IGD-TP and SNETP-TP4 meeting Exchange Forum PRAGUE October 29th and 30th 2013

Gérard LAURENT

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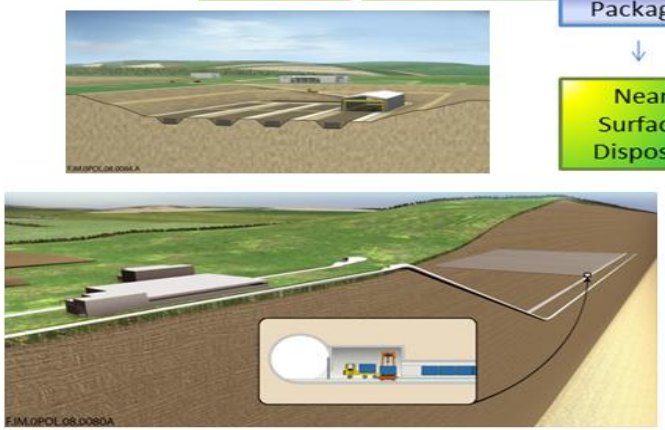
- Spectrum of common targets and communalities that a broader trans-national collaboration will be of mutual benefit for similar reactor types like UNGG, Magnox, RBMK, MTR, or similar waste forms (e.g. sleeves) and others need to find co-disposal solutions.

- Confederate around a 'Programme-related R&D approach' targeting to near-term national and industrial solutions at the pilot scale (**CarboSOLUTIONS**). Fully coincides with the 'Horizon 2020' FP8 objectives towards programme-related logics.
- The overall funds are based on national programmes, industrial efforts on i-graphite management.

i-Graphite Management Options (FR)



Original Plan

23 Gg of i-graphite in France

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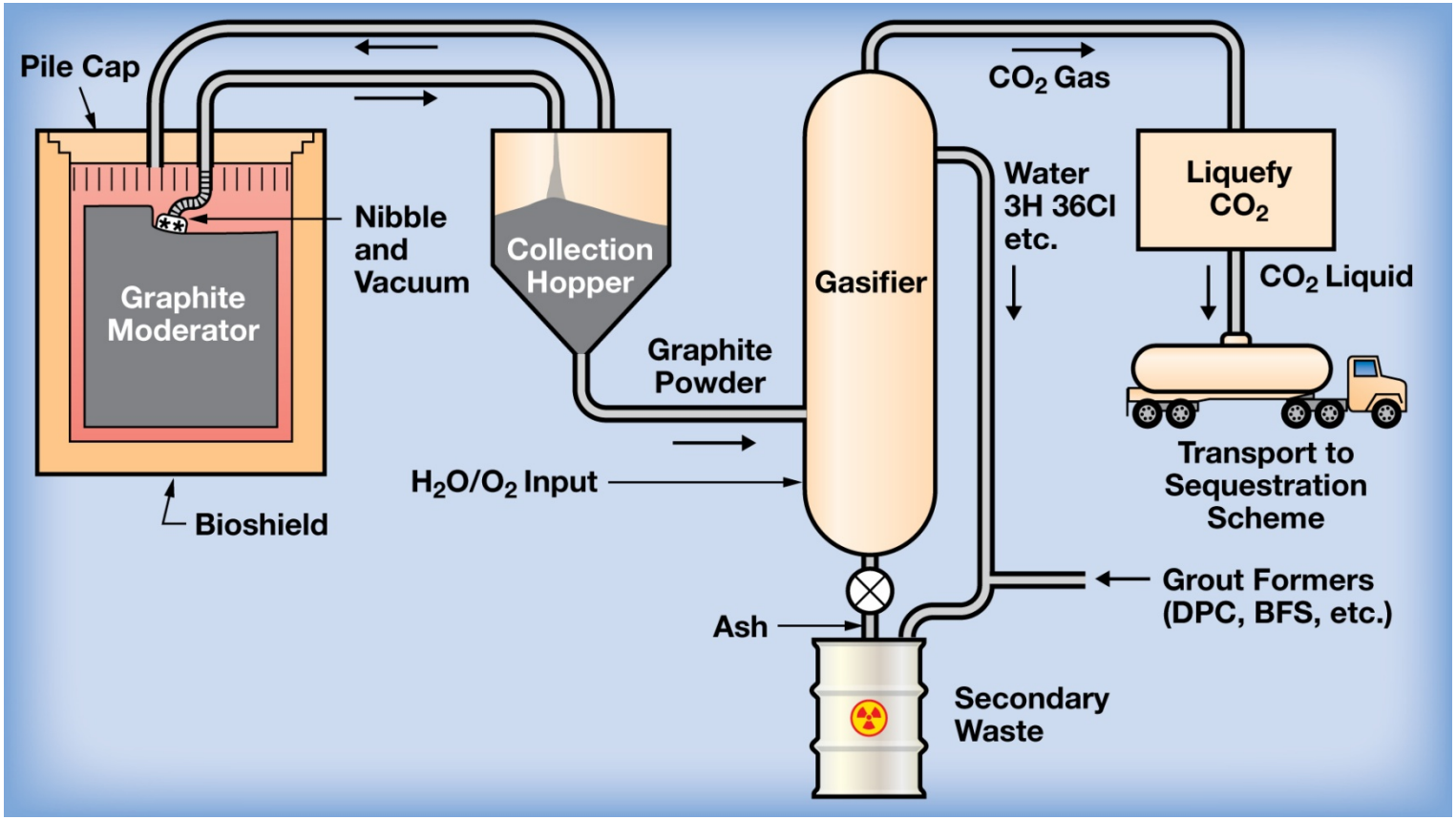
- Each country is in a particular situation because, at this time, long term intermediate storage inside the reactor may be accepted or not by the national safety authority,
- But in all cases, we have to find an industrial solution : treatment versus disposal in a next future,
- In parallel, at the end of the Carbowaste project, we have done a great job on :
  - Radiological inventory for our i-graphite (calculations cross measurements),
  - Graphite treatment: tests done with Julich, CEA, UK, NNL, etc…
  - R&D program of each national country,
  - Leaching datas etc…
- This knowledge give us a good reference to start an industrial treatment process research.

- OVERALL GRAPHITE MANAGEMENT PROPOSAL :



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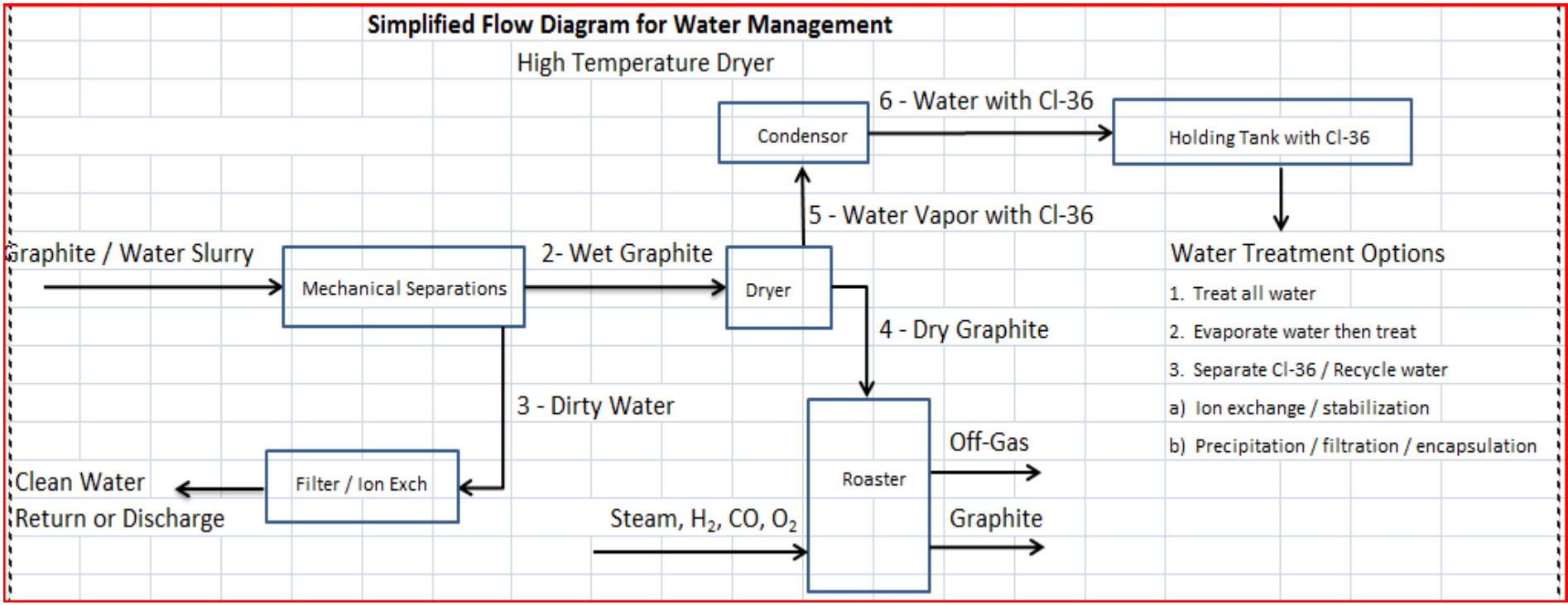

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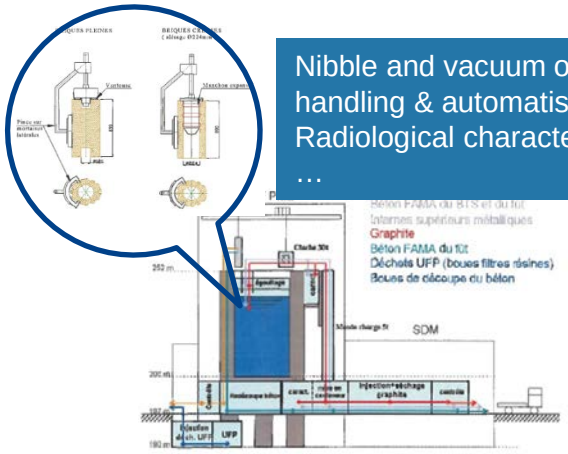
OVERALL GRAPHITE MANAGEMENT PROPOSAL : to industrial design

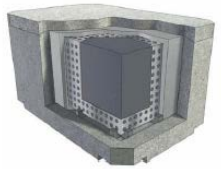
Key technologies required all along the GRAPHITE waste stream

1 Decommissioning



Nibble and vacuum or Remote handling & automatisation
Radiological characterisation
…

2 Intermediate storage ?



Sorting technologies ?
Intermediate or final storage container ?

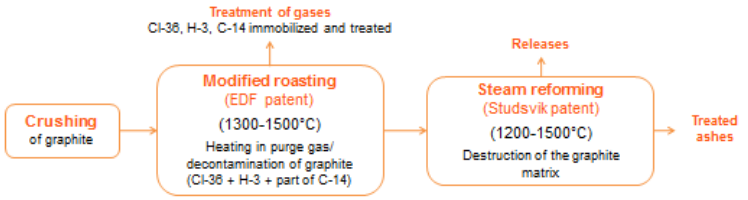
3 In situ treatment or transport to treatment plant ?

Transport container ?

4 Graphite Treatment Plant

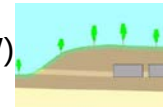
Full scale industrial thermal process
Crushing and preliminary treatment
Effluents management and monitoring
Treatment efficiency monitoring…

- Principle of Graphite Treatment :
  - Decontamination (C-14, Cl-36, H-3) and geological disposal of treatment residues,
  - Destruction of decontaminated graphite by steam reforming technology and geological disposal of ashes.



5 Secondary waste management

6 Final disposal routes



Dedicated near surface storage (LLW)
Deep Geological storage (ILW)
Sequestration scheme

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- It seems very important to define a **common strategy**
- CARBOWASTE has defined the R&D fundamentals, now we have to come to :
  - The real industrial needs
  - Great interest to rise and study :
    - The main topics,
    - A global design,
    - The project proposal,
    - A time schedule,
    - The cost involved…
  - **It will be the target of the new proposal 'Carbo Solution'.**

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It seems very important not only to work on the core process (ie the modified roasting or decontamination device) but to have a **global assessment of what the design would look like**, this can include :

- Nibble and vaccuum for graphite stack,
  - depending of the reference choice for stack decommissioning (in France **water** for Bugey and Saint Laurent (2) **air** for Chinon (3)),
- Crushing graphite,
  - aerosols size what spectrum acceptable?
- Considerations for the Movement of Radioactive Graphite Particles in a Pipeline,
- Roasting (core process):
  - with the 'good choice' of purge gas,
- Complete Gasification or not?
  - ie only graphite decontamination or complete destruction?

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- **+ CO2 behaviour :**
  - concentration and solidification : France reference ?
  - or vaccuum on a sequestration site : UK reference ?
- **Tritium trapping and conditionning :**
  - What level of possible releases ?
  - on what substrat at what level?
  - safety acceptance for disposal
- **Chlorine 36 immobilisation and conditionning :**
  - same questions,
- **Other gases treatment :**
  - What can be a release target ?
- **Water management (may be)**
- Of course the solution may not be the same for each country but it seems very important to share studies and informations on all theses 9 (?) topics.

This global design will be the 'vertebral column' to define all the R&D topics connected to the graphite treatment.

- It seems very important to start an international cooperative thought on this design depending on the national choice for each country to do the reactor decommissioning itself (in air, underwater?) .

- The relationship between crushing, roasting, gasification etc.. Are
  - very important and
  - sometime relatively complex but
  - with possible some positive sinergy,

- It seems impossible to do the choice of each sub-item independantly and it is risk connected to the **global safety acceptance** of the project.

Only this global design could authorise :

- **A safety assesment (including for example on a release target for environment, a dosimetric evaluation for workers or a design accident) to see if it will be possible to ask for an autorisation from the safety authority for each country**

- **A precise cost evaluation and comparison with direct disposal of i-graphite.**