NUCLEAR
REGULATORY AUTHORITY
OF THE SLOVAK REPUBLIC

Experience from MACCS applications by the Slovak regulator

J. Husarcek, UJD SR (NRA SR)

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Highlights

- **Introduction**
  - UJD SR
  - Nuclear installations in Slovakia
- **Legal basis**
- **MACCS2 applications**
- **Description of MACCS2 model and open questions**
- **Conclusion - planned activities**

Introduction (1)

- **UJD SR – Central state administrative office responsible for state supervision of nuclear safety of nuclear facilities in Slovakia**
  - Core processes
    - Development of national decrees and guidelines
    - Review and assessment
    - Inspections and enforcement
    - Issuing decisions
  - ~130 employees including 87 nuclear safety inspectors

- **Division for safety analyses and technical support**
  - Performance of regulatory review calculations by means of computer codes
  - 1 person dealing with MACCS2 and radiological analyses

Introduction (2)

- **Bohunice site**
  - 2x WWER-440/V213 (V2 NPP) (in operation)
  - 2x WWER-440/V230 (V1 NPP) (in decommissioning)
  - 1x Heavy water moderated gas cooled reactor (A1 NPP) (in decommissioning)
  - Intermediate spent fuel storage (wet/dry)
  - Other installations for management of radioactive waste

- **Mochovce site**
  - 2x WWER-440/V213 (in operation)
  - 1x WWER-440/V213 (in commissioning)
  - 1x WWER-440/V213 (near completion of deferred construction)
  - Other installations for management of radioactive waste

Legal basis

- **Act on radiation protection (No. 87/2018 Coll. as amended)**
  - Requirements for radiological analyses
  - Conditions for the conductance of radiological analyses (e.g., dose conversion factors for workers/population, age dependent breathing rate, shielding factors)
  - Defined radiological limits (e.g., worker, student, population, situations)
  - Effective dose for various time periods (1 y, 5 y, 50 y)
  - Effective dose for specific organs (eye lens, skin) and age categories of the populations

- **UJD SR guidelines**
  - Specifications of provisions of generally binding legal documents (GBLD)
  - Description of methodology for rad. analyses (to some extent, for specific cases)
  - Some radiological limits

MACCS applications

- **Professional use of MACCS2 at UJD SR since summer 2022**
- **External support for input deck development and code applications**
- **Regulatory review calculations in support of review and assessment of documentation submitted by license holder/applicant:**
  - Radiological analyses of selected DBAs/BDBAs/SA for radioactive releases into environment
  - Sensitivity calculations for selected parameters/models
  - No legislative requirements for PSA Level-3
- **MACCS2 models developed at UJD SR with data set examples provided in MACCS delivery packages:**
  - Plant specific source term (radiological composition, mass, energy and timing of releases)
  - Data from national generally binding legal documents (e.g., dose conversion factors, breathing rate, conditions for radiological analyses)
  - Some input data are externally procured (i.e., hourly meteorological data for NPP sites in Slovakia)
  - Currently no collection of data on population, food and water ingestion, land uses

MACCS model and open questions (1)

- **Currently used MACCS modules: ATMOS and EARLY; module CHRONC is not activated**
  - ATMOS - calculations pertaining to atmospheric transport, dispersion, and depositions while the material is in the atmosphere; downwind transport is modeled
  - EARLY - calculations pertaining to the emergency phase; the exposure pathways considered are cloudshine, groundshine, and resuspension inhalation
  - CHRONC – not used
- **30 radial spatial elements (01 – 30 km) to be in line with protection zone, EPZ and experience from radiological analyses**
- **43 (60) – number of radioactive nuclides considered; 10 radionuclide groups (in correspondence to MELCOR code)**
- **Wet deposition – washout coefficient by default**
- **Dry deposition – 4 particle size groups (we consider that it refers to iodine)**

MACCS model and open questions (2)

- **Site specific meteorological data**
  - Incomplete set of data
  - Inconsistencies between the weather stability class (Pascquill) and wind speed, day/night time conditions
- **Atmospheric dispersion coefficients (function of distance and weather stability category)**
  - Karlsruhe-Julich system release
- **Plume release duration limited in MACCS to 20 hours (in reality release can take days)**
- **Core inventory a release fractions set up according to the analyzed scenario**
- **DOSE conversion factors (DCF file of MACCS 1.5.11)**
  - Differences in dose conversion factors provided in Slovak national generally binding legal documents (Radiation protection act) and sample problems in MACCS delivery package (organs, radionuclides, values)
- **Resuspension turned on**
- **Shielding and exposure factors – considered normal activity, no evacuation, no sheltering**

MACCS model and open questions (3)

- **Meteorological sampling data - random samples for each day of the year**
- **Code runs from „command prompt“ window**
- **Calculated centerline dose to 'L-EDEWBODY“ vs. distance (Sv) (we consider that it represents effective dose - life time 50-year dose commitments)**

MACCS – planned activities

- **Continuous improvement and completion of input models**
- **Evaluation of impact of atmospheric dispersion coefficients on calculated results**
- **Evaluation of impact of available conversion factors on calculated results**

Thank you for the attention