• **Cryoplant** equipment to be procured by F4E.

• **Fuel Cycle** components to be procured by F4E
  
  – Vacuum Pumping;

  – Tritium Plant;

  – Radiological and Environmental Monitoring Systems (REMS);

• **Equipment:**
  – Two Liquid Nitrogen plants
  – Two Helium 80 K loops
  – Auxiliary Systems (storage, purification).

• **Duty:** To supply the ITER Tokamak with cooling power (liquid nitrogen, 80 K gaseous helium).

• **Procurement plan:**
  – Call for tender to be launched in October 2012 for a turn-key contract placed with a prime contractor.

• **Experience required:**
  – Cryogenic process plant (nitrogen liquefaction…)
  – Cryogenic storage, gas purification system;
  – Engineering and construction for large cryogenic plant.
F4E components indicated in red

For illustration only

LN2 plant compressors

Area # 53
(160 m x 13,35 m)

He warm storage tanks

GN2 storage
Purifier

LHe storage

Dryers

Quench tanks

Building # 51
(75 m x 45 m)

Building # 52

LN2 storage

80 K He loop
cold boxes

80 K loop compressors

Heaters

LN2 plant cold boxes

L. Perna, UK Fusion & ITER Business Opportunities – Culham, UK, 11-October-2012
### Cryoplant (3/3): Procurement Schedule

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**Cryoplant – Technical Responsible Officer**

**M. Simon** ([marc.simon@f4e.europa.eu](mailto:marc.simon@f4e.europa.eu); +34 93 320 1832)
• **Equipment:**
  – Cryopumps = vacuum pumps which trap gases and vapours on a cold surface;
  – Cold valve boxes & cryolines;
  – Leak detection and localisation equipment.

• **Duties:**
  – To provide the ITER Tokamak with clean, ultra high vacuum at large pumping speed;
  – To distribute helium to and from the cryopumps;
  – To detect and locate leaks.

• **Procurement plan:**
  – Contracts for design (*in progress*);
  – Contracts for manufacturing (including final design as regard the cold valve boxes and cryolines).

• **Experience required:**
  – For design: vacuum, cryogenics;
  – For manufacturing: welding and machining, helium leak detection, metrology, cleanliness, coating, pressure equipment.
A half-sized prototype of the ITER Torus and cryostat cryopumps was tested at the Karlsruhe Institute of Technology (KIT):

A full-sized prototype and then the operational cryopumps will now be built.
JET, the European fusion experimental device in the UK, also used cryopumps in the neutral beam system:
### Torus and Cryostat Cryopumps (1.8 m in diameter, 3.5 m long)

- Call for tender (*build-to-print*) in progress for the manufacturing of a prototype.
- In 2014 or 2015, call for tender (*build-to-print*) for the manufacturing of eight cryopumps.

### Cold Valve Boxes, cryojumpers, warm regeneration lines

- Early 2013, call for tender for the final design and manufacturing of warm regeneration lines.
- In 2015, call for tender for the final design and manufacturing of the cold valve boxes and cryojumpers.

### Neutral Beam Cryopumps (2 m high, 8 m long)

- In 2013, call for tender (*build-to-print*) for the manufacturing of a prototype for the Mitica Test Facility in Padova.
- In 2016 or 2017, call for tender (*build-to-print*) for the manufacturing of four cryopumps.

### Leak Detection & Localization

- System currently in pre-conceptual design phase (R&D), managed by IO with limited F4E involvement.
- Procurement to be launched after 2014.
• **Equipment:**
  – Water Detritiation System;
  – Isotope Separation System.

• **Duties:**
  – To detritiate water;
  – To produce pure Deuterium as well as 90% Tritium / 10% Deuterium mixture.

• **Procurement plan:**
  – Contracts for conceptual design;
  – Contracts for preliminary design;
  – Contracts for final design and manufacturing.

• **Competences required:**
  – Chemical component separation (cryogenic distillation, catalysts);
  – Experience in handling of tritiated gases & large component manufacturing.
In 2013, call for tender for water tanks final design and manufacturing;  
In 2013, call for tender for “Main” WDS preliminary design; 
In 2015, call for tender for “Main” WDS final design and manufacturing.
To expansion volume

• In 2012, call for tender for conceptual design;
• In 2015, call for tender for preliminary design;
• In 2016, call for tender for final design and manufacturing.

Tritium Plant – Technical Responsible Officer
Giovanni Piazza
(giovanni.piazza@f4e.europa.eu; +34 93 320 1827)
• **Equipment:**
  – Radiological detectors and process systems;
  – Personnel control and environmental monitoring systems.

• **Duties:**
  – To monitor radiations and contamination (room, process, personnel);
  – To monitor environment.

• **Procurement plan:**
  – Most components are off-the-shelf items but need to be adapted to ITER requirements;
  – Procurement split into three phases: preliminary design; final design; manufacturing and on-site installation, testing and commissioning.

• **Competences required:**
  – Sensors and detectors for nuclear use;
  – Experience in radiological and environmental safety;
  – System integration (CSS, CODAC, electronics, software).
• In 2013, task order from an existing framework contract for REMS *preliminary design*.

• In 2014, task order from an existing framework contract for REMS *final design*.

• In 2015, call for tender for REMS *manufacturing, on-site installation, testing and commissioning*.
REMS – Radiological Monitor Environmental System

|------|------|------|------|------|------|------|------|------|------|------|------|------|------|-------------|

- **Conceptual Design**
  - CDR REMS 28 - Aug - 2012
  - PA for REMS 18 - Dec - 2012

- **Preliminary Design**
  - PDR REMS

- **Final Design**
  - FDR REMS

- **Manufacturing design of Be and Environmental monitors**

- **Manufacturing, FAT and delivery BE and Env. Mon**

- **Manufacturing, FAT and delivery Nuclear monitors**

- **Equipment installation**

- **Equipment test and commissioning**

- **First delivery to ITER**

- **Final delivery to ITER**

- **ITER Site Acceptance 6 - Oct - 2022**

**REMS – Technical Responsible Officer**

L. Perna (lorenzo.perna@f4e.europa.eu; +34 93 489 7469)
• **Equipment:**
  – Radioactive liquid treatment and storage systems
  – Solid waste characterization equipment, waste processing and storage.

• **Duty:** To process solid, liquid and wet Type-A Radwaste and *conventional* waste.

• **Procurement plan:**
  – Mostly industrial items to be adapted to ITER requirements;
  – Procurement split into three phases: *preliminary* design; *final* design; *manufacturing and on-site installation, testing and commissioning*.

• **Competences required:** radioactive and activated waste management.
Waste Management System

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- Conceptual Design
- CDR: Conceptual Design Review
- PDR: Preliminary Design Review
- FDR: Final Design

- Preliminary Design
- FAK

- Final Design
- FTR

- Tendering

- Manufacturing design
- Waste management system

- Equipment installation and test
- Commissioning
- Acceptance

- Waste management In-kind Procurement Accepted - 26-May-2026
- Delivery to ITER - 29-Apr-2022

WMS – Technical Responsible Officer
L. Perna (lorenzo.perna@f4e.europa.eu; +34 93 489 7469)
Thanks for your attention

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  S. Papastergiou (stamos.papastergiou@f4e.europa.eu; +34 93 489 7514)

• Tritium Plant – Technical Responsible Officer
  G. Piazza (giovanni.piazza@f4e.europa.eu; +34 93 320 1827)

• REMS and WMS – Technical Responsible Officer
  L. Perna (lorenzo.perna@f4e.europa.eu; +34 93 489 7469)