PLEIADES

Smarter Plant Decommissioning

WASTREAM for supporting the dismantling of nuclear installations

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Agenda:

- 1. Introduction
- 2. Description of main tools :
  - 2.1 PLEIADES platform
  - 2.2 WASTREAM software suite
  - 2.3 Interaction PLEIADES/WASTREAM
- 4. Methodology
- 5. Results
- 6. Conclusion

1. Introduction

- The PLEIADES project aims at connecting digital tools for smarter nuclear decommissioning
  - Databases and ontology
- The WASTREAM software suite (Tractebel)
  - Used as support decommission projects → Estimation of waste fluxes
- The work presented aims at demonstrating how Tractebel developed a synergy between WASTREAM and PLEIADES databases → waste estimation using PLEIADES framework

2.1 PLEIADES platform

- European initiative
- Common data environment for dismantling projects:
  - Structured database (+ dismantling ontology)
  - File database → store any type of file format
  - Identity and access management
  - Connection via web browser or API

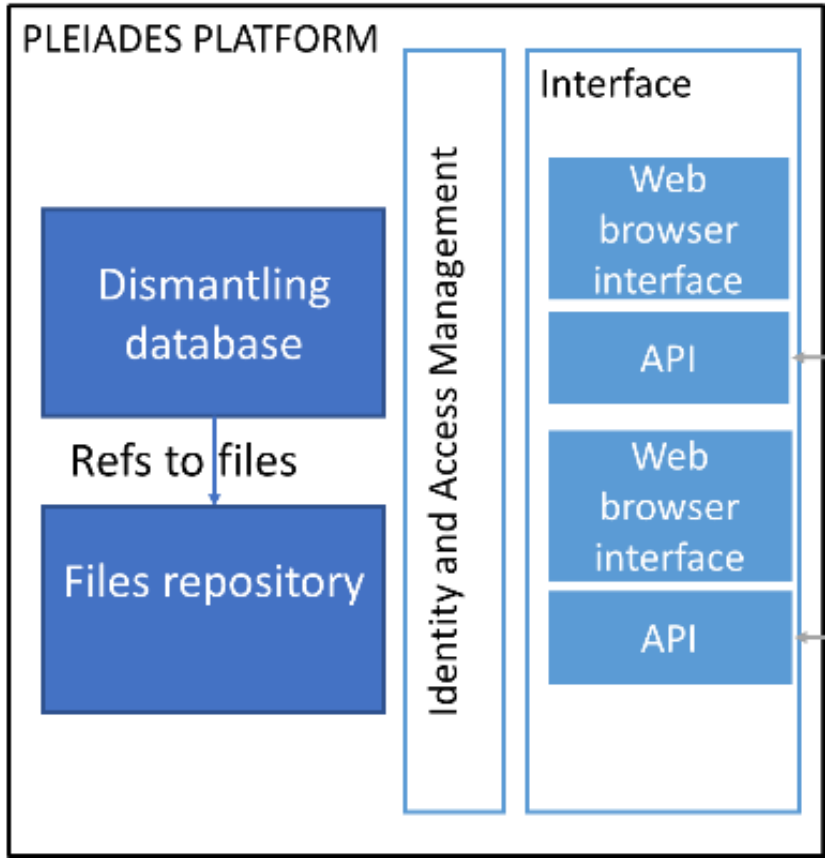


Fig1 : Graphical representation of the PLEIADES Platform

2.2 WASTREAM software suite

- The WASTREAM software suite allows:
  - Define waste stream models
  - Establish the link between the installation physical inventory, the waste streams and the dismantling planning
  - Calculating / analyzing / visualizing the quantities of waste produced
- Fast running and compatible with a wide variety of physical inventory databases / dismantling schedules

2.2 WASTREAM software suite

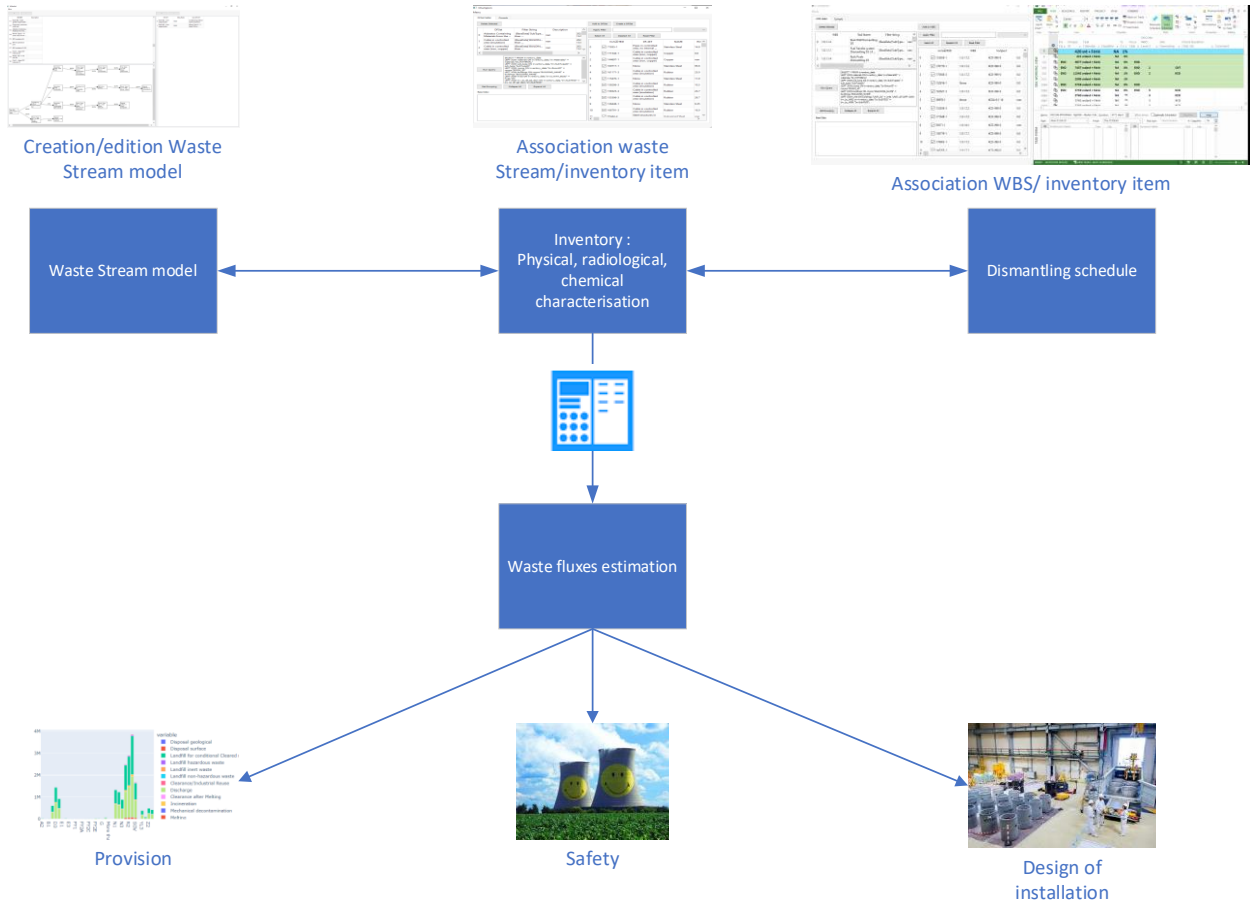


Fig2 : Graphical representation of the WASTREAM software suite

3.1 Interaction PLEIADES/WASTREAM

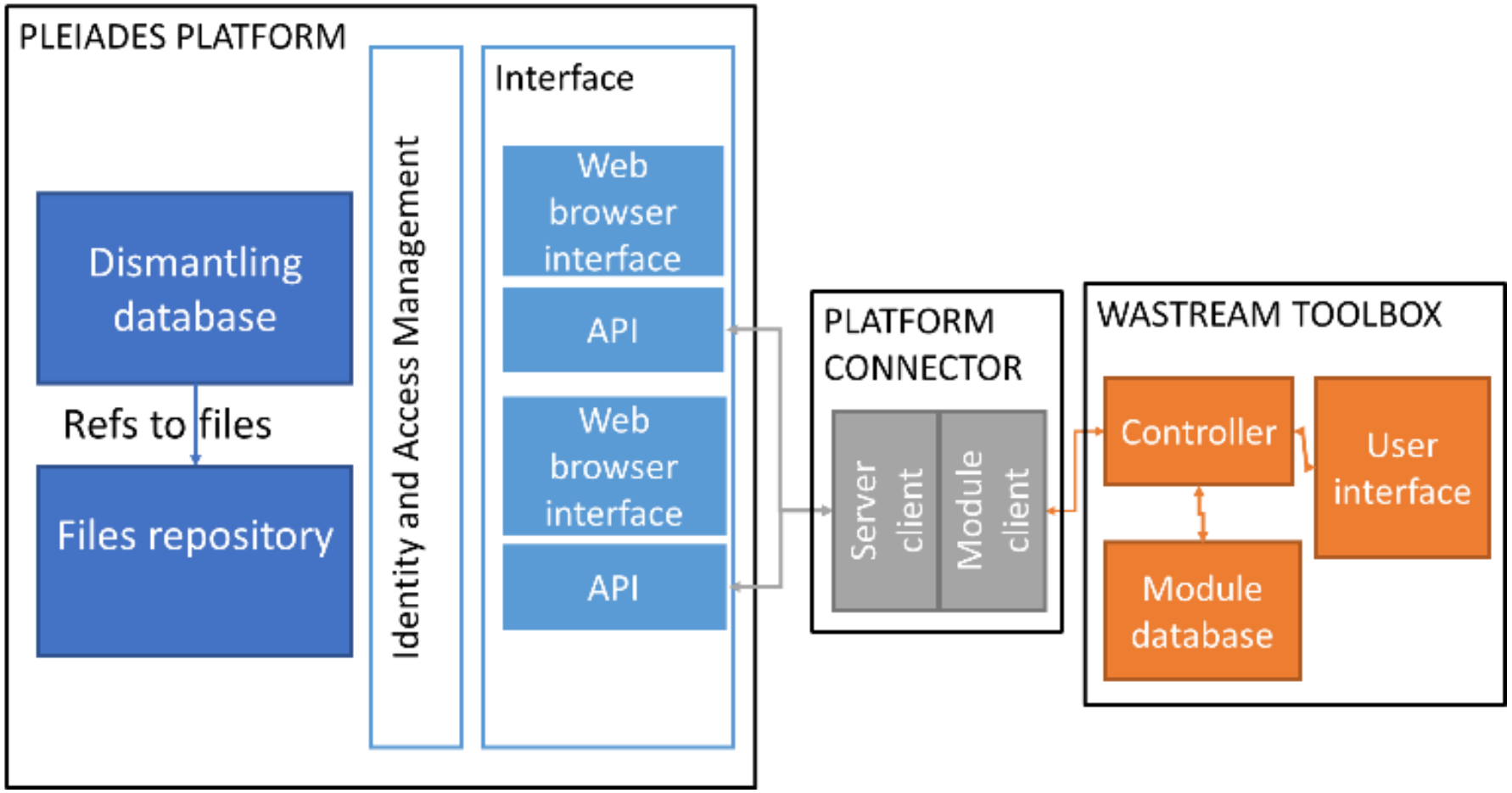


Fig3 : Graphical representation of the interaction PLEIADES/WASTREAM

4. Methodology

- 5 Steps
- Proof of concept using data from other PLEIADES participants
  - Start from IFC 3D model (BIM)
  - Synergy WASTREAM ↔ PLEIADES platform
  - Synergy between EU operators
- Optional: incorporate the results back into the IFC 3D model

4.1 Loading of physical and radiological characterization in PLEIADES database

- Starting point = 3D model containing:
  - Physical characterization
  - Radiological characterization (dose)
    - Activation
    - Contamination
- WASTREAM automates transfer of inventory items to PLEIADES
  - Entries created in PLEIADES structured database
  - Radiological (activity) and physical characterization

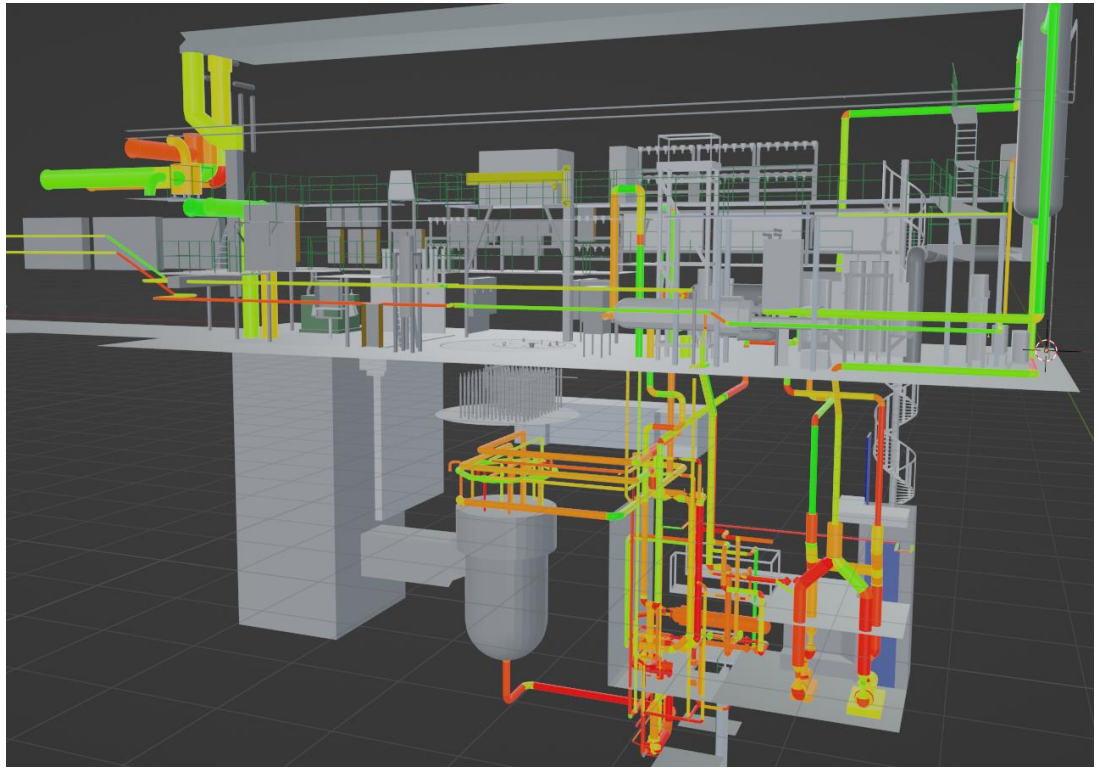


Fig 4 :visualization of pipes activity in HRR model (Green: low activity, Red: high activity. fictive data) [HALDEN]

4.2 Definition of the waste stream model

- Waste stream model defined using WASTREAM:
  - Node (square shape):
    - Entry / treatment / exit
  - Arrows:
    - Link between operation
    - Mass / Activity ratio
- Complete model stored in file database
- Entry points stored in structured database

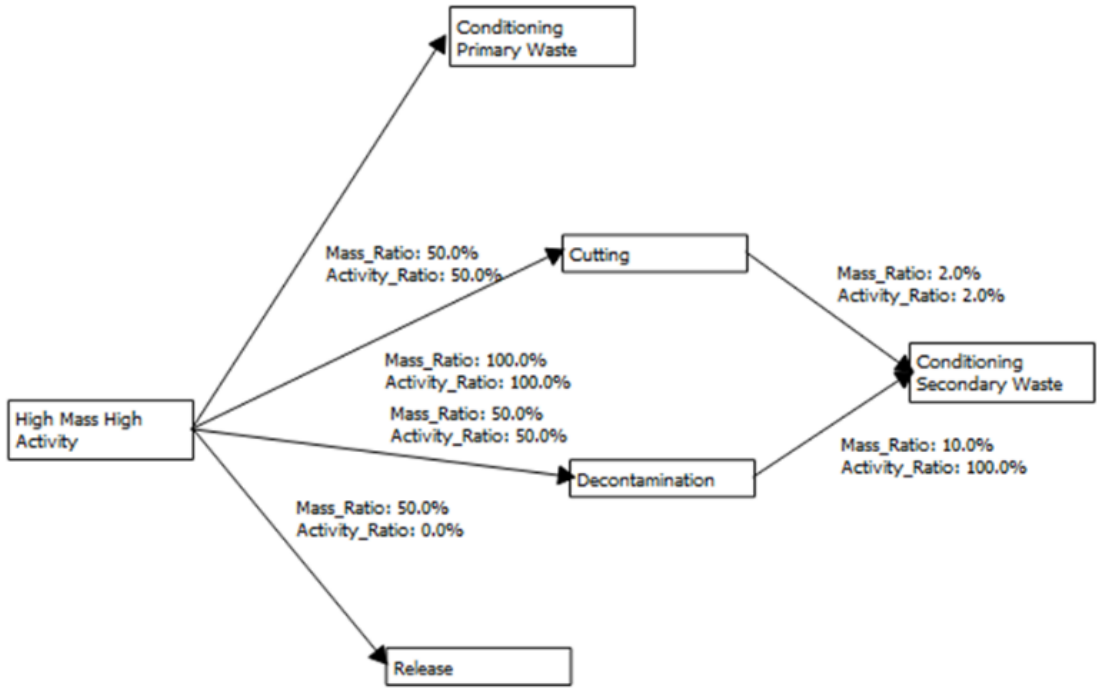
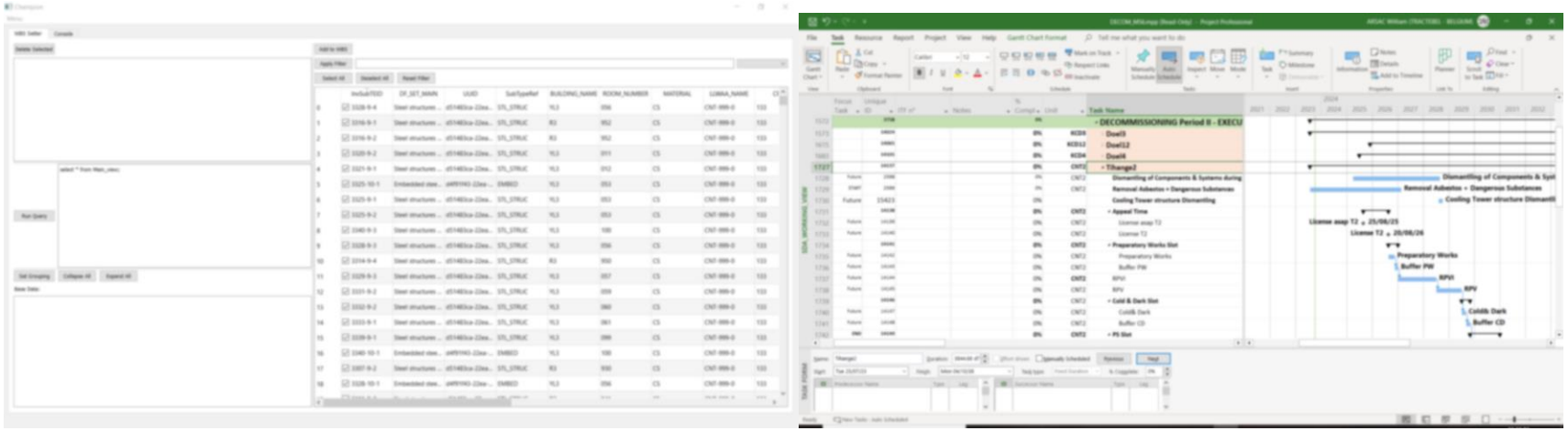


Fig5 : Graphical representation of the waste stream model

4.3 Definition of the planning

- The scheduling of dismantling works defined using software like Microsoft Project
- Following a WBS structure
- Each task are stored in structured database



4.4 Association of assets/waste stream/WBS

- Association performed using WASTREAM
  - Read Pleiades structured database (API)
  - Follow document_id link recursively
  - Produce a flat table
  - Filtering
  - Write association in structured database
- Filter stored in document database (traceability, reuse, …)

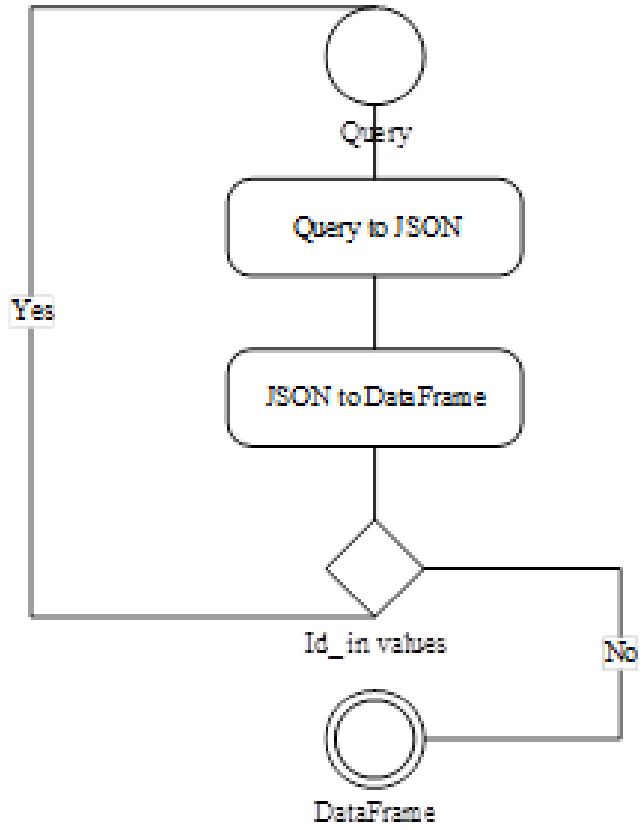


Fig5 : Graphical representation algorithm used to produce a flat table from the structured database

4.5 Calculation (waste estimation)

- Input information stored in document and structured database
  - Document: waste stream model
  - Structured:
    - Characterization data association
    - Waste Stream association
    - WBS (planning) association
- The calculation leverage matrixial operation → fast running
- Results stored in structured database:
  - For each inventory item mass and activity split over all the waste stream model (parent child association)

4.6 Optional: 3D model enrichment

- Estimations obtained from WASTREAM can be pushed back:
  - To other Pleiades structured database
  - To file database
- Initial 3D model can be enriched (BIM) :
  - Waste estimation
  - Dismantling date

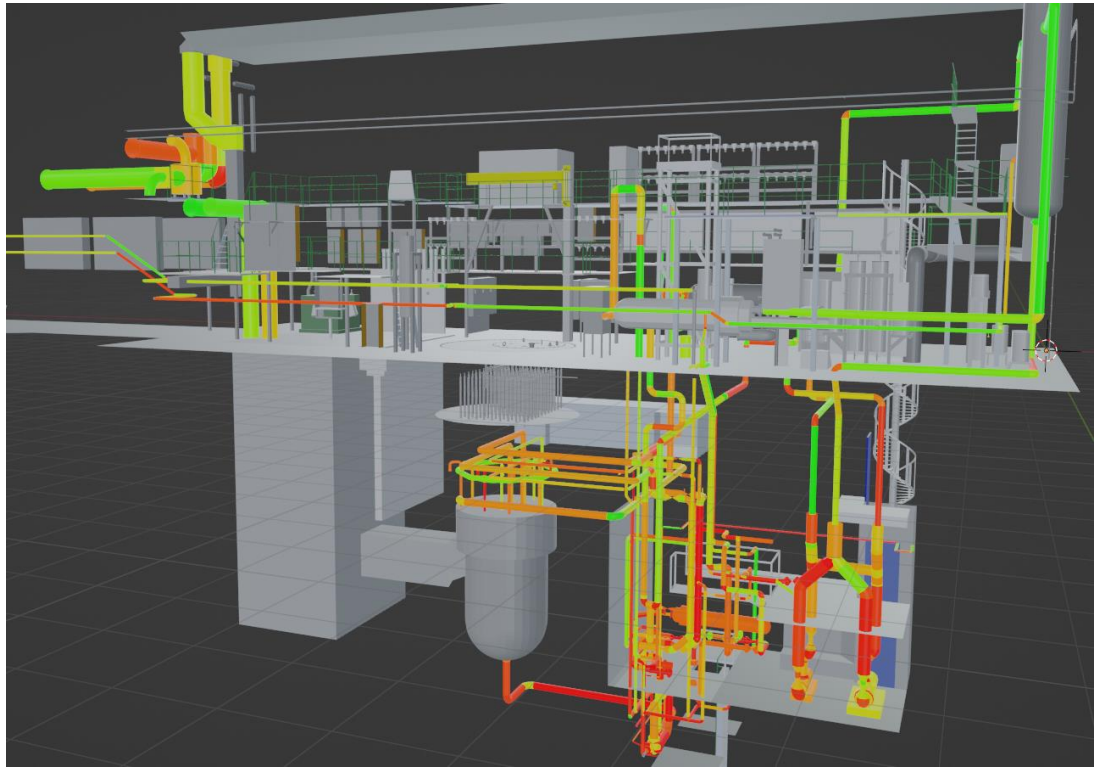


Fig 6 :visualization of pipes activity in HRR model (Green: low activity, Red: high activity. fictive data)

4. Methodology: Summary

- 4.1 Loading of physical and radiological characterization in PLEIADES database
- 4.2 Definition of the waste stream model
- 4.3 Definition of the planning
- 4.4 Association of assets/waste stream/WBS
- 4.5 Calculation (waste estimation)
- 4.6 Optional: 3D model enrichment

5.1 Results: input preparation

- IFC model → structured database
- Tree waste stream:
  - High mass high activity
  - High mass low activity
  - Low mass low activity
- Association with WBS / waste stream

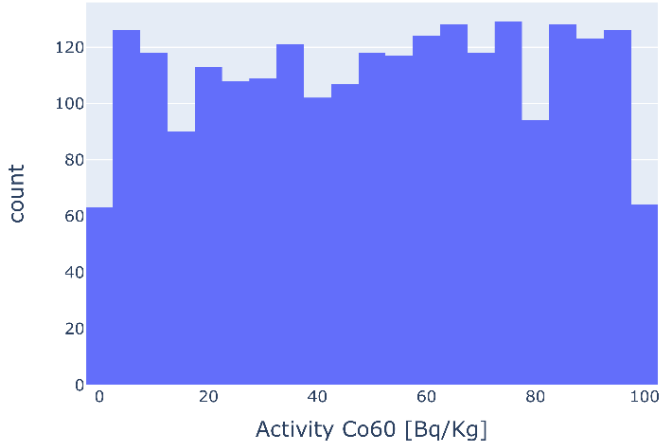


Fig7 : Specific activity distribution in databases

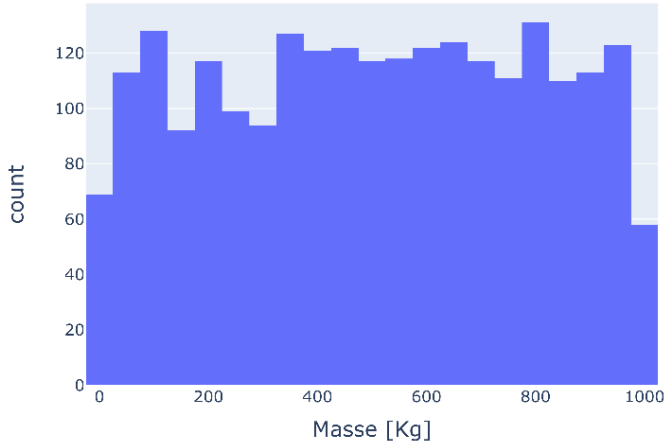


Fig8 : Masse distribution in databases

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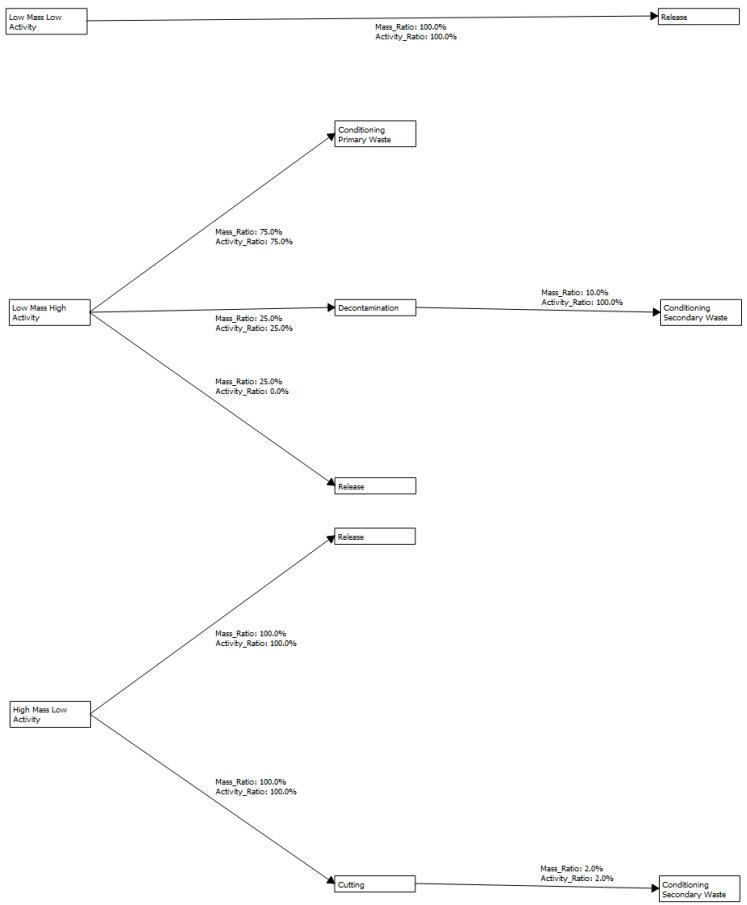

Fig9 : Graphical representation of the waste stream model

5.2 Results: waste fluxes estimation

- Waste stream allows to estimate waste masses / fluxes
- Fast running calculations ease sensitivity studies :
  - Evaluate the impact of specific parameters
  - Comparison of waste fluxes management options
  - Addition of new constraint coming from external stakeholder

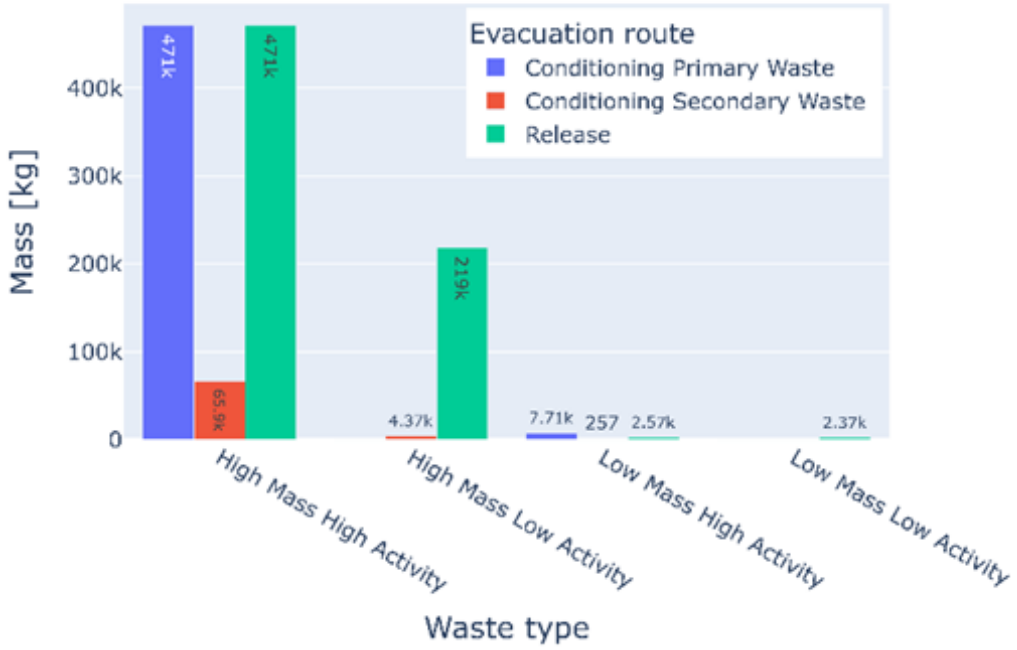

Fig 10 : Waste mass of different types per exit point

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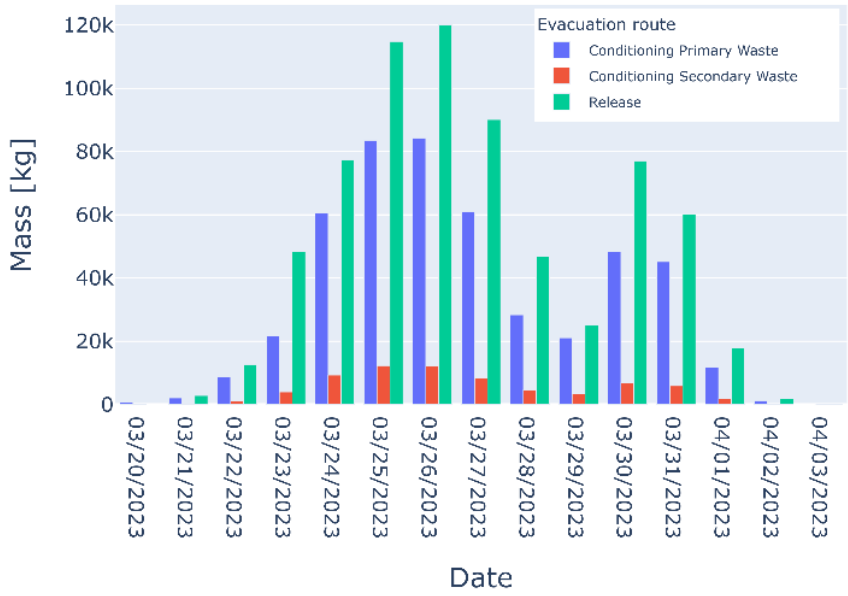

Fig 11 : Waste flux per exit point

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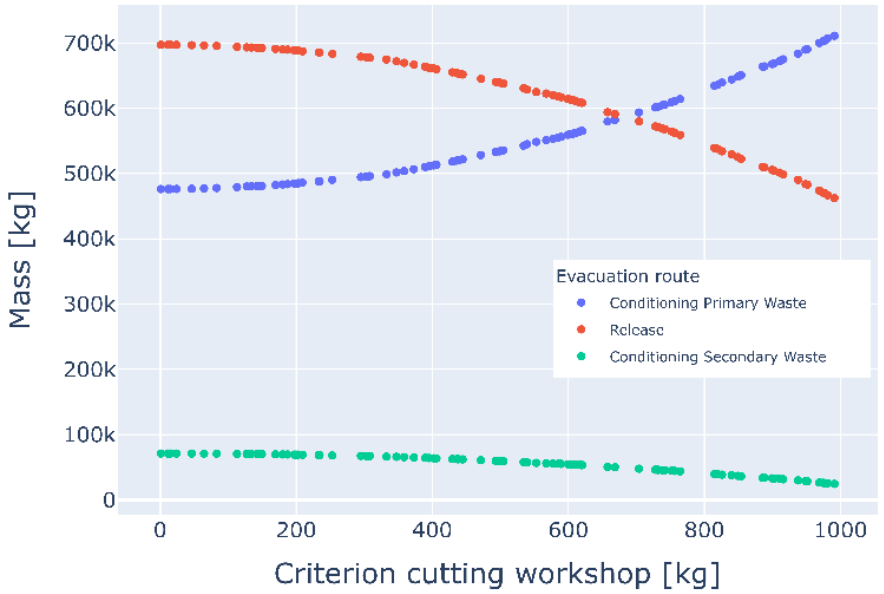

Fig 12 : Waste mass of different types per exit point in function of criterion from cutting workshop

6. conclusion

- Purpose of the study :
  - Test connectivity and adequacy of PLEIADES database structure /platform
- WASTREAM software suite developed by Tractebel is able to connect to PLEIADES platform to:
  - Produce waste estimation calculations
  - Provide guidance to decision makers
  - Support the preparation of dismantling activities/routes
- Validates the PLEIADES data structure and API connectivity, as well as the flexibility of the WASTREAM software suite

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