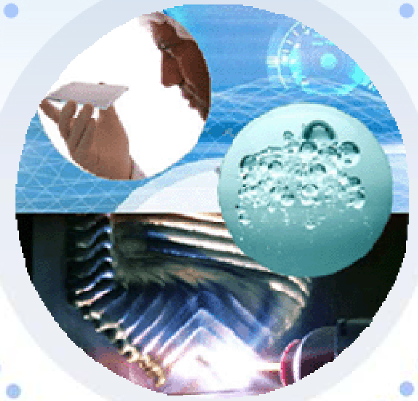

Modelling tritium in aquatic environment

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EDF R&D – LNHE

From tritium discharge in water to dose to man

- Dispersion/transport in river or sea
- Transfer to aquatic organisms
- Transfer through irrigation to agricultural products

River transport models tested on the Loire scenario (EMRAS)

GOUTAL et al., 2008, Journal of Environmental Radioactivity

- CASTEAUR — *IRSN, France*
- MASCARET – TRACER module — *EDF, France*
- MOIRA+ – MARTE module — *ENEA, Italy*
- RIVTOX — *IMMSP, Ukraine*

Conclusions :

•Good agreement between model and measurements for average concentrations

•Performance of models controlled by appropriate estimates of water velocities and water fluxes : 1D hydrological models better adapted to sharp release or high hydraulic variability

Evolution of aquatic tritium models

- Literature review in 2000 : Steady state specific activity models with or without OBT
- In 2000, CALVADOS (later called OURSON) dynamic model for tritium and carbon 14 in aquatic environment applied on the Loire river
- 2004- 2006, development of a metabolic model for carbon 14
- 2004-2007 IAEA EMRAS intercomparison exercises
  - dynamic transfer to mussel –transplantation scenario in Perch lake

    application of carbon 14 metabolic conceptual model to tritium

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General model for transfer to biota

- HTO
  - Rapid equilibrium between HTO in the organism and HTO in the surrounding media (air or water)
  - Turn-over rate controlled by ratio between water intake and body water content

- OBT
  - same general equation for OBT and carbon 14 in phytoplancton, fish, terrestrial plants and animals based on food intake rate or CO2 assimilation rate for photosynthetic organisms (Sheppard et al 2006)

$$\frac{d(A_{biota}^{C14} \cdot M_{biota}^{mass})}{dt} \cdot =$$

$$A_{biota}^{C14}(t) \cdot \frac{dM_{biota}^{mass}(t)}{dt} + M_{biota}^{mass}(t) \cdot \frac{dA_{biota}^{C14}(t)}{dt} =$$

$$-\lambda_{loss} \cdot A_{biota}^{C14}(t) \cdot M_{biota}^{mass}(t) + I \cdot K \cdot D \cdot A_{substrate}^{C14}(t) \cdot M_{biota}^{mass}(t)$$

→

$$\frac{dA_{fish}^{C14}(t)}{dt} = -k_{ing} A_{fish}^{C14}(t) + k_{ing}.DF.\frac{C_{phyto}}{C_{fish}}.A_{eau}^{C14}(t)$$

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Other aquatic models to consider

- *AQUATRIT* *IFIN, Romania*
- *BIOCHEM* *TUM, Germany*
- *Model from NIRS, Japan*
- *Model from SRA, Japan*