

Radiation Protection Aspects of Water Chemistry and Source-Term Management

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INFORMATION SYSTEM ON OCCUPATIONAL EXPOSURE

Content

1. Organization of the report
2. Theoretical background
3. Key parameters related to source term control and reduction
4. Open discussion and presentation of the group membership

Source Term Management: a complex but fundamental question for RP professionals

**2 ways for
improving doses**



**Better organize the
shutdown schedule**

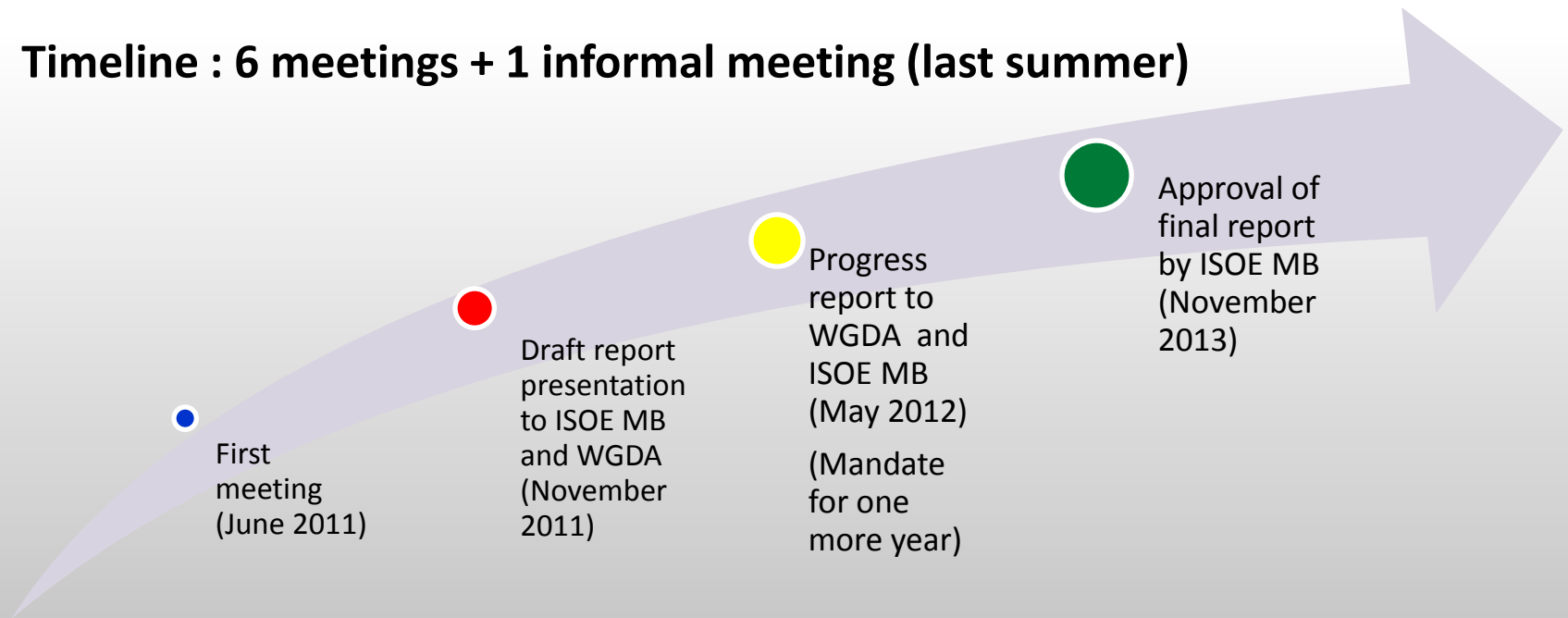


**Act directly on
Source Term**

Most efficient for ALARA

EGWC : Group's background information

- **Chairman : Alain ROCHER (EDF, France)**
- **Established in November 2010**
- **15 members : included Utilities, Safety Authority, Technical Centers representatives and EPRI.**
- **Timeline : 6 meetings + 1 informal meeting (last summer)**



Expert Group Objectives

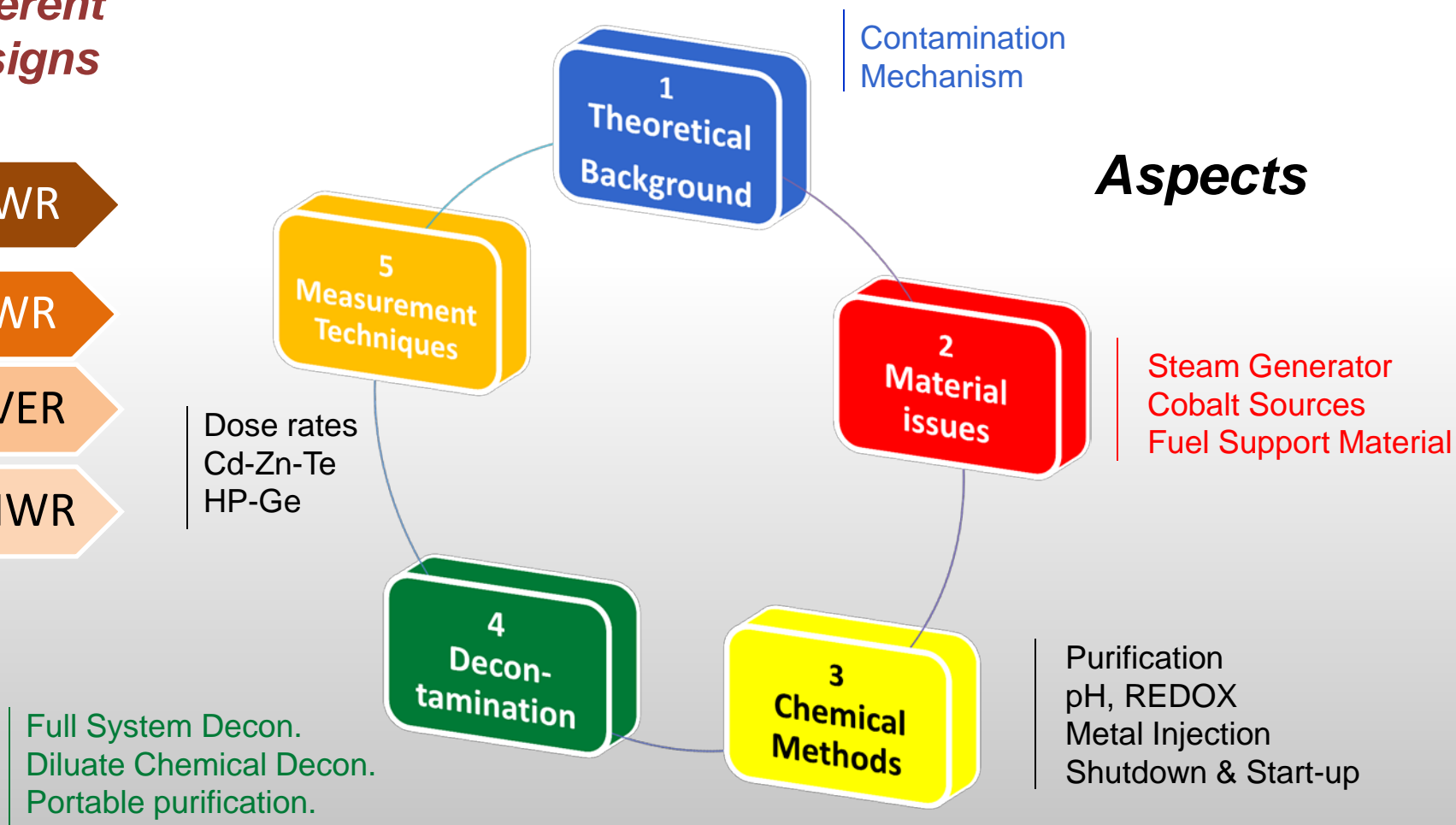
- **Review and analysis** of current knowledge, technology and experience on radiation protection aspects.
- **Develop a report** in order on the current state of knowledge, technology and experience.
- **Identify key parameters**, best practices.
- **Enable the dialogue** between RP workers and Chemists

Key parameters dealing with Source Term Management

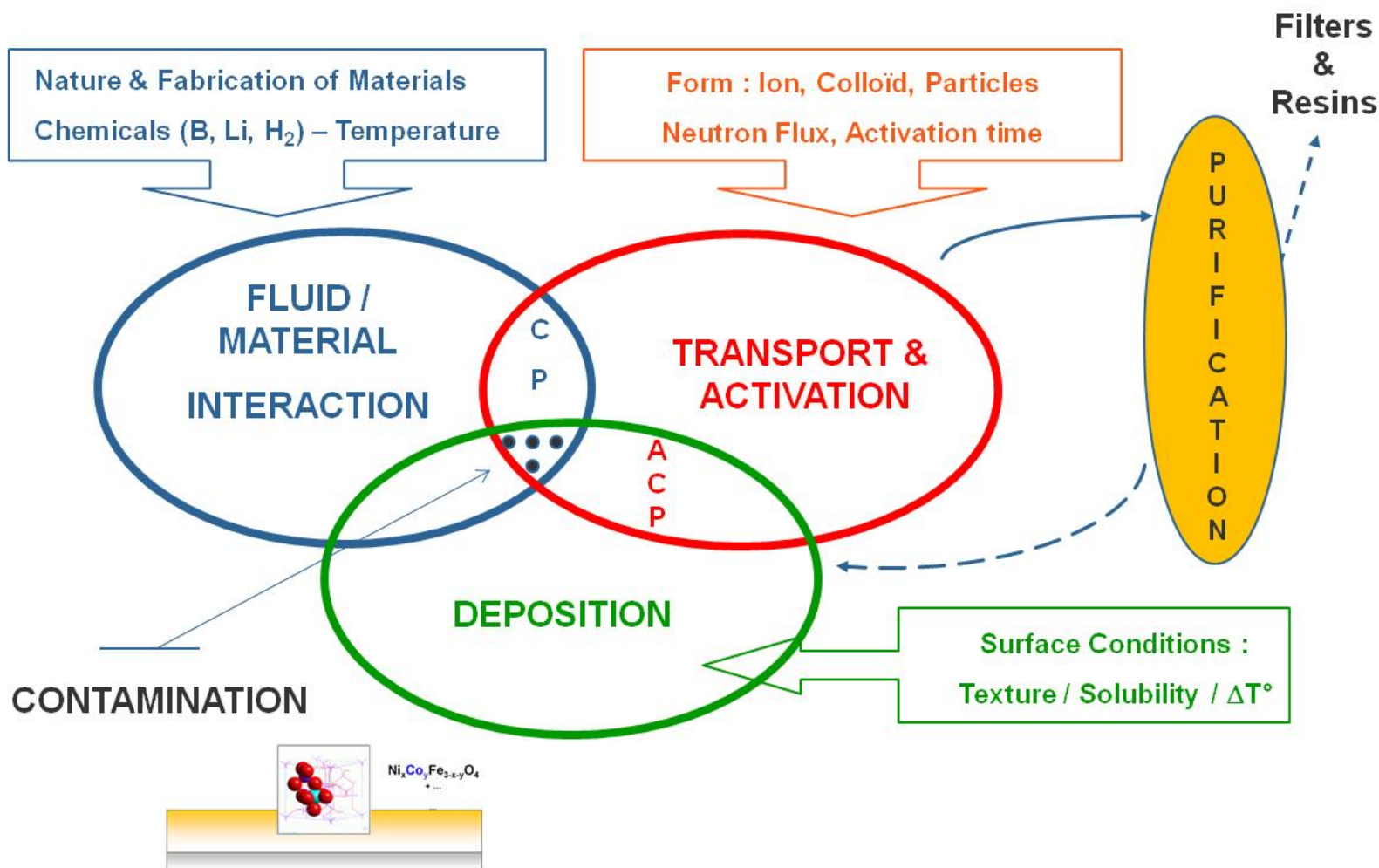
Different Designs



Aspects



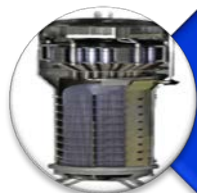
Theoretical background



Material issues



Chapter 3.2



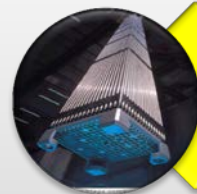
Steam Generator

Manufacturing process
Surface preconditioning



Cobalt sources

Impurities in materials and
stellites



Fuel support material

Replacement Inconel by
Zirconium based alloy



Other techniques

Electroplishing
Stabilized Chromium
Process (SCrP)

Chemical methods



Chapter 3.3

Use of Specific Filters
and Resins
Maximum flowrate

**Purification
Clean-up
system**

**Shutdown &
Start-up
operations**

Requirements for chemicals,
purification flowrate,
criteria for stopping
the last primary pump



B/Li : PWR, BWR, PHWR
B/Na : VVER

**pH_T &
H₂ control**

H₂ content
ElectroChemical Potential
(ECP)

Metal injection (Zn, Fe (BWR))

No Zinc injection
(VVER)

Zinc injection : 70 PWRs since 1990ies + All BWRs

Remediation of contamination during outages

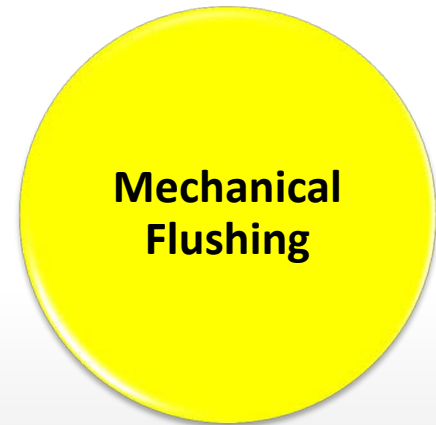
Oxydo Reduction Solutions :
HP/CORD UV
EMMAC, ...



Loops
SG
...

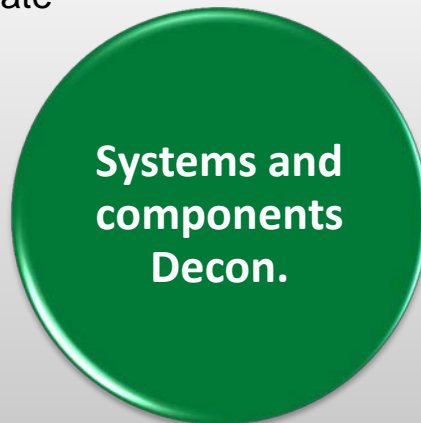


Auxiliaries
CVCS
HRS...



Hot
Spots

Lower Oxydation-state
Metal Ion (LOMI)



Pumps
Valves
...

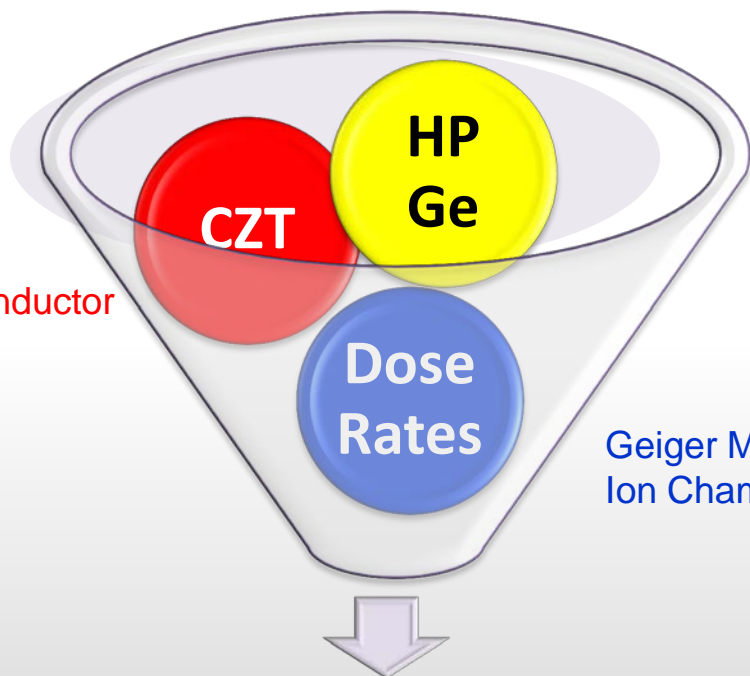


Underwater Demineralized
Clean up the Reactor
Cavity Water
...

Measurement Techniques

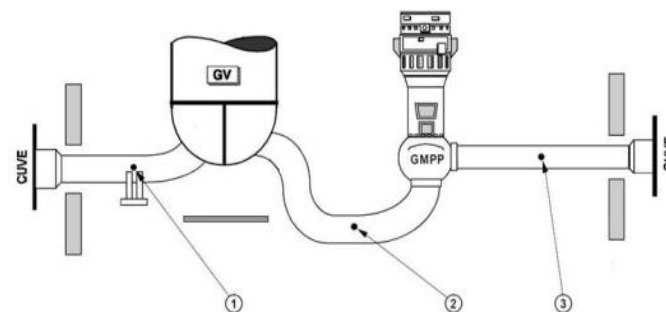


Chapters 4 and 5



Measurement programs :

- Standard Radiation Monitoring Program (EPRI)
- RCS and RB Indexes + CZT (EDF)



EDF RCS index



CZT device



HP-Ge EMECC device

Discussion

- The EGWC publication* illustrates how is important:
 - To develop a common understanding of current RP issues for nuclear utilities - source term management, dismantling activities, preparation of accidental situation from a RP perspective (SAM Expert Group), etc.
 - To share good practices so as to bring operational answers to identified issues/weaknesses,
 - To contribute to the development of a sustainable RP culture among professionals when sustainability of skills is a major issue for the coming 5 to 10 years for most utilities.

* RADIATION PROTECTION ASPECTS OF PRIMARY WATER CHEMISTRY AND SOURCE-TERM MANAGEMENT
THE REPORT WILL BE AN ELECTRONIC REPORT AND BE AVAILABLE BY MID-2014

ISOE : a key actor in that context.

ISOE work in the field of source term management - MOU

- **Memorandum of Understanding (MOU) in an agreement between ISOE Management Board and EDF (2011) on a win win basis:**
 - EDF possesses knowledge and know-how in the **development and use of CZT Gamma Spectroscopy technology**
 - Interest in **facilitating the use of CZT measurement technology** and EDF protocols in other NPPs to permit the increase in the knowledge, data and understanding of methods to reduce the formation, transport and deposition of corrosion products.
 - EDF agrees to transfer previous results for CZT measurements and permit access to this information by utility members of ISOE.
 - ISOE and its technical centres agree to facilitate the transfer of NPP CZT measurement data.

EGWC members

- **EDF, France : A. ROCHER (Chair), G. RANCHOUX**
- **EPRI, USA : D. PERKINS, D. WELLS**
- **CEPN, France : L. VAILLANT**
- **OECD/NEA, France : H.B. OKYAR**
- **VATTENFALL, Sweden : M. OLSSON**
- **ENEL, Slovak Republic : I. SMIESKO**
- **ISOE/NATC & COOK NPP, USA : D.W. MILLER**
- **EXELON, USA : W. HARRIS**
- **BRUCE POWER, Canada : C. PRITCHARD, D.E. MILLER**

THANK YOU !