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Status of MACCS Code Development

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Outline

- MELCOR Accident Consequence Code System (MACCS) models and capabilities
- Improvements in the most recent versions
- New models being developed
- Improvements to the Sector Population, Land Fraction, and Economic Estimation Program (SecPop) preprocessor
- Summary

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MACCS Models and Capabilities (1 of 2)

- MACCS is the NRC tool used to evaluate the offsite consequences of hypothetical radioactive releases into the atmosphere
- Evolved from codes going back to the 1970s
 - Calculation of Reactor Accident Consequences (CRAC)
 - Reactor Safety Study (WASH-1400)
 - CRAC2
 - 1982 Siting Study
 - MACCS v1.5.11
 - NUREG-1150
 - MACCS v2.4 – 3.8
 - Security Studies
 - Protective Action Recommendation Study
 - State-of-the-Art Reactor Consequence Analyses (SOARCA)
 - Spent Fuel Pool Consequence Study
 - BWR Mark I and II Containment Venting Study

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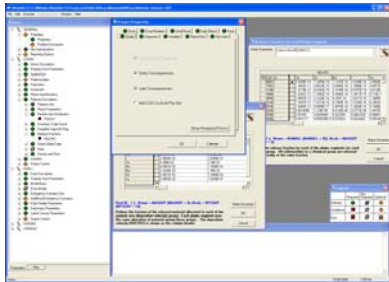
MACCS Models and Capabilities (2 of 2)

- Models treat
 - Atmospheric transport and deposition onto the ground
 - Statistical effect of variability in weather
 - Dose pathways for cloudshine, groundshine, inhalation, ingestion, and deposition onto skin
 - Protective actions during emergency, intermediate, and long-term phases
- Calculates offsite consequences
 - Doses
 - Health effects
 - Economic costs
 - Land contamination

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WinMACCS Interface

- Graphical interface improves usability
 - Organizes problem definition
 - Provides visual cues
 - Defines parameters and ranges
- Automates evaluation of uncertainty
- Incorporates post processing of output



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Improvements In Version 3.8

- Flexible capability to define the location of cohorts
- Keyhole evacuation model
- Choice of units
- Tracking population movement
- Resizable parameter input screens
- Improvements in reporting options

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Defining Cohorts



- Cohorts represent emergency response of distinct segments of the population
- Each cohort follows a timeline of actions

SOARCA Cohort	Peach Bottom	Surry
Cohort 1	0 to 10 Public	
Cohort 2	10 to 20 Shadow	
Cohort 3	0 to 10 Schools and 0 to 10 Shadow	0 to 10 Schools
Cohort 4	0 to 10 Special Facilities	
Cohort 5	0 to 10 Tail	
Cohort 6	Non-Evacuating Public	

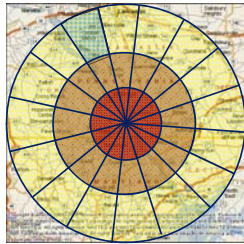


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Added Flexibility in Defining Cohorts



- The user can locate cohorts in regions anywhere within MACCS grid
 - Feature was supported previously, but not user friendly
 - Map layer can be used to facilitate cohort locations
- E.g., regions might represent
 - Emergency Planning Zone (EPZ)
 - Shadow evacuation
 - No evacuation
 - Special facility

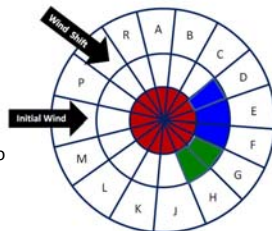


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Keyhole Evacuation Model



- Keyhole consists of
 - A central circular region
 - An pie-shaped outer region
- User defines initial dimensions of keyhole
- Shift in wind direction causes pie-shaped region to expand
- Model allows for foreknowledge of weather (forecasting)

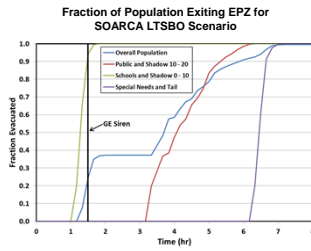


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Tracking Population Movement



- The timing of evacuating cohorts crossing boundaries can be evaluated to verify consistency with the Evacuation Time Estimate (ETE)
- Overall timing of the entire population can also be evaluated



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New Models Being Developed



- Ability to calculate consequences from multiple reactor units and/or spent fuel pools
- More flexible dosimetric modeling
- A more advanced option for treating atmospheric dispersion
- An alternative model for economic consequences based on Gross Domestic Product (GDP) losses

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Improvements to SecPop Preprocessor



- Version 4.2 released in October 2013
 - Incorporates 2010 census data
 - Incorporates 2007 economic and land use data (2012 data soon to be added)
 - Generates site files with up to 64 compass sectors
 - Includes a smarter algorithm for assigning economic regions

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Summary



Recent MACCS, WinMACCS, and SecPop developments improve modeling fidelity and add user efficiency

- More flexible definition of cohorts
- Explicit modeling of keyhole evacuation
- Choice of units
- Output of population movement for verification against ETE data
- Updated population and economic data
