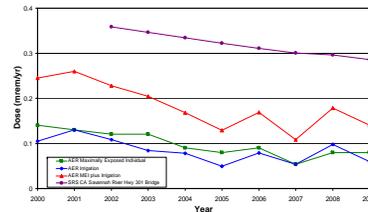
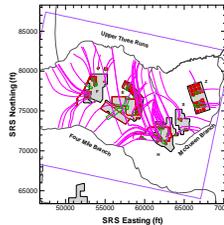


Composite Analysis: A DOE Site Decision Tool

Mark Phifer

May 25, 2011



Performance Assessment Community of Practice Technical Exchange

Composite Analysis – What Is It?

CA is a cumulative **end state** public dose projection

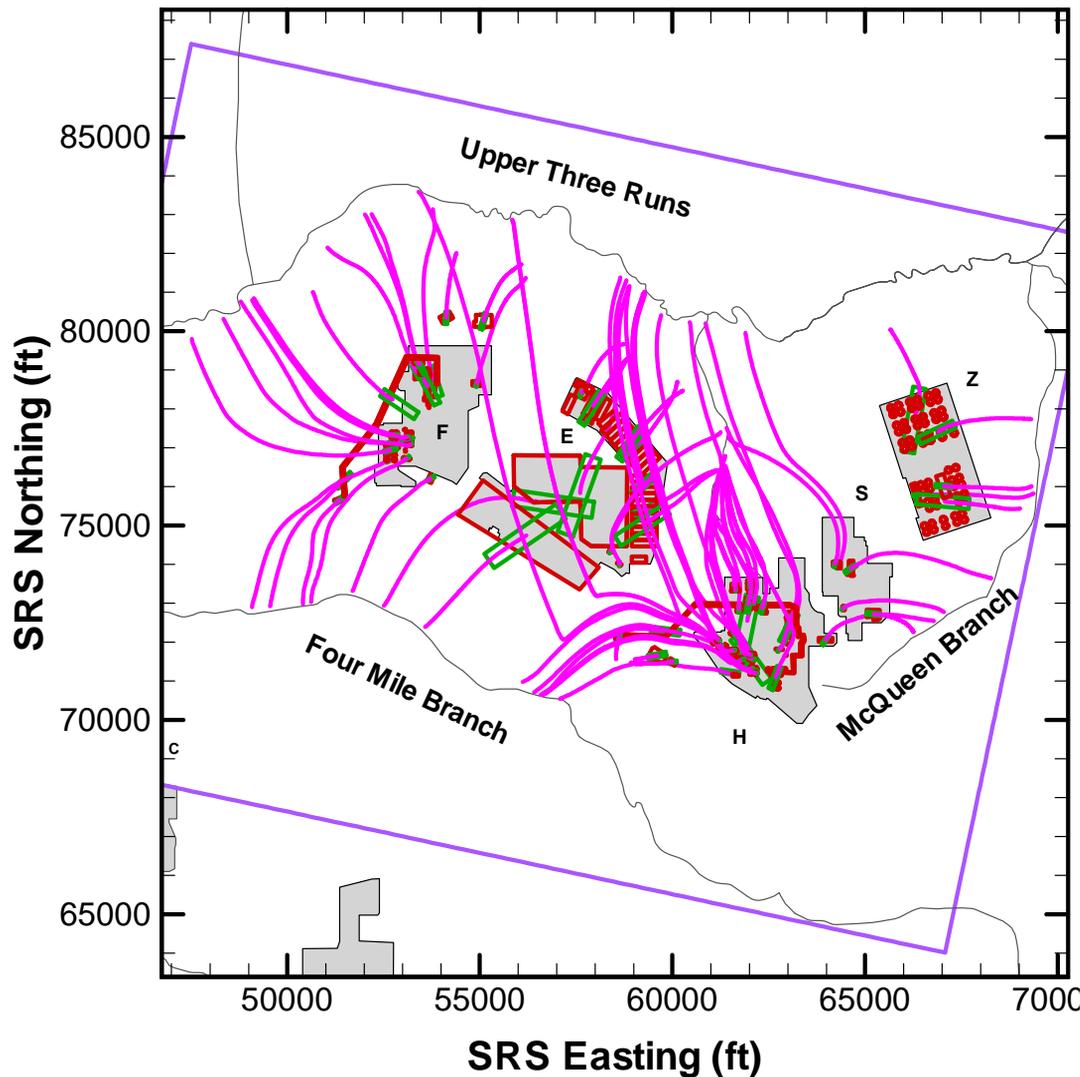
- Required by DOE Order 435.1, Radioactive Waste Management
- To provide *reasonable expectation* of future public radiological protection
- Cumulative effect of all **end state** radioactive sources (e.g., CERCLA, RCRA, and D&D) at a DOE site that could interact with LLW disposal facilities and tank closure
- Point of assessment (POA) = Publicly accessible point of maximum dose supported by the DOE site's land use plans
- Assessment period (AP) = 1,000 years
- Performance measures:
 - 100 mrem/year primary dose limit
 - 30 mrem/year administrative dose constraint

DOE Site Decision Tool – SRS CA Example

SRS CA Example Overview

- Cumulative Impacts
- Sensitivity (What if?)
- Configuration Management
- Monitoring Integration

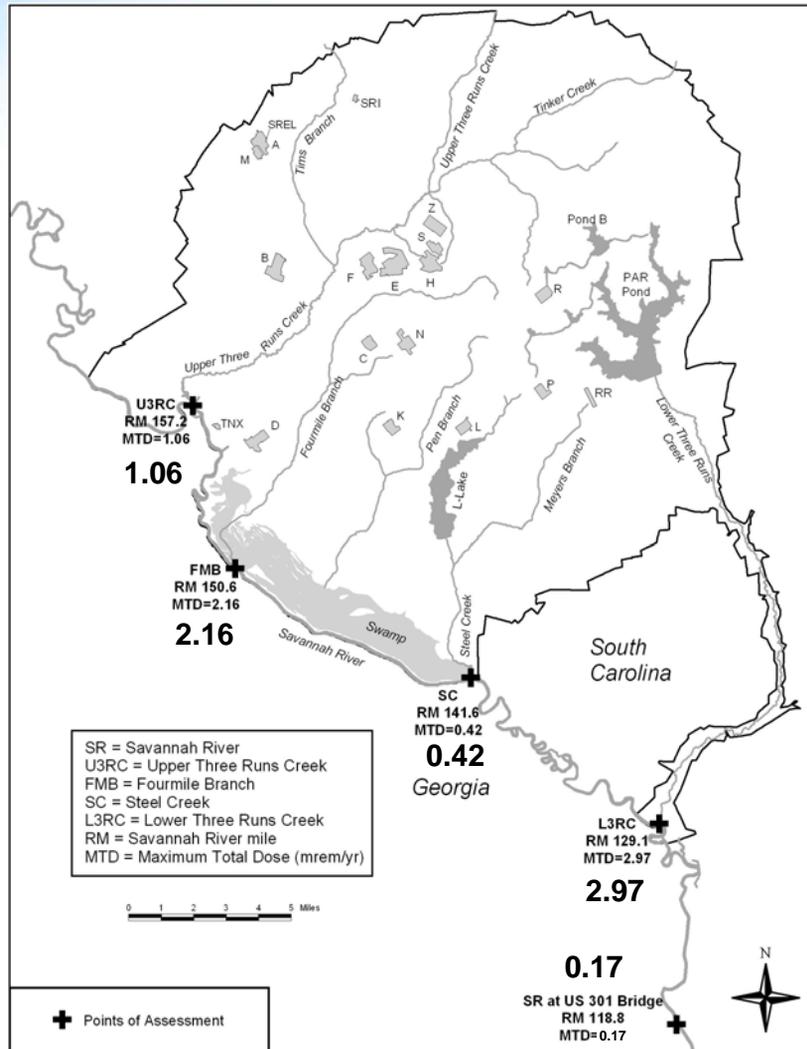
Cumulative Impacts: Aquifer Flow



General Separations Area Radionuclide Source Interaction:

- 89 sources
- Radionuclides mix in Upper Three Runs or Fourmile Branch then discharge to Savannah River

Cumulative Impacts: Public Dose



● Source Interaction

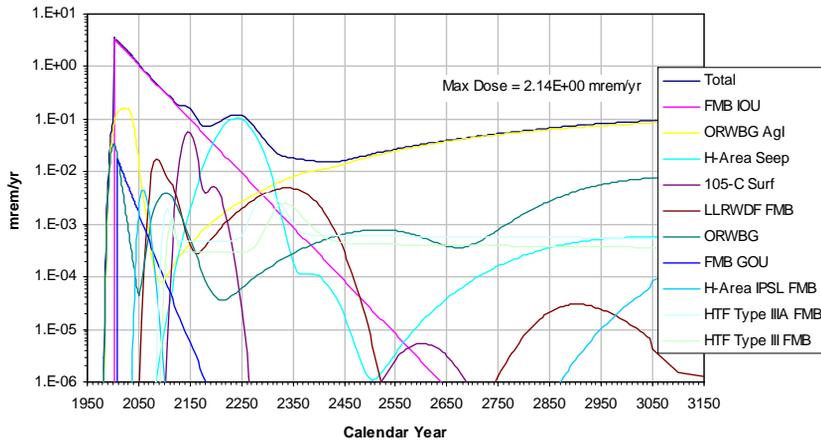
- 81 Sources at U3RC
- 118 Sources at FMB (add 37)
- 141 Sources at SC (add 23)
- 152 Sources at L3RC (add 11)
- 152 Sources at Savannah River (Highway 301 Bridge)

● Maximum 3 mrem/year at Lower Three Runs

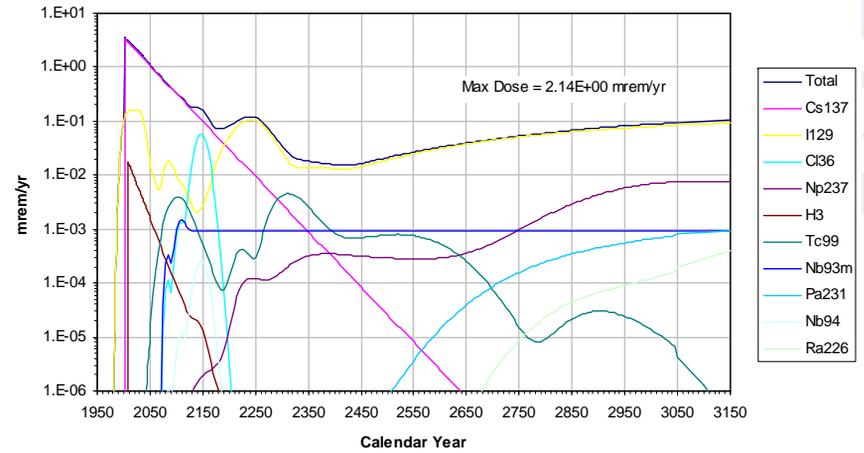
● Traced back to individual sources, radionuclides, and pathways

Cumulative Impacts: Traced Back

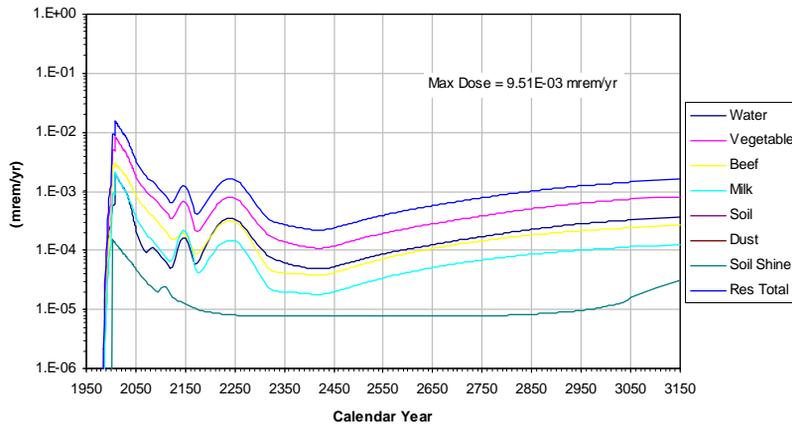
Fourmile Branch Dose by Source



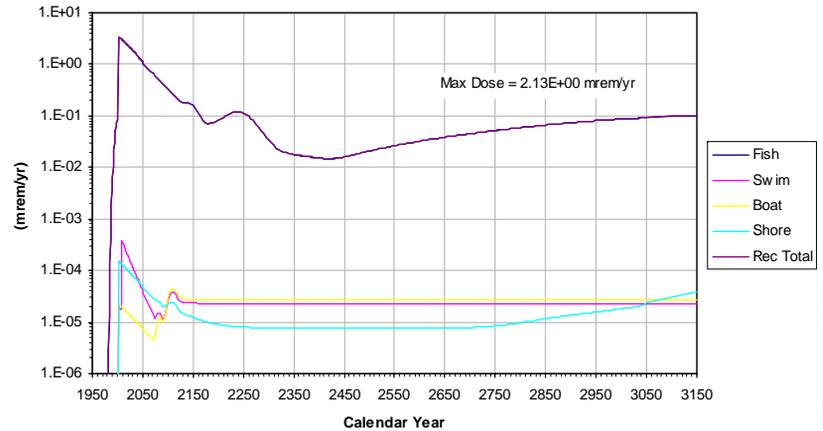
Fourmile Branch Dose by Radionuclide



Fourmile Branch Residential Dose



Fourmile Branch Recreational Dose



Sensitivity (What if?): Questions

- One off “what if” analysis from Base Case
- What if the:
 - SRS Land Use Plan changed?
 - Stream Flow decreased?
 - Inventory increased? (What would it take to reach a dose of 30 mrem/yr?)
 - SRS End State Date changed?
 - Assessment Period changed?
 - Groundwater Divide Location changed?
 - Aquifer Clay Content decreased?

Sensitivity (What if?): Results

Sensitivity	Principal Result
SRS Land Use Changed	Maximum dose of 9.7 mrem/yr for Fourmile Branch POA at the edge of the SRS industrial core versus 2.2 mrem/yr base case
Stream Flow Decreased	Maximum at 7Q10 (Low) Flow = 10.1 mrem/yr (LTR POA) versus 3.0 mrem/yr base case
Inventory Increased	Inventory multiplier to reach 30 mrem/yr at POAs: 10 at LTR (IOU); 14 at FMB (IOU); 28 at UTR (H-Canyon); 75 at SC/PB (IOU); and 950 in SR
SRS End State Date Changed	Changing the End State Date from 2025 to 2050 results in either no change or a reduction in dose at each POA
Assessment Period Changed	16 significant sources have maximum doses outside the 1,000-year assessment period. The highest dose over 100,000 years is 3.6E-01 mrem/yr from the NRCDA (part 6) versus 3.7E-03 mrem/yr base case
Groundwater Divide Location Changed	Maximum Dose Increase Factor to FMB = 42.2 (HTF dose increased from 3.3E-04 to 1.4E-02 mrem/yr with groundwater flow direction change from UTR to FMB)
Aquifer Clay Content Decreased	Increase in dose without clay ranged from a factor of 0.9 to 2.8 with an average of 1.4

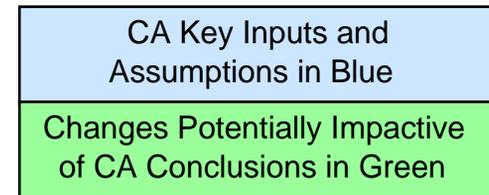
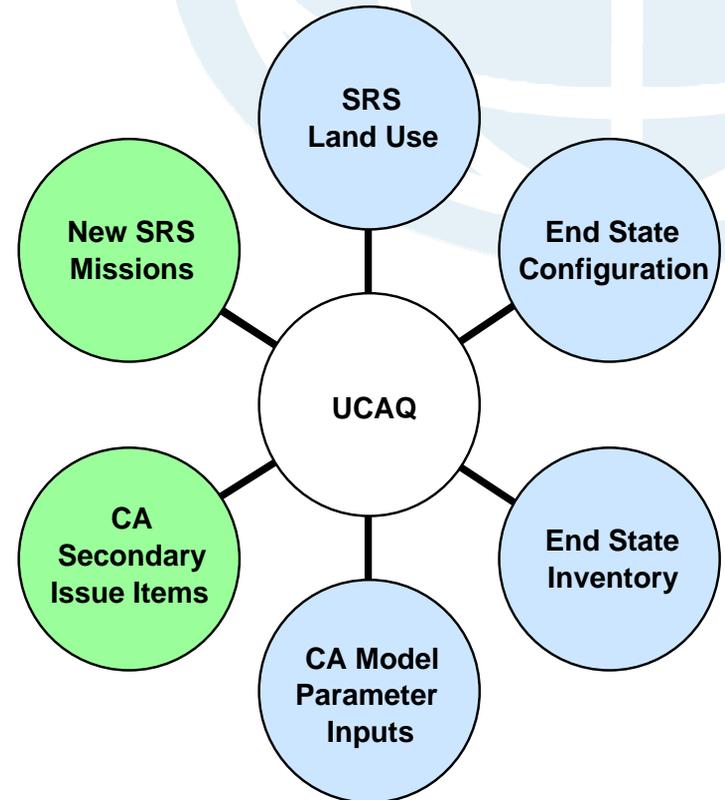
Configuration Management: UCAQ

- **Purpose:**

- Protect key inputs and assumptions of the DOE approved CA
- Evaluate changes that might impact CA conclusions
- Implement graded approach for protection based upon CA dose significance

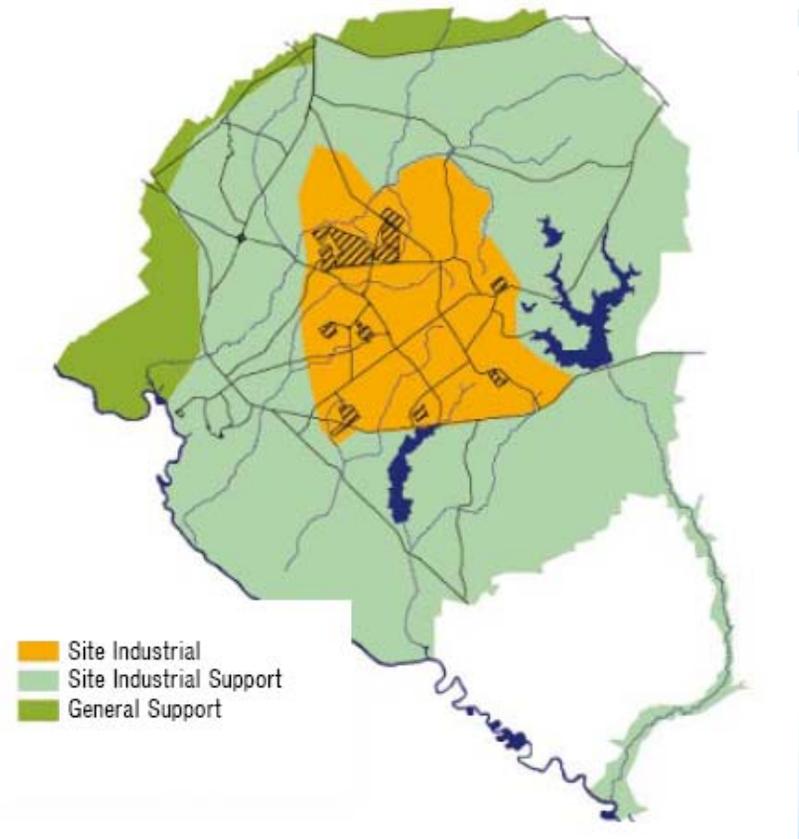
- **Major Components:**

- Unreviewed Composite Analysis Question (UCAQ) procedure
- SRS CA Technical Review Board



Configuration Management: Land Use

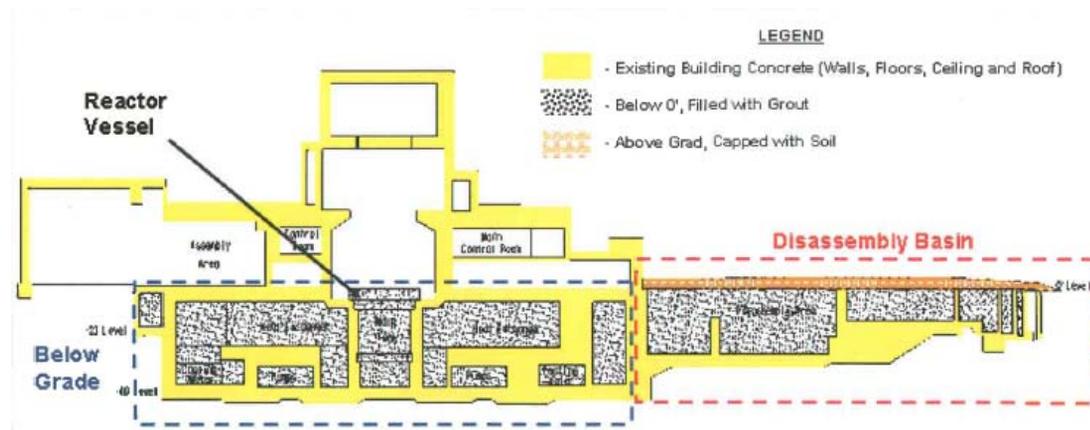
The SRS Land Use Plan, which prohibits unrestricted public access and residential land use over the entire site in perpetuity, is CA dose significant; and this land use restriction will be protected through the UCAQ program



Configuration Management: End State Configuration

The projected end state configurations of approximately 28 facilities / waste sites are CA dose significant; and are protected through the UCAQ program:

- CA considered waste form, barriers, etc.
- Operating facility a significant source if not properly de-inventoried during D&D)



Configuration Management: End State Inventory

The projected end state inventories of approximately 40 facilities / waste sites are CA dose significant; and are protected through the UCAQ program:

- PA facilities (ELLWF, SDF, FTF and HTF)
- CA considered waste form, barriers, etc.
- Maximum dose > 0.01 mrem/yr
- Operating facility a significant source if not properly de-inventoried during D&D



Configuration Management: New SRS Missions

- **SRS is not a closure site (DOE 2005)**
- **The goal for SRS is to complete Environmental Management cleanup and transition to a site focused on national security and other potential future missions (DOE 2005)**
 - Use of SRS by the Department of Army for Military Training
 - SRS Energy Park Initiative
- **The CA dose significance of New SRS Missions will be evaluated through the UCAQ program**



DOE 2005 =
SRS End State Vision

Monitoring Integration: SRS AER General

- **The SRS Annual Environmental Report (AER) is prepared for DOE according to the requirements of:**
 - DOE Order 231.1A, Environmental, Safety, and Health Reporting, and
 - DOE Order 458.1, Radiation Protection of the Public and Environment
- **Among other things the SRS AER documents effluent monitoring, environmental surveillance, and dose calculations used to demonstrate compliance with the above DOE orders, including the DOE Order 458.1 all-pathway public dose limit of 100 mrem/yr**

Monitoring Integration: SRS AER Monitoring

SRS AER monitoring includes the following pertinent to the CA:

- **Radiological effluent monitoring of liquid effluent discharge points (i.e. NPDES discharges)**
- **Environmental Radiological Surveillance of:**
 - Radionuclide concentrations within site streams (UTR, FMB, PB, SC, and LTR) and the Savannah River
 - Radionuclide migration from General Separations Area sources to FMB and UTR
 - Radionuclide concentrations within fish from site streams (UTR, FMB, SC, and LTR) and the Savannah River

Monitoring Integration: SRS AER Pathways

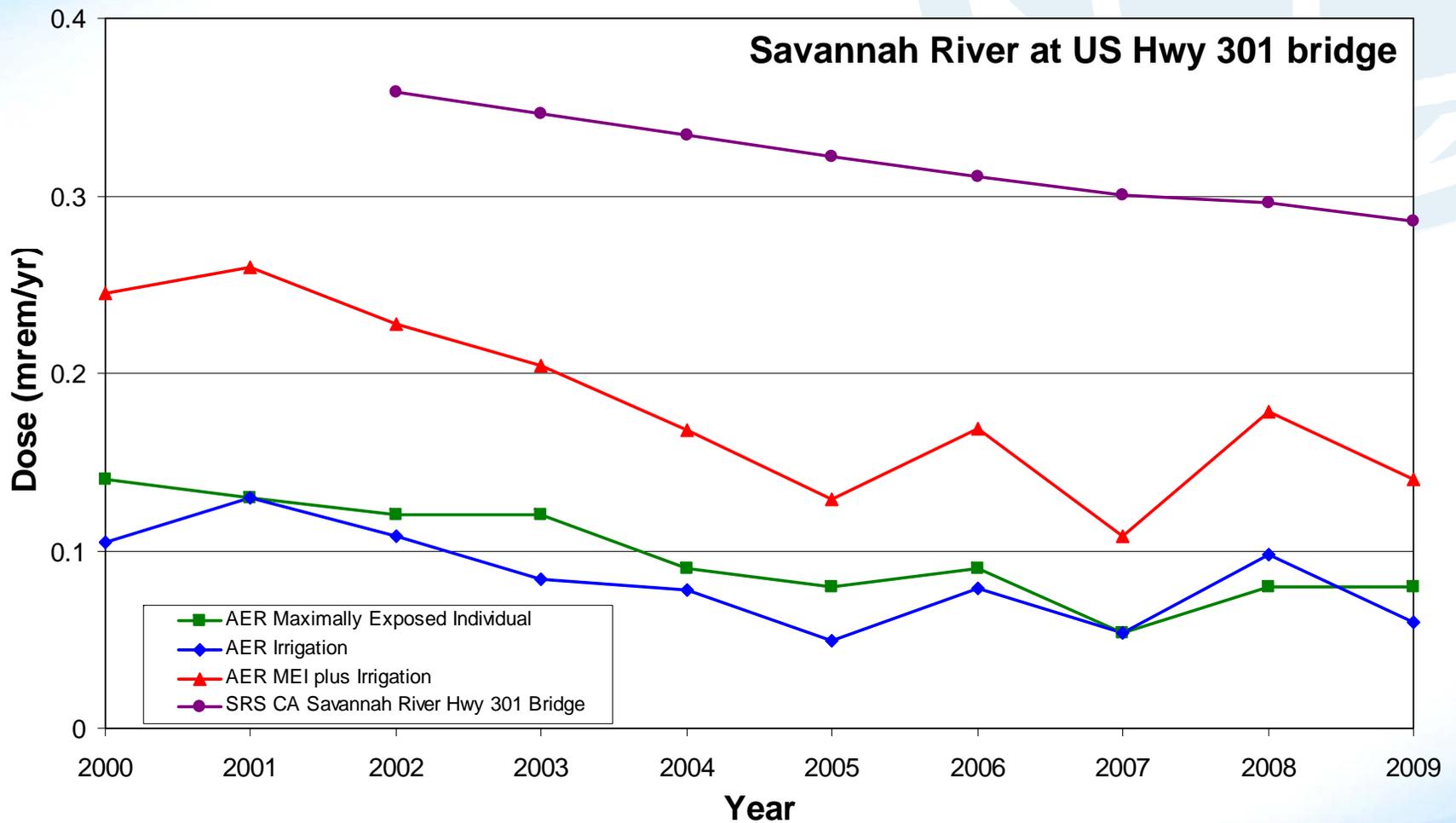
CA Exposure Pathway Dose Calculations	AER MEI ¹	AER Irrigation ²	AER Creek-Mouth Fisherman ³
Ingestion of surface water	X		
Ingestion of vegetables, beef, and milk		X	
Ingestion of garden soil			
External irradiation from garden soil			
Inhalation of garden dust			
Ingestion of fish	X		X
External irradiation from shoreline	X		
External irradiation while boating	X		
External irradiation while swimming	X		

¹ MEI = Maximally Exposed Individual at Savannah River US 301 bridge 365 days a year, drinking 2 L/day water, and eating 42 lbs/yr fish

² Sensitivity to the MEI, since no known agricultural irrigation downstream of SRS using Savannah River water

³ Sensitivity to the MEI, assuming sportsman eats 42 lbs/yr fish harvested solely from the mouths of individual SRS creeks

Monitoring Integration: Dose Comparison



Doses dominated by ingestion of fish containing Cs-137 and water containing H-3

Monitoring Integration: Summary

AER monitoring will be integrated with SRS CA modeling results:

- **Trend appropriate doses between the AER and SRS CA**
- **Process pertinent AER data through the SRS CA Dose Module and trend results**
- **Use SRS CA to inform AER monitoring**
- **Investigate ways to more closely integrate SRS CA and AER pathways and dose modeling**

DOE Site Decision Tool: CA Conclusions

The SRS CA is being utilized as a DOE site decision tool to:

- **Address Cumulative Impacts of all radioactive sources anticipated to remain at SRS's projected end state on a hypothetical member of the public at the site boundary**
- **Address “what if” questions concerning potential changes that may be contemplated at SRS**
- **Protect CA dose significant items through the UCAQ program (land use, end state configuration, end state inventory, new missions)**
- **To provide integration between the SRS CA modeling results (DOE Order 435.1) and the AER monitoring results (DOE Order 458.1)**