factors (last slide)
 - Allows time for research and provision of funding for disposal
 - Long storage timescale may give the impression that nothing needs to be done → lack of political urgency, particularly considering fluidity / short timescales of national government
 - Lead times for implementing disposal are long → decades – don't wait until 2100!
- Intermediate / interim waste management solutions may be necessary (c.f. UK SSBs)
 - A common issue!
- Regarding SIMS → don't depend only on a shared disposal solution → national programmes still desirable
 - The essence of the dual track policy is that you should constantly promote, monitor, develop and compare possible multinational disposal options with the national DGR project. This means that nothing is lost, and you can change track when needed and give acceleration to national DGR project when necessary.

ROUTES Subtask 4.2 workshop

Notes taken for Cross Cutting Topic 1 (Generic WAC and the UK Disposability Assessment Process)

Andy detailed that as the UK currently does not have a site for geological disposal no Waste Acceptance Criteria (WAC) for a UK Geological Disposal Facility (GDF) exist. In order to allow packaging of waste for disposal in a future UK GDF the UK has developed generic specifications for three types of host rock: higher strength rock; lower strength sedimentary rock; evaporites. To assess compatibility of packaging proposals (in the UK the waste packager presents proposals for waste packaging to Radioactive Waste Management Limited (RWM) the Disposability Assessment process is used. Andy outlined the Disposability Assessment process, stating that it uses the most constraining parameters from the generic specifications. Proposals assessed to be compatible with the generic specifications are endorsed via a Letter of Compliance (LoC). Andy went on to detail how RWM assures the continued endorsement of packaging proposals (and produced packages) via the Package Assurance function, which uses various activities (Periodic Review; Cross Cutting Reviews; Technical Audits; Periodic Review Disposability Assessment) to ascertain and/or maintain the validity of endorsements.

Andy identified that Scottish wastes do not follow UK policy and that Scottish policy is to dispose of waste in near-surface facilities. However, as Scotland has not developed an analogue to the Disposability Assessment process the Disposability Assessment process is used to assess the compatibility of Scottish waste packaging proposals with near-surface disposal.

In the subsequent discussion, approaches to defining WAC and of assessing proposals for geological disposals adopted in Italy, France and Sweden were discussed:

- Italy is following the RWM and Letter of Compliance approach closely;
- The approach to develop WAC and ensure that the Waste Package is compliant with "WAC" is the same in France;
- SKB (Sweden) give a range of predefined processes (packages and conditioning). Make use of one of these. If it requires something not pre-approved, need to follow an argument/submission based process

Use of high integrity containers in the UK was discussed. Andy detailed that in the UK currently Ductile Cast Iron Containers (DCICs) are used to package dried spent ion exchange resins. There are concerns around the amount of voidage present in some of these waste packages. LoCs for these waste packages all contain a caveat that states that this position may change in the future and that the waste packages should retain the capability to fill the voidage with suitable material if required.

Another type of high integrity container, the Self-Shielded Box (SSB), currently used at Sellafield for interim storage of waste. RWM is currently undertaking work to assess their suitability as disposal packages

The packaging of High Heat Generating Waste (HHGW) was discussed. Andy detailed that the UK does not yet have final designs for waste packages for HHGW (as their design will be driven by the geology of the GDF, which is yet to be determined). However, a range of specifications for Interim Products are being developed to allow safe storage of HHGW. The Interim Products will form part of any waste packages for HHGW.

There was discussion around moving from generic specifications to WAC, specifically concerning the conservativeness and scope of the generic specifications and WAC. Andy stated that WAC need to be consistent with the generic specifications. However, if we reduce the number of generic specifications (e.g. remove one of the rock types), the WAC may relax if the most constraining criteria from the generic specifications are removed.

When asked if generic specifications could lead to unreasonably conservative criteria, Andy replied that you would continue to use the same packages but would have lesser demands on proof of performance when going from generic specifications to WAC. A lot of the challenge is about the quality of the evidence. It takes more evidence to demonstrate understanding of packaging to meet more conservative criteria. Generic WAC are more conservative. You might package things more than you needed to, but this isn't seen as a risk. You also might spend some more money but this provides the max amount of safety - versus the risks of not packaging things correctly. You have to take a holistic approach and look at everything to be able to make a suitable judgement.

Angelo Paratore: Italy is following the RWM and Letter of Compliance (LoC) approach closely. Are high integrity containers still being used in the UK?

Andy Harris: Yes, but we don't expect to see them being used for "normal" wastes. They are currently used to package resins that need drying. There is uncertainty concerning the allowable voidage in high integrity containers. LoCs contain a caveat that states that this position may change in the future.

Ductile Cast Iron Containers (DCICs) are currently used in the UK for packaging wastes. Self-Shielded Boxes (SSBs) are not yet used – RWM is undertaking work to assess their suitability for disposal packages.

Elisa Leoni: The approach to develop WAC and ensure that the Waste Package is compliant with "WAC" is the same in France. Question to the audience: Does any other country have a completely different approach?

Angelo Paratore: In Italy we're following a similar 'Disposability Assessment' approach, gaining flexibility postponing the conditioning of solid ILW and packaging them in so called High Integrity container (no matrix Ductile Cast Iron Containers).

Andy Harris: SKB give a range of predefined processes (packages and conditioning). Make use of one of these. If it requires something not pre-approved, need to follow an argument/submission based process.

Jan Haverkamp: In a situation such as High Heat Generating Waste (HHGW) that is packaged into copper canisters does not provide enough protection, is there sufficient flexibility to change packaging formats? Is it possible to repackage smaller to fit into smaller vaults, i.e. Is there flexibility to clean out existing packages to make smaller packages and would you increase the total amount of waste if you repackage?

Andy Harris: For HHGW we don't have designs for the final waste packages yet, as we don't have the geology selected yet. We want to set generic specifications for interim storage solutions that allow a range of final packages (e.g. copper canister). These are currently being developed. This has to be bounded to a degree (hierarchy of options), including generic designs for packaging, as there does come a point where you have to decide on a finite range of options. You can't keep the options open forever without building expensive new storage facilities.

Andy also noted that Scottish wastes aren't to be disposed of in a GDF (they have a different approach). Near surface disposal is less well defined, but they use the same processes as Disposability Assessment (DA), as it is the next best thing / good surrogate for this.

Liz Harvey: In developing WAC from generic specifications will the scope and extent of the WAC be expected to be wider than the scope and extent of the generic specifications?

Andy Harris: WAC needs to be consistent with all of the generic specifications. Generic WAC are therefore more demanding to adhere to. Hence, if we reduce the number of generic specifications (e.g. remove one of the rock types), the WAC should relax, as the most constraining criteria from the generic specifications are used to bound things.

Elisa Lioni: Do not you think that Generic Specifications could lead to unreasonably conservative criteria?

Andy Harris: You would continue to use the same packages but would have lesser demands on proof of performance when going from generic specifications to WAC. A lot of the challenge is about the quality of the evidence. It takes more evidence to demonstrate understanding of packaging to meet more conservative criteria.

Generic WAC are more conservative. You might package things more than you needed to, but this isn't seen as a risk. You also might spend some more money but this provides the max amount of safety - versus the risks of not packaging things correctly. You have to take a holistic approach and look at everything to be able to make a suitable judgement.

ROUTES Subtask 4.2 workshop

Notes taken for Cross Cutting Topic 3 (Managing the potential for non-compliances to arise as WAC are iterated – Examples from Slovenia and from Belgium)

For this topic, Chris De Bock presented examples of new criteria introduced in the WAC for the near surface disposal facility to be constructed in Belgium such as insensitivity of the cemented waste to the alkali-silica reaction or delayed ettringite formation, and restrictive and very conservative limits for content per waste drums of mineral chloride ions, sulphate and cellulose materials. In its presentation, Chris also give examples on proposed solutions to tackle these more restrictive criteria such as ongoing R&D to support future relaxation of these criteria, new guidance to the waste producers on setting the row waste and modification of the acceptance system.

The second speech on this topic was given by Nadja Zeleznik presented an example of development of WAC for storage facility in Slovenia. The WAC development was a process imposed by the inadequate condition of the storage facility at that time and this process was initiated by a decree of the regulatory authority.

Discussions:

Anastasia Savidou asked for the Slovenia case how they determined the WAC and if they had in mind the future. Nadja pointed out that the WAC development was an urgent solution and the WAC were kept as simple as possible keeping open all future options for waste treatment and conditioning and these WAC for storage facility were developed without knowing the future criteria for final disposal.

For Belgium case, Crina Bucur asked what will happen with the waste that are not complying the more restrictive criteria and are nevertheless conditioned for storage, if based on the Safety Report the criteria for final disposal will not be relaxed. Chris specified that this is a calculated risk, but from the ongoing discussions with the safety authorities the WMO is confident that the criteria can be further relaxed. A similar question was put Anastasia, namely how easy is the reconditioning for the waste that does not meet the more restrictive criteria. Chris specified that the waste reconditioning will be considered only if the criteria will not be relaxed and as alternative to reconditioning the disposal route can be changed and the already conditioned waste may be disposed of in the geological repository. Also Chris pointed out that as in Belgium a disposal facility was never licenced up to now the safety authority tends to be very conservative and some time the very restrictive criteria imposed are not feasible.

Soufiane Mekki, asked about management of alpha-bearing waste. Chis answered that in Belgium this waste category is not intended to be disposed in the near surface disposal facility but in the geological repository, while Nadja indicated that calculation will be made to decide if the alpha-bearing waste can be accepted in a silo type repository to be commenced in Slovenia.

Soufiane also asked about the implementation of WAC in case of conditioning made by the waste generator. Chris specified that the WAC along the waste life cycle were “negotiated” between ONDRAF/NIRAS and waste generators while Nadja mentioned that regular inspections are performed to check the process documentation.

Soufiane Mekki gave example of French experience with the waste conditioned prior the surface disposal facility Centre L’Aube was commissioned. For those waste packages a long term collaborative work was done/is ongoing (?) for re-characterisation, re-categorisation and reconditioning. Elisa Leoni completed with the fact that a proper solution can be achieved by an iterative process between waste generators, WMO and regulator and, for the waste already conditioned, a good balance between the two options have to be found: geological disposal versus reconditioning.