RIC 2024 Hybrid

U.S. Nuclear Regulatory Commission
36th Annual Regulatory Information Conference

MARCH 12-14, 2024
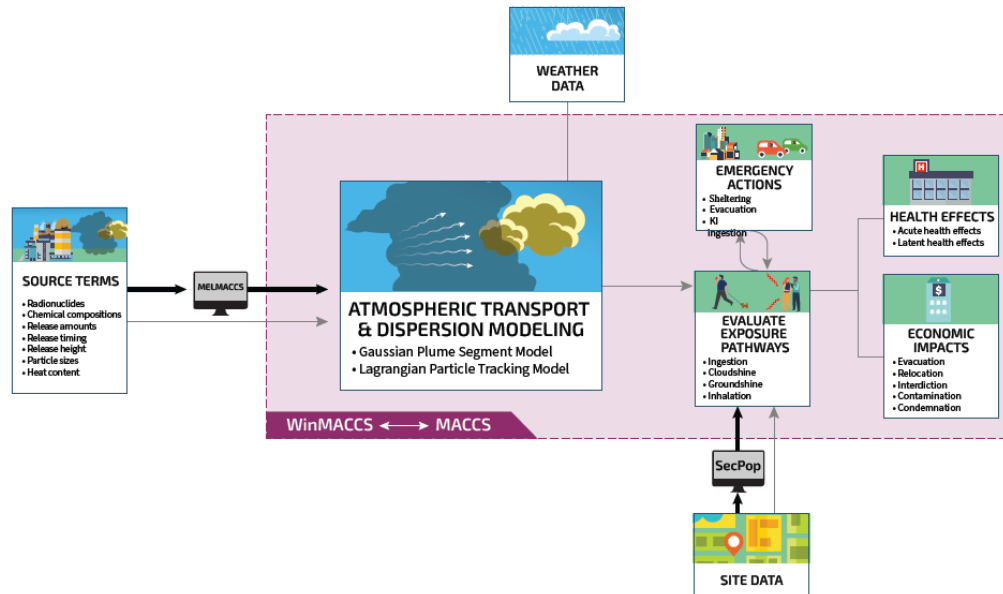
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MACCSimize Safety!

Office of Nuclear Regulatory Research

Division of Systems Analysis
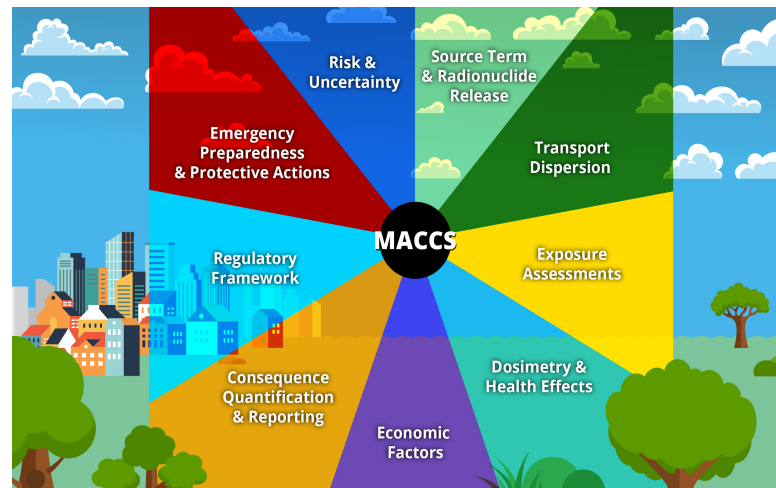
Accident Analysis Branch

Depiction of nuclear accident consequence modeling with MACCS: WinMACCS serves as the user interface to MACCS, source terms are processed through MelMACCS, and SecPop generates site data from U.S. census information.

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What is the [MACCS Consequence Analysis Code](#)?

Overview

The MACCS consequence analysis code was developed and is used to evaluate the offsite consequences of radioactive releases to the environment. MACCS models atmospheric transport, emergency and long-term protective actions, radioactive exposure pathways, dosimetry, health effects, and economic consequences.

- MACCS outputs capture a variety of metrics, including dose, health effects, fatality risk, economic losses, and land contamination.

- MACCS can be used for regulatory and cost-benefit analyses, environmental reports and impact statements, plant-specific evaluations of severe accident mitigation alternatives, U.S. Department of Energy documented safety analyses, probabilistic risk assessments, and numerous research studies.

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Consequence analysis: A fundamental tenet of safety regulation

- An important part of good regulation is estimating public consequence measures and using this knowledge to inform regulatory decisions.

- MACCS allows the NRC to estimate public consequence measures and provides a powerful tool to inform development of our regulations and guidance.

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MACCS Users Community

- **857 MACCS Users**

  - Americas 556
  - Asia 176
  - Europe 120
  - Africa 5

- **24 Cooperative Severe Accident Research Program (CSARP) Member Countries**

- **149 Organizations**

  - Regulators, Researchers, Universities, and the Commercial Nuclear Industry

857 Registered MACCS Users
24 Countries
149 Organizations

24 NORTH AMERICA

530

27

MACCS Users From USA
132 Government
136 National Laboratories
48 Universities
210 Commercial
4 Non-profit

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MACCS Code Development Activities

MACCS/WinMACCS

- MACCS is the main executable of the computer code. The NRC released MACCS version 4.2 in March 2023.
- WinMACCS serves as the current user interface for MACCS. The NRC released WinMACCS version 4.2 in March 2023.
- The user interface is undergoing a modernization effort, which is expected to be completed by Summer 2024.

MACCS-HYbrid Single-Particle Lagrangian Integrated Trajectory (HYSPLIT)

- Provides capability to perform high-fidelity Lagrangian atmospheric transport modeling. The NRC released MACCS-HYSPLIT version 1.2 in March 2023.

SecPop

- Generates site data from Census information. The NRC released SecPoP version 4.3.1 in July 2020.
- SecPoP is being updated to include the 2020 US census data and code improvement upgrades (expected by Fall 2024).
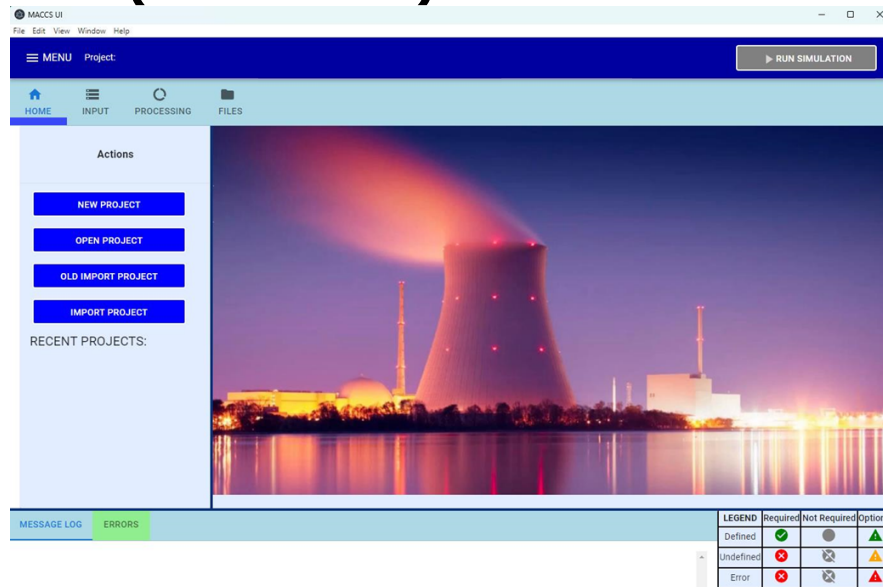
MelMACCS

- Provides source term parameters to MACCS. The NRC released MelMACCS version 4.0 in September 2022.
- MelMACCS is undergoing code improvement upgrades (expected by Winter 2024).

AniMACCS

- Provides animation of plume segments of MACCS. The NRC released MelMACCS version 1.3.1 in January 2022.

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Modernizing the MACCS User Interface (MACCS-UI)

- The MACCS-UI is undergoing a modernization effort with the key goal of ensuring long-term usability.

- The MACCS-UI is anticipated to offer a user interface and functionalities akin to WinMACCS.

- The MACCS-UI modernization is expected to be completed by Summer 2024.

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MACCS Advanced Reactor Initiatives

The MACCS development team is currently working on several advanced reactor initiatives to ensure that the MACCS code continues to meet regulatory needs for consequence analysis.

Item	Phenomenological Areas	2019	2020	2021	2022	2023	2024	Reports
CA1	Atmospheric Transport and Dispersion (Nearfield Modeling)	x	x	x				SAND2021-6924
CA2	Radionuclide Release Screening			x	x			SAND2022-12018
CA3	Radionuclide Release Screening (Atmospheric Transport and Dispersion & Dosimetry)				x			SAND2022-12766
CA4	Dosimetry and Health Effects (Tritium Modeling)				x	x	x	SAND2022-12016
CA5	Radionuclide Evolution in Atmosphere					x	x	In progress

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MACCS Advanced Reactor Initiatives
Radionuclide Evolution in the Atmosphere (Task CA5)
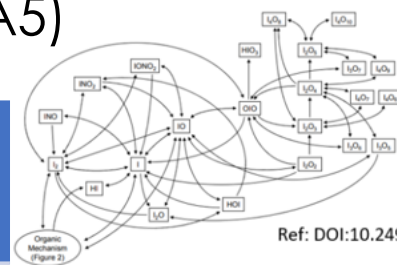
Relevant Environmental Transformation Processes

- Chemical Reactions
- Oxidation
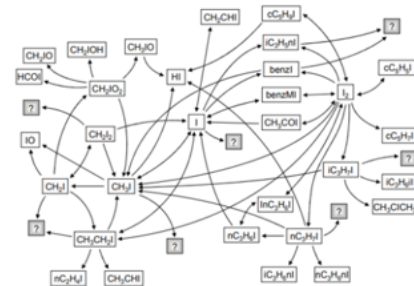- Agglomeration
- Hygroscopicity

Current MACCS Capabilities

- Radionuclide Decay and Ingrowth
- Dry Deposition
- Wet Deposition

Other Atmospheric Transport and Dispersion Models

- HYSPLIT
- CMAQ
- WRF-CHEM
- SORAMI
- RASCAL
- RATCHET

Ref: DOI:10.2495/AIR150071

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MACCS Applications Supporting Other Emerging Areas

- Future Focused Research Activities
  - The NRC is researching using National Centers for Environmental Prediction data to support severe accident consequence analysis at locations without onsite meteorological data.

- Environmental Justice
  - The NRC is planning to initiate research on how MACCS can use census data and other data sources to enable the reporting of community vulnerability indices for populations around a site. The NRC also plans to re-evaluate how MACCS models recovery decisions in low-income areas.

- Radionuclides Accident Consequence Analyses for Space Launch
  - The United States is developing space nuclear systems where such systems safely enable or enhance space exploration or operational capabilities [NSPM-20].

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Connect With Us

PM MACCS Code Development & Applications
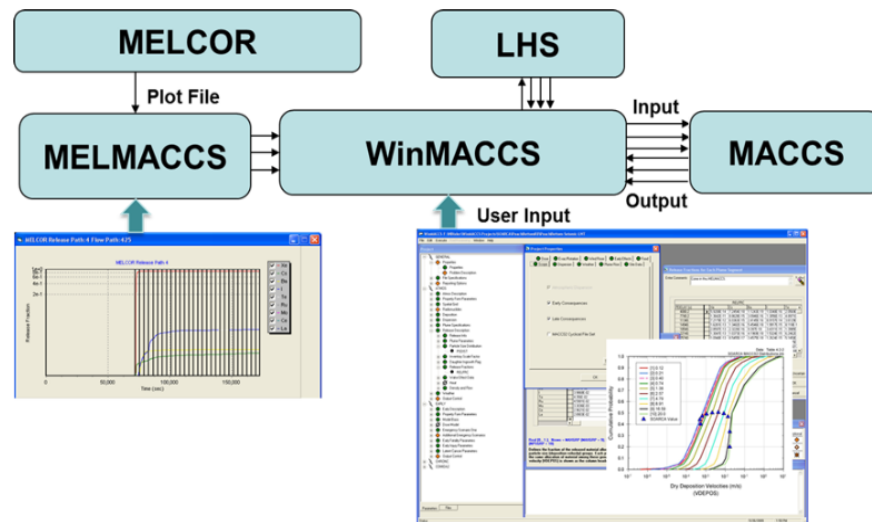
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