

OVERVIEW ON CHALLENGING WASTE IN ASTRA

What ASTRA means by “challenging waste”.

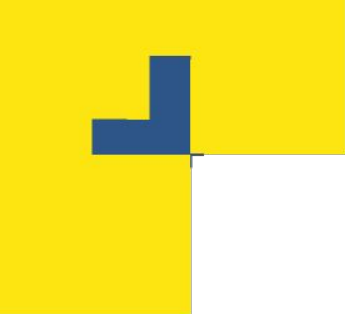
Main findings from Milestone 61 and Milestone 70.

Implications for SIMS, shared solutions and future R&D.

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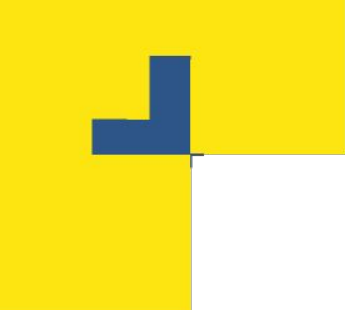
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ASTRA CONTEXT: WHY CHALLENGING WASTE IS STRATEGIC TOPIC

- ASTRA investigates readiness, feasibility and optimisation of alternative radioactive waste management strategies.
- The work is especially relevant for Small Inventory Member States (SIMS), where full national infrastructure may be disproportionate to the waste volume.
- The focus is not limited to one waste type; it covers small, heterogeneous, legacy and long-lived waste streams that do not fit easily into standard routes.
- The strategic question is how to move from isolated national approaches towards proportionate, safe and cost-effective solutions.

Key message: challenging waste management requires technical solutions, but also proportionate regulation, long-term planning and cooperation.



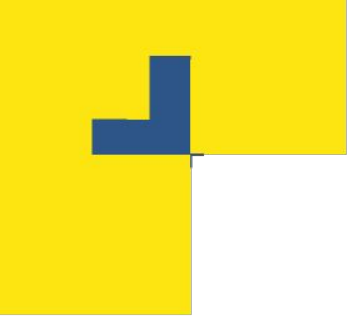
EVIDENCE BASE USED FOR THIS OVERVIEW

Milestone 61: NORM, U/Ra/Th and DU

Milestone 70: SIMS and shared solutions

- Task 5.1: management strategies for small amounts of waste in SIMS and LIMS.
- Task 5.2: shared solutions and multinational cooperation mechanisms.
- Uses questionnaires, workshops and Live Discussion Forums.
- Identifies priority gaps: inventory, characterisation, treatment, conditioning, WAC and scalable disposal.

Key message: the two reports together show both the waste-specific challenges and the system-level cooperation needs.

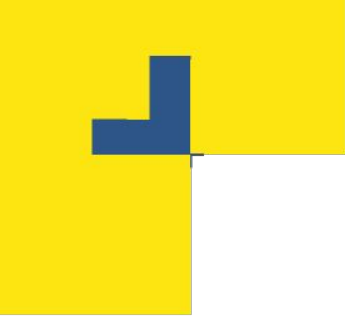


WHAT MAKES A WASTE STREAM „CHALLENGING“?

In ASTRA, challenging waste is best understood as waste that creates difficulty somewhere along the lifecycle from inventory to final disposal.

- Small quantities can still require complex treatment, packaging or safety justification.
- Historical or legacy waste may have incomplete documentation and uncertain conditioning history.
- Heterogeneous waste can be difficult to characterise and classify against waste acceptance criteria.
- Long-lived naturally occurring radionuclides require attention to long-term safety and disposal performance.
- Some materials, especially depleted uranium, may be treated as waste, resource or safeguarded material depending on the country.

Key message: challenging waste is defined by the management problem it creates, not only by its radiological inventory.



MAIN CATEGORIES OF CHALLENGING WASTE ADDRESSED IN ASTRA

The ASTRA work covered several waste categories that require tailored approaches rather than generic disposal assumptions.

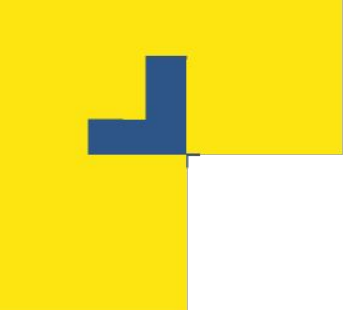
Waste categories

- Legacy and previously conditioned waste.
- NORM and Ra/Th/U-bearing waste.
- Depleted uranium and uranium-bearing residues.
- Disused sealed radioactive sources.
- Sludges, metals, concrete and other heterogeneous streams.

Why they matter

- May lack clear inventory or records.
- May require re-characterisation or reconditioning.
- May not fit existing WAC or disposal concepts.
- Can create disproportionate costs for SIMS.
- Require credible long-term safety demonstration.

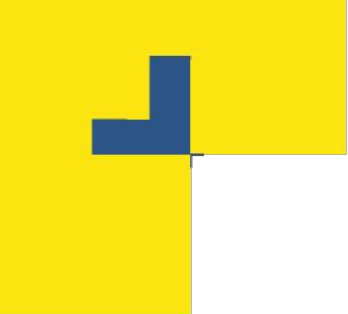
Key message: ASTRA treats challenging waste as a lifecycle issue connecting waste producers, WMOs, regulators, TSOs and research organisations.



NORM, RA/TH/U AND DEPLETED URANIUM: KEY OBSERVATIONS

- Milestone 61 shows substantial differences between countries in how NORM, Ra/Th/U-bearing waste and depleted uranium are defined and managed.
- NORM is generally understood as waste containing natural radionuclides above country-specific exemption or clearance criteria.
- Depleted uranium is more ambiguous: in several countries it is not simply treated as waste, but as a potential resource, reusable material or safeguarded material.
- This affects whether countries develop disposal programmes, maintain long-term storage, pursue reuse/recycling, or defer final decisions.
- Countries with more mature systems tend to combine inventory control, treatment or conditioning, reuse/recycling where appropriate, and disposal planning.

Key message: NORM and DU management cannot be harmonised unless definitions, regulatory thresholds and strategic end-points are made clearer.



CURRENT MANAGEMENT TENDENCIES FOR NORM AND DU

Reported management options include waste minimisation, pre-treatment, treatment, blending, reuse/recycling, conditioning, storage and disposal.

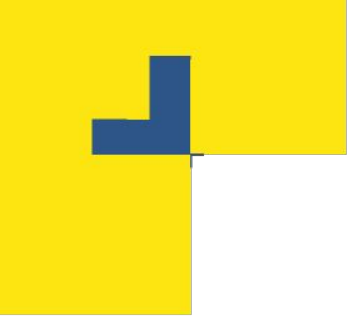
Observed tendencies

- Storage and disposal are the most common or most frequently considered management routes.
- NORM is more frequently associated with operational disposal routes than DU.
- Reuse and recycling are particularly relevant for DU, including re-enrichment, MOX-related use or possible backfill concepts.
- Treatment and conditioning are unevenly developed across countries.

Disposal pathways considered

- Near-surface disposal facilities.
- Dedicated disposal sites or engineered landfills.
- Silo-type or other intermediate concepts in some contexts.
- Deep geological disposal for waste requiring long-term isolation.
- Continued storage where final disposal routes are not yet defined.

Key message: many countries are still optimising the route from material status and inventory to final disposal or long-term storage.

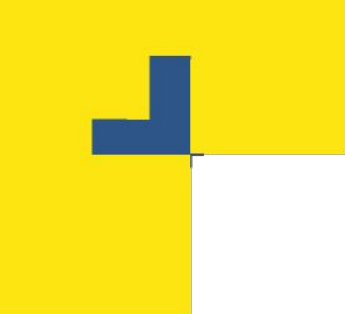


LEGACY AND CONDITIONED WASTE: PRIORITY GAPS

Milestone 70 identifies previously conditioned or legacy waste as one of the most pressing topics for knowledge exchange and targeted solutions.

- Reliable inventories are a prerequisite for safe management, but historical records can be incomplete, inconsistent or lost.
- Characterisation may require combining archival information, non-destructive measurements, sampling and conservative assumptions.
- Treatment and conditioning must produce stable waste forms suitable for interim storage and eventual disposal.
- Existing packages may need reconditioning if they no longer meet modern safety or storage expectations.
- Waste acceptance criteria are essential, but may not yet exist for final disposal in countries still defining national strategies.

Key message: legacy waste management depends on disciplined data management as much as on physical treatment technology.



SHARED SOLUTIONS: OPPORTUNITIES AND CONSTRAINTS

Why shared solutions are attractive

- They can reduce duplication of expertise and infrastructure.
- They help SIMS access specialist competences that may not be available nationally.
- They support generic safety case development, harmonised costing and common methodologies.
- They can strengthen long-term programme resilience under uncertainty.

Why implementation is difficult

- National legal frameworks may restrict import or export of radioactive waste.
- Governance responsibility must be clear before infrastructure can be shared.
- Safety, security and regulatory expectations need alignment.
- Consent-based siting and public participation are decisive for legitimacy.

Key message: shared solutions are not only technical projects; they require legal clarity, governance design and societal confidence.



CONCLUSIONS AND NEXT STEPS

ASTRA shows that challenging waste requires an integrated approach across the whole management chain.

- Develop and maintain robust waste inventories, especially for legacy and conditioned waste.
- Strengthen characterisation strategies and documentation practices before treatment and packaging decisions are locked in.
- Clarify the status and end-point strategy for NORM, Ra/Th/U-bearing waste and depleted uranium.
- Develop proportionate safety cases and WAC for non-standard and small-volume waste streams.
- Use shared solutions to support knowledge exchange, generic studies, training, specialist competence and demonstrator projects.
- Move from exchange of experience towards practical cooperation models that can be tested and refined within EURAD-2.

Key message: the strategic value of ASTRA is to turn fragmented national experience into coordinated European progress on challenging radioactive waste.

THANK YOU FOR YOU ATTENTION