A Short Overview of UK approach to minimising Waste and Improving Plant Safety

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Objective

Present the importance of:

- Starting waste management in the right place
- putting structure, rigour, transparency at the heart of nuclear waste management decision making
- EURRP case study on plastic bags
The background

- Encouragement of critical thought about waste avoidance/minimisation and the Waste Management Hierarchy
- Support managers as they seek to understand and control waste to make positive improvements across the entire infrastructure (not just their self-contained portion)
- Aim to reduce the amount of waste because:
  - Disposal capacity is limited
  - Minimise the ongoing management challenge
  - Risk & safety are compromised by hazardous waste, e.g. caustics, heavy oils, radioactive materials.

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The background

- Some waste is unavoidable (designed into the process)
- Some waste is avoidable (from process failure) e.g.
  
  - Need active management of wastes
  - Avoid waste creating secondary risks from processes going out-with design
  - Secondary risks e.g. from ineffective storage of combustible materials cause plant stoppage.

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A solution is needed

• Methods for thinking about the minimisation of avoidable waste are needed.

• Nuclear industry suffered problems as waste solutions were unavailable but other drivers meant plants were built nevertheless.

Potential Solution

• Waste And Sourcematter Analysis (WASAN),
  • A method for thinking about waste minimisation.
  • Think through causes of avoidable waste
  • Identify options to avoid/reduce waste
The role of source-matters

• **Focus on managing the source of waste (source-matter)**

• **Understand:**
  • The behaviour of source-matters
  • How to prevent waste proliferation when operations fall outwith design

• *Operational view:* Think about how source-matters/plant can be managed before the avoidable waste is created

• *Strategic view:* Think holistically about how source-matters cause system deviations/waste elsewhere when processes fall out-with design e.g. material transfers

• Combine Operational/strategic views to identify actions to enhance their management
Operational / strategic thinking

This thinking aims to deliver analysis that is:

- **Structured**: so that important issues are clearly understood/recorded
- **Rigorous**: sufficient breadth & depth - confidence
- **Systematic**: Analyse source-matters similarly so the system of waste production is understood
- **Systemic/holistic**: Consider the need to move waste across operations/plants i.e. thinking about waste minimisation at a wider (systems) level - beyond a single plant
Good practice decision making

- The development of a rigorous and transparent audit trail
- Of lasting quality
- Understandable to those who may not have contributed directly to its development.
- Especially important where hazards extend across generations
Waste And Source-matter ANalysis (WASAN)

• A group workshop method to support the analysis of source-matters.

• Developed for plant managers & other stakeholders

• To develop actions to safely minimise/prevent their generation of the avoidable waste

• To analyse:

  (1) the behaviour of a process,

  (2) waste minimisation inside that process,

  (3) consequences for waste production from up/downstream processes falling out-with design

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Waste And Source-matter ANalysis (WASAN)

- Inspired by good practice industry methods such as:
  - The Waste Management Hierarchy - stages
  - HAZOP (Hazard Operability Study) - analyses where hazards may occur
  - HSE’s Enforcement Management Model – assess a proportionate response if a breach of law suspected
Case study:

Enriched Uranium Resides Recovery Plant (EURRRP)
Springfields (UK)
EURRRP plastic bags
Applying WASAN: A case study

• Used WASAN with senior staff
• Generating many plastic bag waste from EURRP operations
  • contain alpha bearing nuclear matter
  • transported around EURRP & wider site
  • sizeable cost and volume of waste
  • double bagging – a protective measure.
• A potentially avoidable waste stream
• Potentially save time, money & processing capacity whilst maintaining safety
WASAN’s generic structure

a. Define system boundary

b1. Analyse internal operations
b2. Analyse external operations

Select & apply keywords
Validate audit trail
Identify candidate actions

Theme candidate actions
Evaluate & agree actions
Validate audit trail

c. Evaluate actions

d. Programme deliverables
**Stage B1 - Analyse internal operations**

- *Aim*: To systematically identify issues in minimising the generation of waste inside a process

- *Technique*: The Waste Management Hierarchy (WMH) provides keywords to analyse how each waste can be avoided, minimised, ...
Stage B2 - Analyse external operations

- **Aim:** To systematically examine the effect of ‘outwith-design’ transportations on waste inside the process facility.
- **Technique:** Two steps based on qualitative sensitivity analysis and HAZOP:
  - **Define** transportations immediately into/out of the process facility: Picturing transportations and writing definitions.
  - **Apply** keywords to transportations to conduct sensitivity analysis: Keywords represent states of being outwith-design e.g. too much, too little material.
Some suggested WASOP Guide Words

- **Nothing** being transported between the facility-in-focus and the up/downstream facility
- **More than** normal being transported between the facility-in-focus and the up/downstream facility
- **Less than** normal being transported between the facility-in-focus and the up/downstream facility
- **Part of the material** being transported between the facility-in-focus and the up/downstream facility
- **Other material (as well as the designed material)** being transported between the facility-in-focus and the up/downstream facility
- **Other material (instead of the designed material)** being transported between the facility-in-focus and the up/downstream facility
- **Material reversing** through this transportation route between the facility-in-focus and the up/downstream facility.
Stage C1 – Evaluate actions

- **Aim:** To systematically evaluate potential actions.
- Action Evaluation Grid: To evaluate the attractiveness of actions to reduce waste to ALARP
  - Establish themes by analysing Stages A, B1, B2
  - Establish recommendations to address themes
  - Propose actions/activities for recommendations
  - Evaluate actions and prioritise: Action Eval Grid
  - Agree timing of deliverable (& person)
<table>
<thead>
<tr>
<th>Themes</th>
<th>Recommendations</th>
<th>Proposed actions to the Action Evaluation Grid</th>
<th>Who is responsible</th>
<th>Deliverable/timescale</th>
</tr>
</thead>
<tbody>
<tr>
<td>Explore if plastic bags as an avoidable waste is a significant problem and what the size of the problem is</td>
<td>R1) Understand the size of the potential problem i.e. the avoidable waste that is generated</td>
<td>A1a) Identify a local waste measure for plastic bags and implement a process for measuring</td>
<td>GH</td>
<td>D1a) Implement a measure for plastic bags by 31st May (this year)</td>
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<tr>
<td></td>
<td></td>
<td>A1b) Assess how many bags we use and evaluate whether this is excessive</td>
<td>GH</td>
<td>D1b) Commission a working party to explore. Findings due 15th July (this year)</td>
</tr>
<tr>
<td>Question the need to double bag and consider alternative forms of containment</td>
<td>R2) Review the use of plastic bags</td>
<td>A2a) Consider a reusable container to replace plastic bags in between processes</td>
<td>IJ</td>
<td>D2a) Commission a working party to make proposals. Proposals due 31st December (next year)</td>
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<td>A2b) Examine the safety case and the history behind double bagging to see if we can single bag or use alternative</td>
<td>KL</td>
<td>D2b) Have a summary of the findings by 31st December (this year) and an interim proposal for the way forward by 31st March (next year)</td>
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<td></td>
<td>A2c) Explore if there are other process reasons for generation of waste (plastic bags)</td>
<td>MN</td>
<td>D2c) Commission a working party to explore. Findings due 31st October (this year)</td>
</tr>
<tr>
<td>Ensure that future strategies for the site consider EURRP throughout</td>
<td>R3) Consider the role of EURRP in the wider site strategy</td>
<td>A3a) Establish the future of EURRP in future site strategies</td>
<td>IJ</td>
<td>D3a) Commission a working party to explore the strategic role of EURRP in the site, by 31st March (next year)</td>
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## Stage C2 – Illustration of Action Evaluation Grid

<table>
<thead>
<tr>
<th>What is the realistic benefit from implementing the recommendation?</th>
<th>How sure are we of the recommendation working adequately?</th>
<th>How long to reach the point of implementation?</th>
<th>Evaluating actions against the criteria</th>
</tr>
</thead>
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<tr>
<td>significant waste savings</td>
<td>well defined and proven</td>
<td>within 1 month</td>
<td>A2a) Consider a reusable container to replace plastic bags in between processes</td>
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<td></td>
<td>1-3 months</td>
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<td></td>
<td></td>
<td>+3 months but within financial year beyond financial year</td>
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<tr>
<td>adequately defined and analogues exist (other examples of it working)</td>
<td>within 1 month</td>
<td>A2b) Examine the safety case and the history behind double bagging to see if we can single bag or use an alternative</td>
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<td>+3 months but within financial year beyond financial year</td>
<td></td>
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<tr>
<td>no analogues exist and development could be required</td>
<td>within 1 month</td>
<td>A3a) Establish the future of EURPP in future site strategies</td>
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<td>lesser significant waste savings</td>
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<tr>
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**must do**

**should do**

**could defer**
Stage C2 – Illustration of Timing of Deliverables

A1a) Identify a local waste measure for plastic bags and implement a process for measuring

A1b) Assess how many bags we use and evaluate whether this is excessive

A2c) Explore if there are other process reasons for generation of waste (plastic bags)

A2a) Consider a reusable container to replace plastic bags in between processes

A2b) Examine the safety case and the history behind double bagging to see if we can single bag

A3a) Establish the future of EURRP in future site strategies
Final thoughts

• Successful application of WASAN includes the need to:
  • Select the right knowledge holders - ensure technical & political aspects are uncovered/resolved
  • Effectively facilitate a group to explore/learn/agree the presence/cause of avoidable waste production
  • Record discussions/agreements in a substantial audit trail of lasting quality
**Final thoughts**

- WASAN, where structured analysis of avoidable waste production is needed
- Builds audit trail of lasting quality.
- Adaptable to different waste minimisation challenges
- Develops waste minimisation options (shows rejection of alternatives)
- Narrow range of contexts - seeking further opportunities
Questions

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