



RIC 2013

Consequence Analysis with MACCS2

Session on Severe Accident Code Analysis and Fukushima Response Activities

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- Overview
- MELCOR Accident Consequence Code System V.2 (MACCS2) Modules
- MELCOR Accident Consequence Code System V.2 (MACCS2) Pre-processor Codes
- WinMACCS Architecture and Graphical User Interface
- MELCOR Accident Consequence Code System V.2 (MACCS2) Uses

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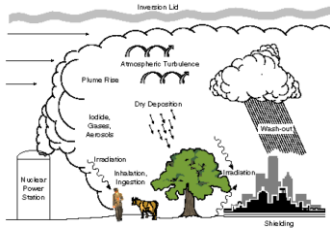
- Tool used to assess the risk and consequence associated with a hypothetical release of radioactive material to the atmosphere.
- Evolved from codes used in the 1970's and the 1980's.
- Accounts for:
 - Transport and dispersion in the atmosphere and deposition to ground
 - Exposure due to inhalation, ingestion, and external irradiation
 - Protective actions during emergency and long-term phases
- Estimates consequence in terms of:
 - Health effects
 - Economic impacts

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Overview: Pathways

MACCS2 models the radioactive release to the atmosphere (e.g. plume rise, dispersion, dry and wet deposition)



MACCS2 estimates the health effects from: inhalation, cloud shine, ground shine, skin deposition, and ingestion (e.g. water, milk, meat, crops)

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MACCS2 Modules

- **ATMOS**
 - Atmospheric transport and dispersion
- **EARLY** (1 day to 1 week)
 - Emergency-phase countermeasures and consequences
 - Consequence altered by sheltering, evacuation, and relocation (i.e. Protective Action Guides (PAG))
- **CHRONC**
 - Intermediate (0 to 1 year)
 - Long-term consequences (0 to 317 years; 50 years typical use)
 - Consequence altered by decontamination, interdiction, and condemnation (i.e. Protective Action Guides)

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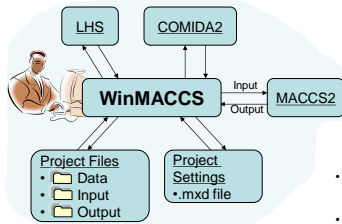


MACCS2 Preprocessors

- **SECPop2000** code
 - US site specific population distribution (based on 2000 census data)
- **MELMACCS** code
 - Utility for creating a MACCS2 formatted source term from MELCOR
- **Dose Conversion Factor** utility codes and files
 - DOSFAC2 code
 - FGRDCF code
 - ICRP-68/72 file
- **COMIDA2** code
 - Food chain
 - Includes decay and ingrowths
 - A standard file is distributed with MACCS2/WinMACCS

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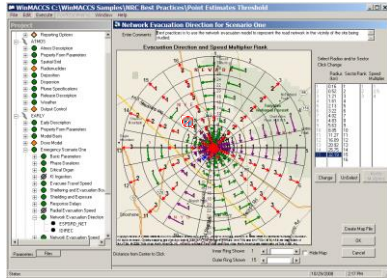
Architecture of WinMACCS



Note: WinMACCS has tools for post processing of MACCS2 output (e.g. plots of complementary cumulative distribution function (CCDF))

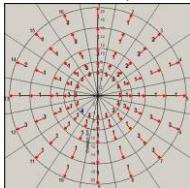
- WinMACCS(Graphical user interface)
 - Organizes all data needed to run MACCS2
 - Constructs input files
 - Enables sampling and processing of uncertain inputs
 - Post-processes results
- Latin Hypercube Sampling (LHS); Performs stratified random sampling of input variables
- COMIDA2; Creates food-chain inputs to MACCS2
- MACCS2; Analyzes consequences from atmospheric release of radionuclides

WinMACCS GUI

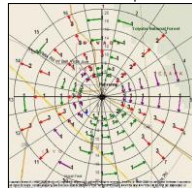


WinMACCS: Network Model Input

Radial Evacuation Specification



Network Evacuation Specification



Enables graphical user modeling input implementation of road networks for population movements in multiple directions



MACCS2 Uses

- Probabilistic Risk Assessments (e.g., NUREG-1150)
- Severe accident studies (e.g., State-of-the-Art Reactor Consequence Assessment (SOARCA))
- National Environmental Policy Act Studies;
 - License renewal
 - New reactor applications
- Other Federal agencies and international organizations

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Backup Slides

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List of Acronyms

- CRAC: Calculation of Reactor Accident Consequences
- DBA: Design Basis Accident
- DCF: Dose Conversion Factor (used to calculate doses from exposures)
- DOE: Department of Energy
- EIS: Environmental Impact Statement
- EPA: Environmental Protection Agency
- GUI: Graphical user interface
- LHS: Latin Hypercube Sampling
- MACCS: MELCOR Accident Consequence Code System
- MACCS2: MELCOR Accident Consequence Code System (version 2)
- NEPA: National Environmental Policy Act
- NRC: Nuclear Regulatory Commission
- PAG: Protective Action Guides for EPA
- PRA: Probabilistic Risk Assessment
- SAMA: Severe Accident Mitigation Alternatives
- SAR: Safety Analysis Report
- SOARCA: State-of-the-Art Reactor Consequence Assessment

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