RADIOACTIVE WASTE

Luisa Ulrici and Luca Bruno,
on behalf of DGS/RP

OUTLINE

- DEFINITIONS AND REGULATORY FRAMEWORK
- WASTE LIFECYCLE AT CERN
- IMPLICATIONS FOR THE RP GROUP
- IMPLICATIONS FOR THE USERS

Definitions and Responsibilities

Radioactive Material:

- radioactive accelerator or detector components in use or stored for reuse
- under the responsibility of the equipment owner (departments, experimental collaborations)
- radioactive: Swiss exemption limit = CERN exemption limit

Radioactive Waste:

- former radioactive material declared as waste by equipment owner
- under the responsibility of HSE unit (DGS-RP).
- radioactive : “Swiss-CERN” - Swiss exemption limit

  “French-CERN” as pre-defined by “Zonage Dechet”

Regulatory framework

RATIFICATION OF THE TRIPARTITE AGREEMENT ON SAFETY AND RADIATION PROTECTION
(September 2011)

ACCORD

ENTRE

L'ORGANISATION EUROPEENNE POUR LA RECHERCHE NUCLEAIRE,

LE CONSEIL FEDERAL SUISSE,

ET

LE GOUVERNEMENT DE LA REPUBLIQUE FRANÇAISE

relatif à la Protection contre les rayonnements ionisants et à la Sûreté des Installations de l'Organisation européenne pour la Recherche nucléaire

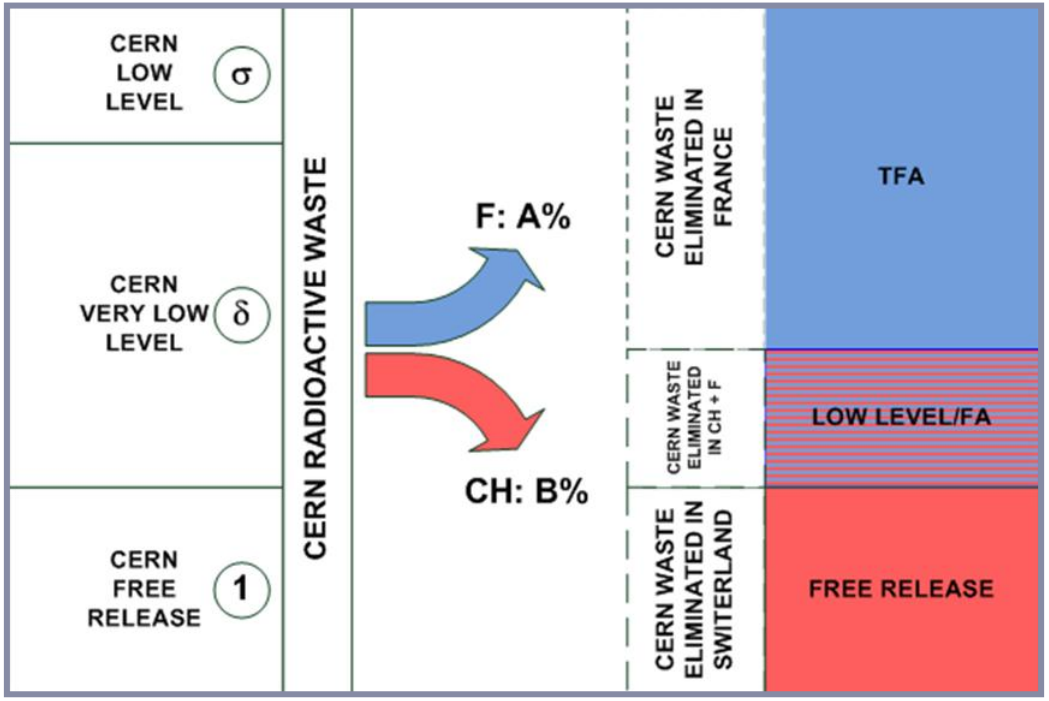
Pour l'Organisation	Pour le Conseil fédéral suisse	Pour le Gouvernement français
Rolf Heuer	Pascal Strupler	André-Claude Lacoste
Directeur général	Directeur de l'Office fédéral de santé publique	Président de l'Autorité de sûreté nucléaire

Definition of criteria for the " fair share" of waste disposal in France and Switzerland depending on
- mass
- residual radioactivity
-toxicity

Establishing of inter-site transport rules

General authorization for import, export and handling of radioactive sources

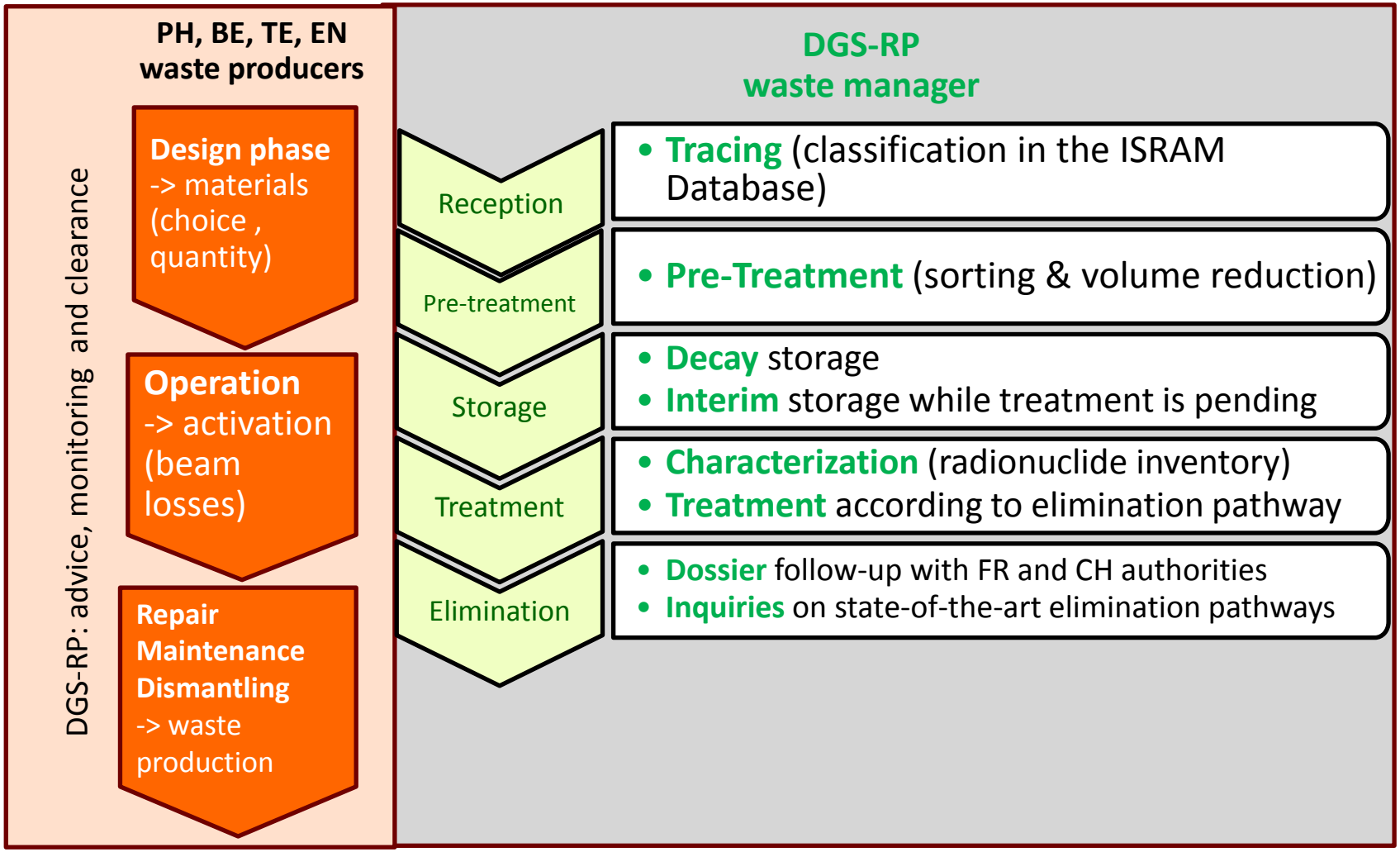
Tripartite Agreement
Reflects Concepts of Host States



fair share – based on quantity, activity and radiotoxicity of the waste as well as on optimized economical approach

Basis: CERN waste study

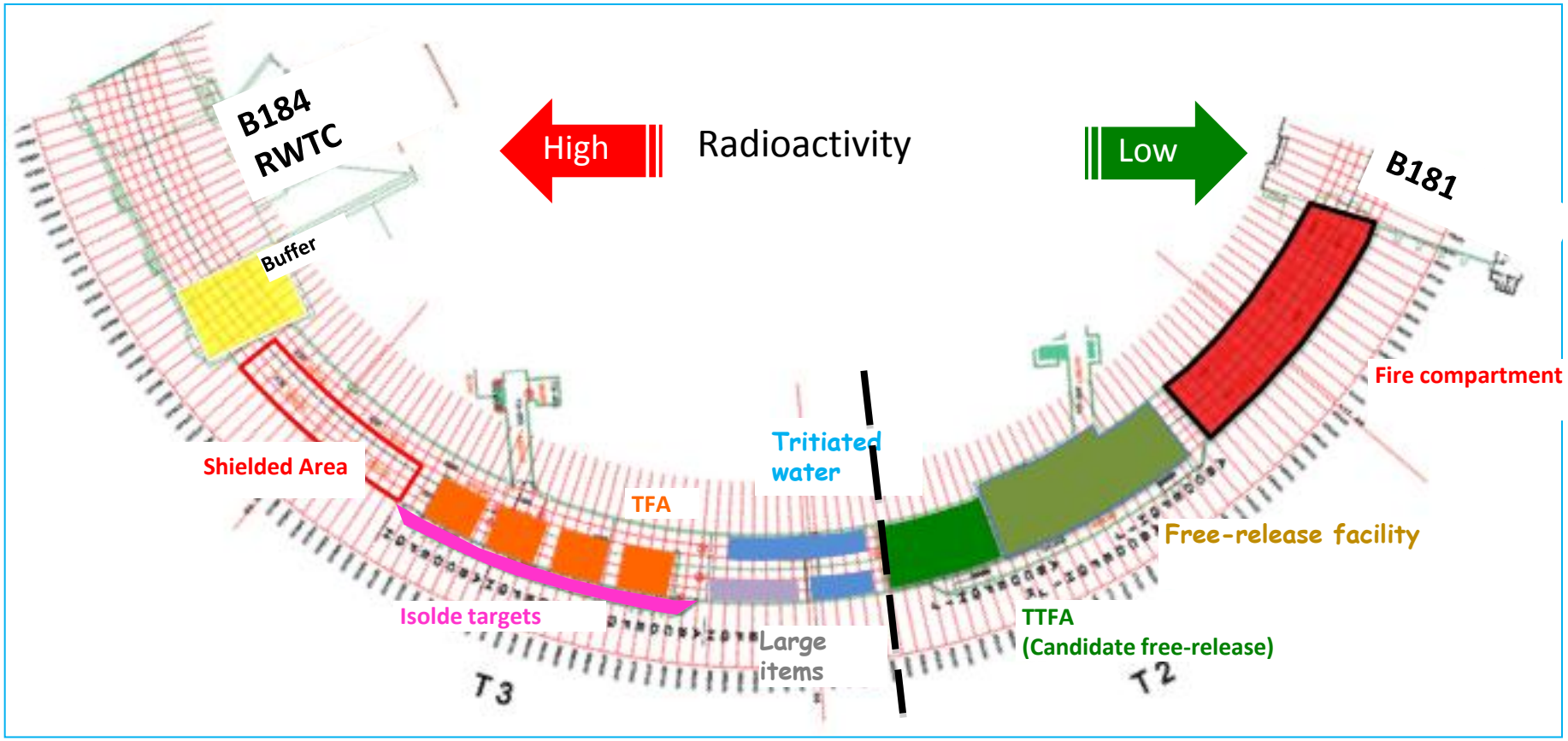
Life Cycle of CERN Waste



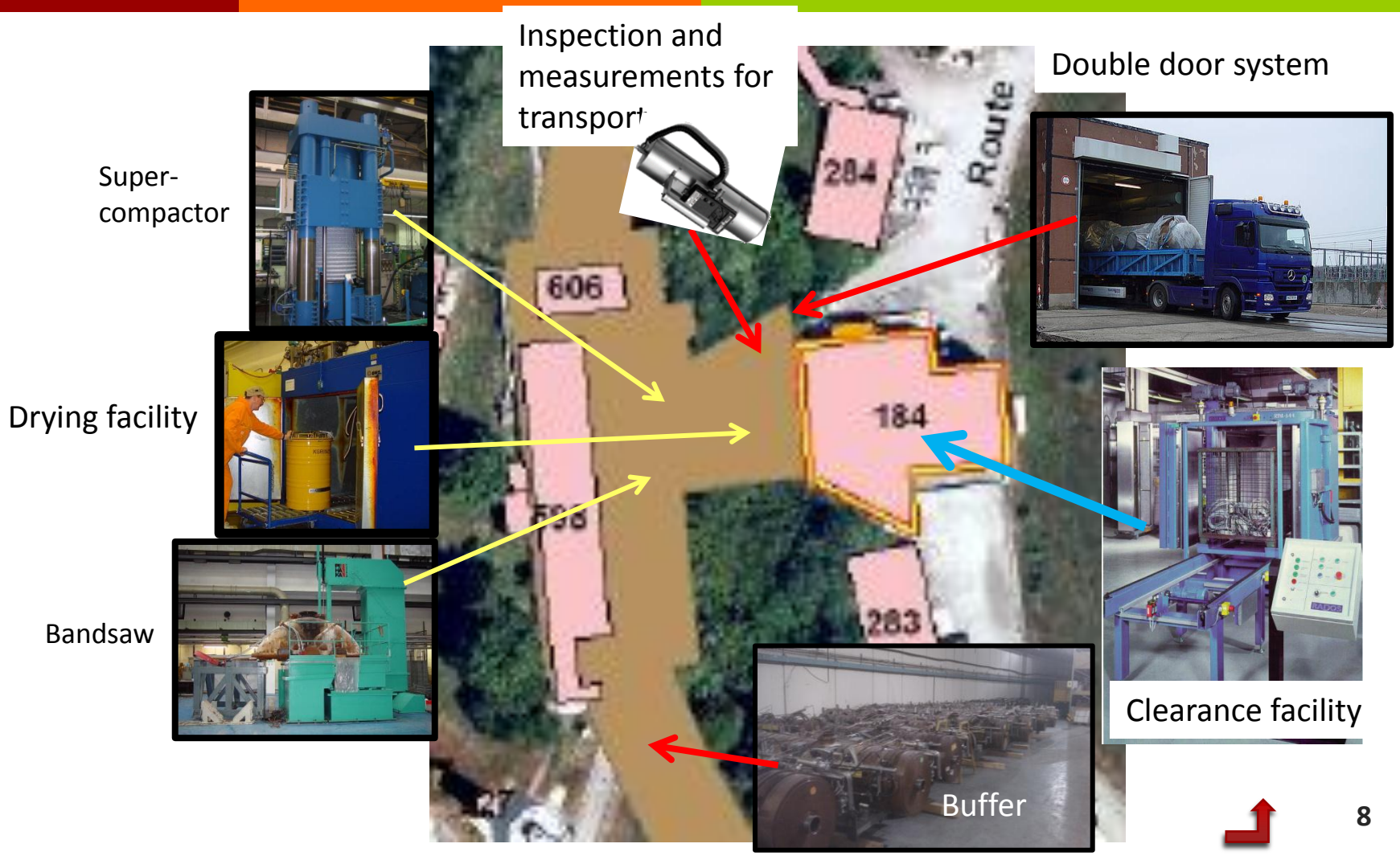
Implications for RW

- MINIMIZATION OF WASTE
  - Costs :
    - F TFA: 1 kEuro/m^3 FA: 10 kEuro/m^3
    - CH TFA: 103kCHF/m^3 FA: case by case based on study
      e.g. disposal of 1 ISOLDE target= 20kCHF
  - Space issues (interim storage)
    - ISR tunnel , octants 2 to 7
- CERN TREATMENT CENTER
  - Conceptual design ongoing for RWTC located in ISR4
- CHARACTERIZATION OF WASTE
  - Development of methods for the assessment of waste (investment of several man years)

Storage layout



RWTC

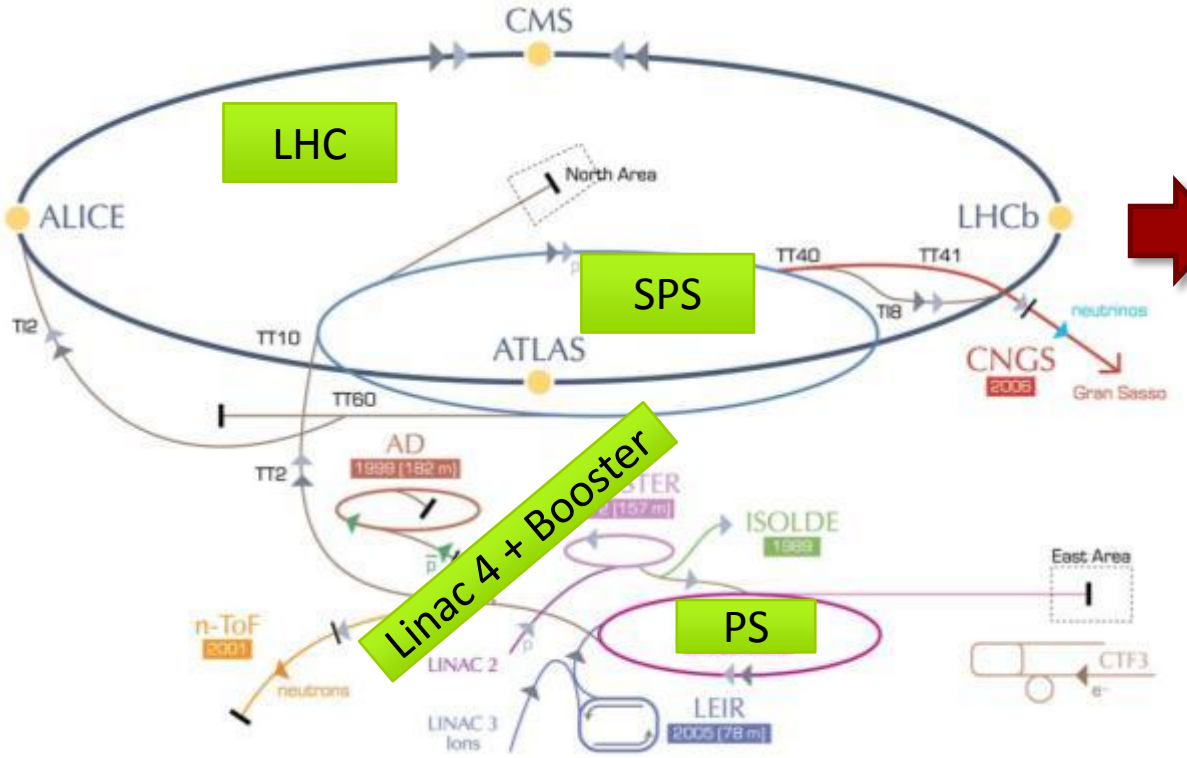

Inspection and measurements for transport
Double door system
Super-compactor
Drying facility
Bandsaw
Clearance facility
Buffer
606
284
184
283

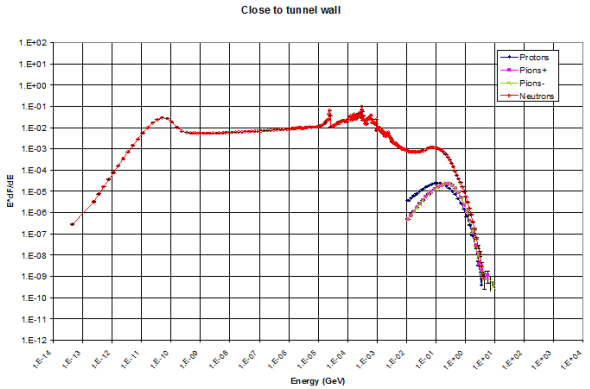
ACTIVIZ

- ActiWiz software → allows to quickly quantify radiological hazard of material implemented into CERN's accelerator environment.
- 69 elements and most common metals and construction materials were processed → first version of a catalogue is now available (LINAC4, BOOSTER, PS, SPS & LHC radiation environments)
- Catalogue provides **radiological guidelines** supporting the user in the choice of materials to be implemented in the accelerator environment.
- Help of users required to adapt the catalogue to the user's needs and to extend the list of materials treated by the catalogue. For adding materials to the catalogue a detailed description (chemical composition and density) of the material to be added is required.

Courtesy of Ch. Theis and H. Vincke: Material guidelines project -radiological hazard classification :ACTIVIZ

Categorization of the radiation environments





FLUKA calculation of 42 «typical» hadronic particle spectra
(p, n, π^+, π^- - close to beamline, wall, shielding etc.)

Radiological hazard assessment for arbitrary materials

Courtesy of Ch. Theis and H. Vincke: Material guidelines project -radiological hazard classification :ACTIVIZ

Measurement techniques for characterization

- Free release detectors→ allows to characterize radioactive waste with very low level activity.

- In situ gamma spectrometers used for characterization of large items

Implications on users I

- MINIMIZATION OF WASTE
  - Procedures for the optimization of engineering design shall be issued
- OWNERSHIP OF RADIOACTIVE WASTE
  - The ownership of radioactive material stays with the departments until acceptance of the Waste Identification Formular (FID) and delivery to the RW treatment center https://edh.cern.ch/Document/General/RadioactiveWaste
  - In specific cases ownership has to be be discussed and agreed with the equipment owner (i.e. ISOLDE targets)

Application of ALARA in equipment design

- A proposal for a guideline was drafted: “ALARA design guidelines and best practices applicable to accelerator equipment” EDMS 1080397
- Similar procedures/guidelines shall be developed by the equipment owners in collaboration with the RP group

Implications on users II

- INTERNAL ACCEPTANCE CRITERIA FOR RADIOACTIVE WASTE
  - Members of the RW section shall take part to preliminary meetings in case of dismantling projects (i.e. WANF).
  - Internal acceptance criteria for radioactive waste is planned to be drafted by RP group and will be discussed with equipment groups.
- PREDICTION OF WASTE
  - A waste study is needed for any new installation or major modification of existing installation (experiment or accelerator)
  - Identification and declaration to tripartite of radioactive waste without immediate elimination pathway (e.g. activated Hg)