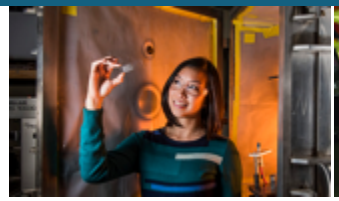
SAND2021-12370PE

Sandia National Laboratories

MELCOR Accident Consequence Code System



Dept 8855

Sandia National Laboratories

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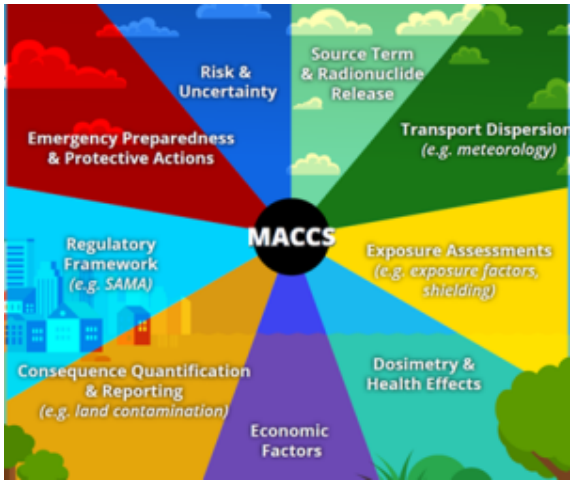
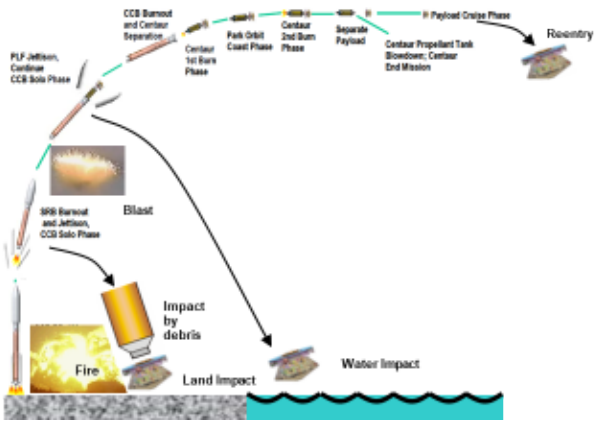
Accident Consequence Modeling and Analysis Department at SNL

Recognized worldwide as leaders in consequence and probabilistic risk analysis of nuclear energy systems and facilities, we leverage our ability to form multi-disciplinary teams and our unique knowledge of specialized codes to drive mission success.



MACCS



Launch Safety

MACCS

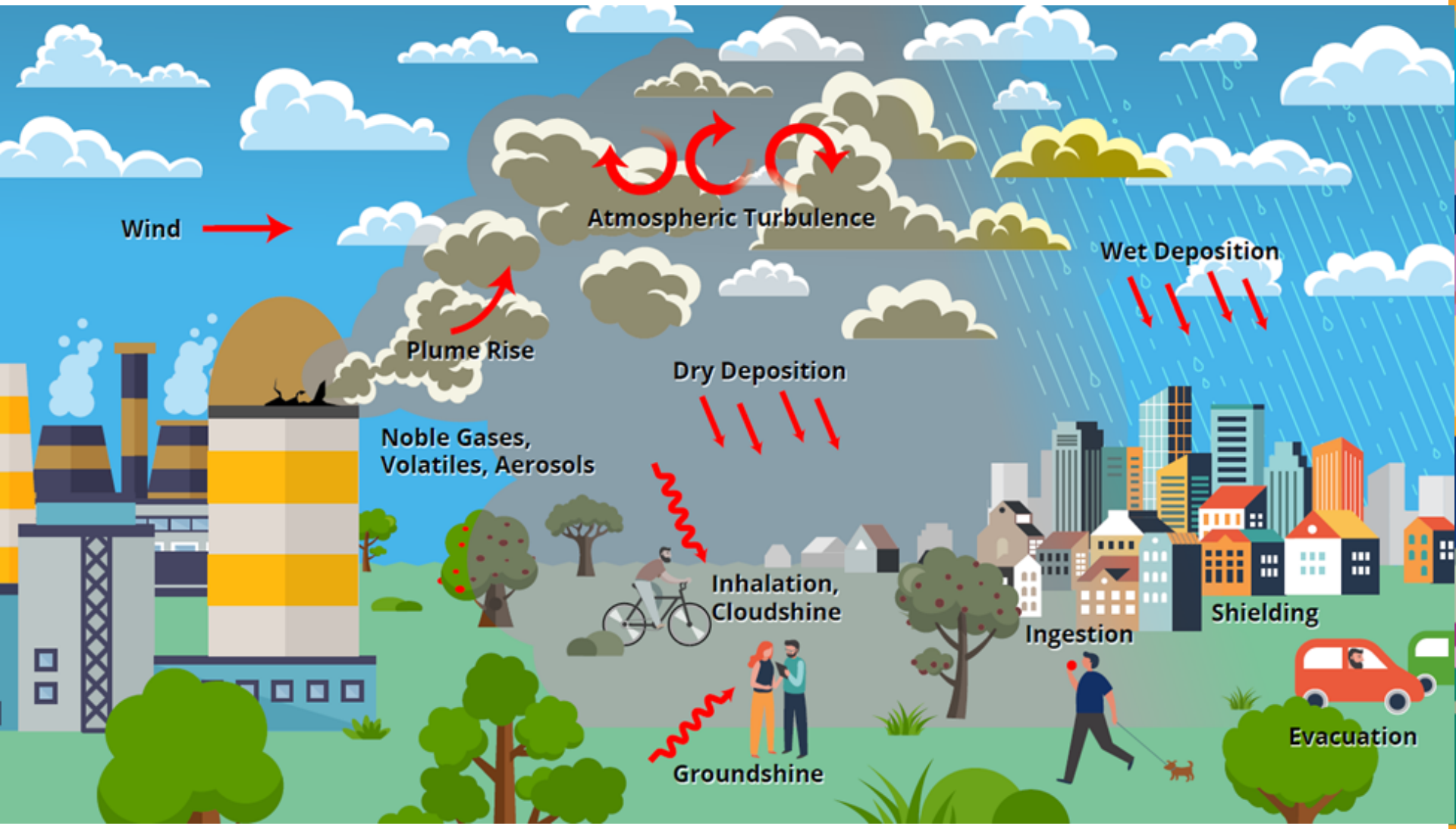
MELCOR Accident Consequence Code System (MACCS) simulates the impact of severe accidents at nuclear power plants (NPPs) and other nuclear facilities on the surrounding environment.

- Created by Sandia to support NRC research and regulatory applications
- Decades of funding and investment from the US NRC ($50M+)
- Typically used for prospective analyses, e.g.,
  - Emergency planning and response
  - Probabilistic risk assessments (PRA)
  - Probabilistic consequence assessments (SOARCA)
  - Cost/benefit analyses (required for environmental analyses in licensing)

MACCS - Capabilities

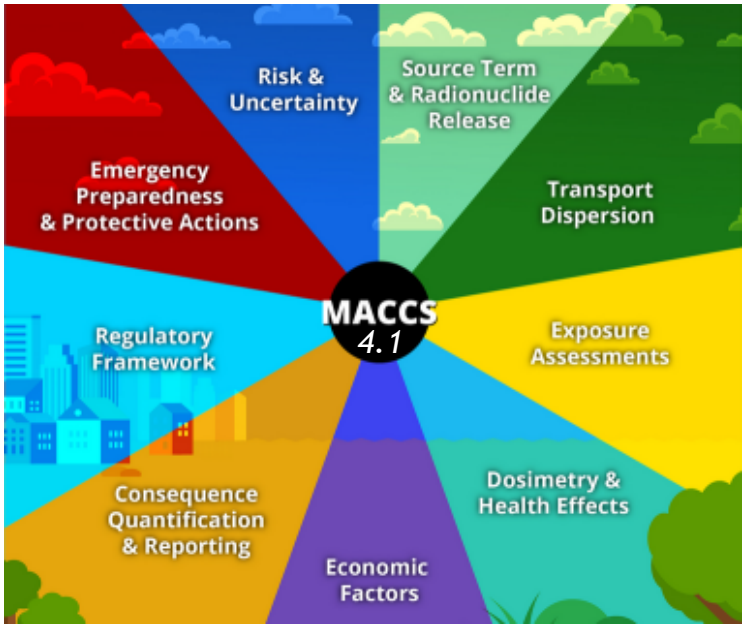
- Representation of source term
  - Magnitude, characteristics, and timing of release
  - Very flexible
- Atmospheric transport and dispersion
  - Gaussian Plume segment model
  - Lagrangian Particle tracking model
- Wet and dry deposition
- Exposure pathways to humans
  - Inhalation
  - Cloudshine
  - Groundshine
  - Resuspension
  - Ingestion
- Uncertainty Characterization
- Emergency actions
  - Sheltering
  - Evacuation
  - KI ingestion
  - Relocation
- Long-term remedial actions
  - Decontamination
  - Temporary or permanent interdiction of property
  - Crop disposal
- Economic losses
  - Evacuation and relocation per diem costs
  - Long-term relocation cost
  - Decontamination costs
  - Loss of property use
  - Depreciation during interdiction
  - Condemnation
  - GDP Losses

Atmospheric Transport Capabilities



Advanced Reactor Initiatives

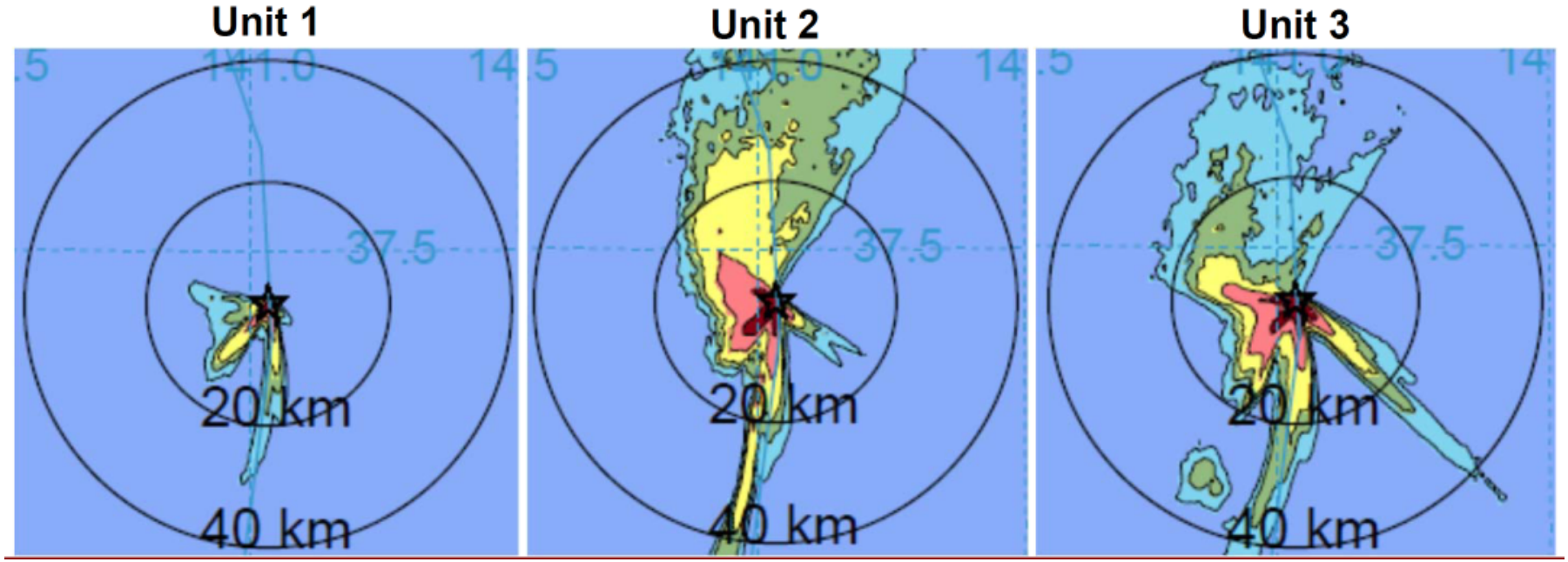
- Modeling near-field dispersion (< 500m)
  - Advanced reactors expected to be safer with smaller source terms
  - Right-sizing Emergency Planning Zone (EPZ) to be potentially less than 10 miles
- Radionuclide screening
  - Preliminary assessment of potentially released radionuclides from 4 advanced reactor types
  - Next step to evaluate gaps and priorities for consequence analysis
- MelMACCS update in process:
  - Used to translate MELCOR reactor data into input files for MACCS
  - Expansion of material inventories
  - More flexibility in chemical group assignment



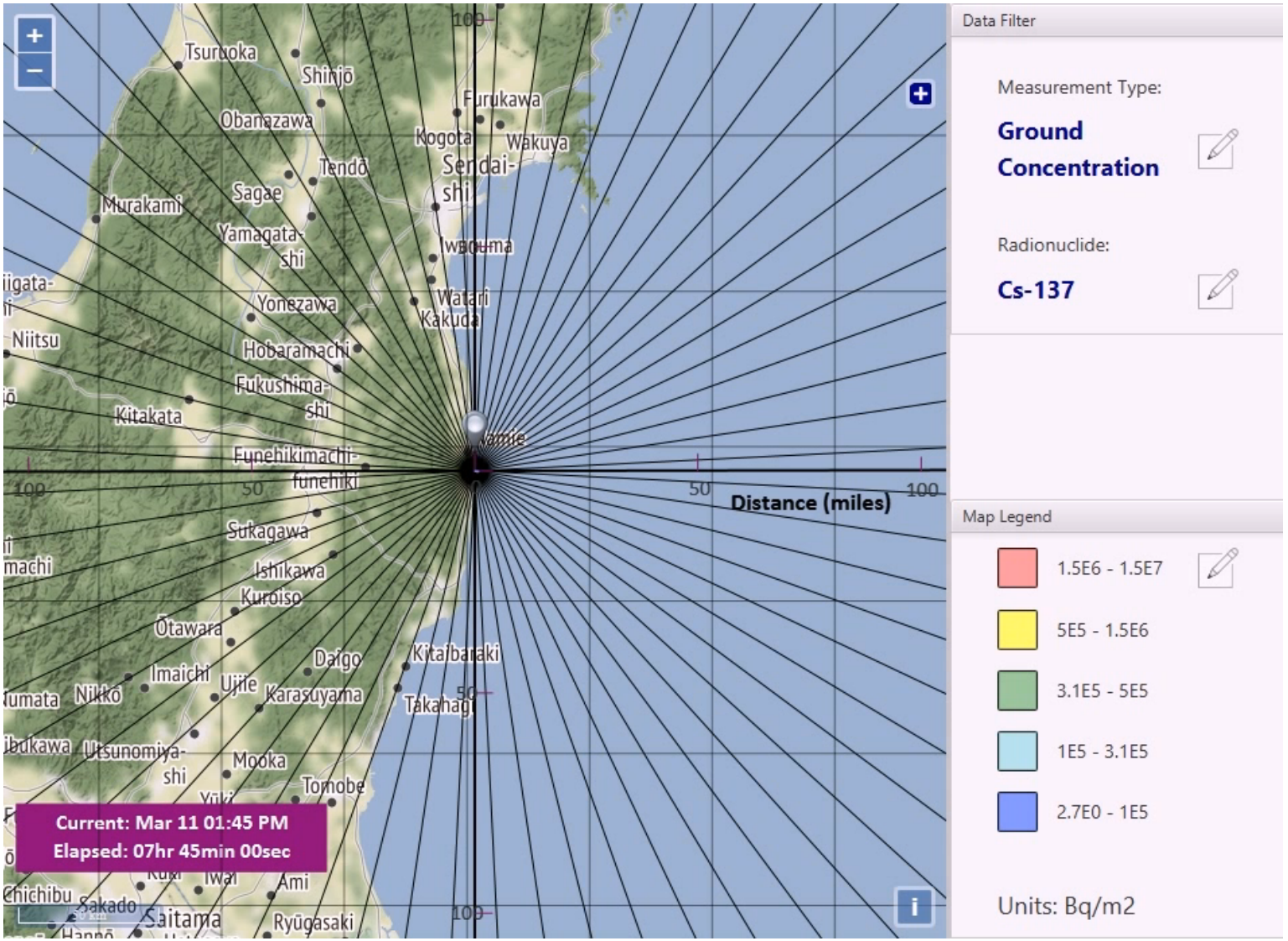
MACCS 4.1 was released on 30 July 2021 which incorporated near-field enhancements for advanced reactor consequence analysis

Example Application: Fukushima

- First multi-unit accident at a nuclear power plant
- Performed benchmarking study using MACCS HYSPLIT atmospheric transport modeling
- Focus on Cs-137 ground deposition data



Fukushima Animation



More Information

- More information on MACCS can be found on the Sandia MACCS website at: https://maccs.sandia.gov/
- More information on launch safety can be found on the Sandia Launch Safety website at: https://energy.sandia.gov/programs/nuclear-energy/launch-safety-for-space-nuclear-missions/

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Dept 8855 is always looking for new opportunities to apply strengths and build valuable partnerships!