TRITIATED WASTE MANAGEMENT - 15607

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Tritium inventories and outgassing reduction: Issues

Case of the tritiated VLLW:
- Specific tritium activity: $2 \times 10^4$ Bq/g,
- Close to 100% are combustible

Reducing the tritium inventory and outgassing in primary waste

Advantages:
- Potential downgrading of classification
- Decreased interim storage periods
- Reduced radiation protection constraints.

Disadvantages:
- Secondary waste
- Industrial maturity.

Main Results

1- Interim storage obtains the best score in technical feasibility (simple and well-tried)
2- Incineration offers a higher tritium and volume reduction than the thermal treatment

Comparison of Three Techniques

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<th>Description</th>
<th>Process description</th>
<th>Destillation factor</th>
<th>Illustration</th>
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<td>Thermal treatment</td>
<td>Low temperature, e.g. 60 °C, 12 hours</td>
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<tr>
<td>Incineration</td>
<td>Combustion, e.g. 1100 °C for 3 hours</td>
<td>&gt;1000</td>
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<td>Interim storage</td>
<td>Storage up to 50 years allowing for tritium decay</td>
<td>Natural decay</td>
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Criteria

- Environmental (40%)
  - Global release per year (water/gas)
  - Public acceptance
  - Waste volumes for disposal
  - Secondary waste management

- Safety (30%)
  - Public exposure
  - Occupational exposure
  - Tritium incident management

- Technical feasibility (30%)
  - Treatment availability
  - Process complexity
  - Techniques maturity
  - Process efficiency
  - Volume and activity reduction

Conclusion and Next Steps

A combination of different techniques is the best solution for reducing tritium inventories and outgassing levels, taking into account:
- Radiological, physical and chemical properties of the waste
- Location of the treatment and interim storage facilities
- Acceptance criteria of the disposal facilities.

1. Interim storage: the only solution that offers an answer for all types of radwaste (combustible and non-combustible; for low and high levels of tritium).

2. Incineration: an attractive solution for soft housekeeping waste:
   - Significant radwaste volume reduction
   - More cost-effective than interim storage
   - Extended release permits will be required for existing incinerators to meet the higher tritium acceptance criteria.

3. Thermal treatment: less interesting for soft housekeeping waste because more secondary waste is produced and the costs are higher than those for incineration.

Research is continuing based on a global optimization approach that takes into account release requirements to ensure the correct operation of the processes and of tritiated waste conditioning, while investigating any improvements for disposal facility operation.

References

- J. Pamela et al. ITER tritiated waste management by the Host state and first lessons learned for fusion development, ISPNT Conference, Barcelona, 2013.