EMERGENCY MANAGEMENT ROUNDUP

EXPECT THE UNEXPECTED

RAD Mixture Tool

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EMERGENCY MANAGEMENT ISSUES

Use of RAD Mixture Tool in Consequence Assessment

- Consequence assessment phases:
  - Activation
  - Timely Initial Assessment
  - **Ongoing Assessment**
  - **Recovery**

Why RAD Mixture Tool Was Created

- Hazard Assessments (HA) modeled radiological mixtures by common isotopes
  - Halogens, Noble gases, Actinides, etc.
    - Results presented by mixture of each
  - Final result is from mixtures of mixtures
- Need:
  - Way to rapidly create and modify mixtures of radiological mixtures

Problems Encountered in Ongoing Assessment

- Two or more containers involved
- Multiple mixtures involved
- 49 isotope limit in HOTSPOT

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RAD Mixture Tool Key Features

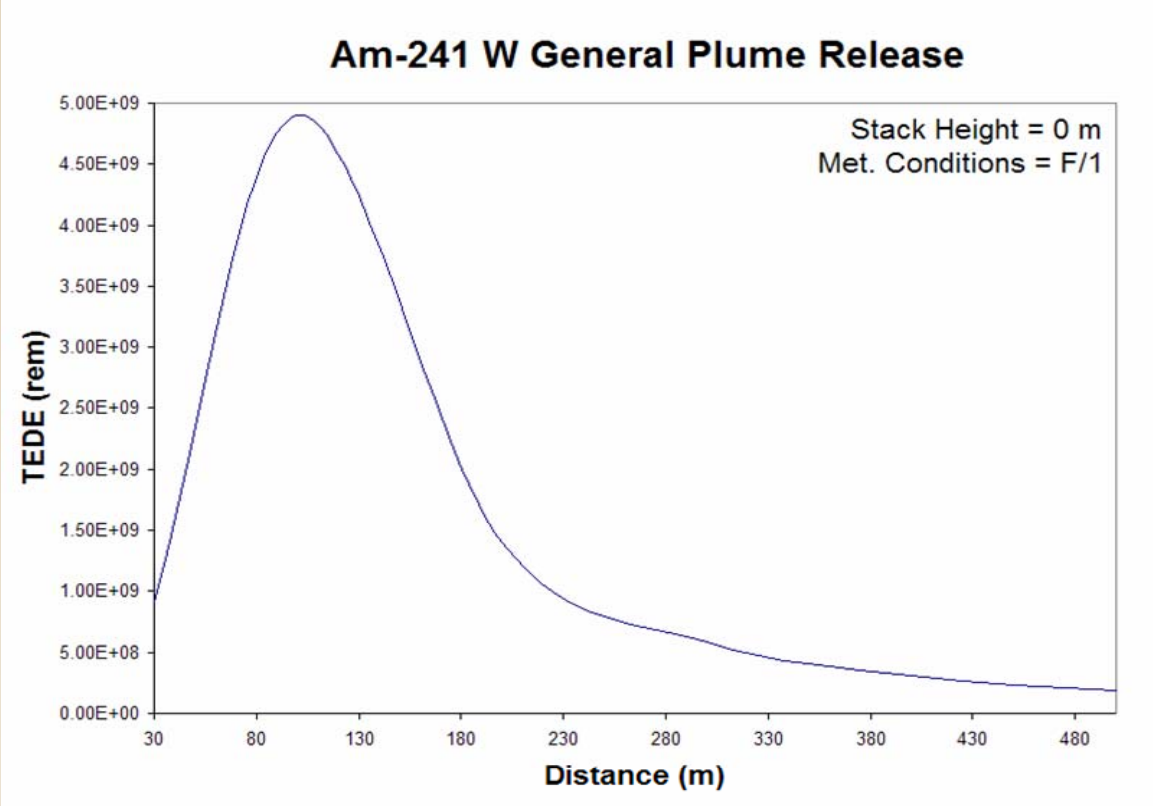
- Combines HOTSPOT mixture libraries
- Editing capabilities for mixtures of mixtures
  - Adjust source terms (mixtures and isotopes)
  - Delete isotopes
- Resolves 49 isotope limit

Resolving 49 Isotope Limit

Question: What isotopes can be discarded from a mixture of over 49 radionuclides without impacting results?

Answer: Those with the smallest *distance-weighted dose*

Example Dose vs. Distance Curve

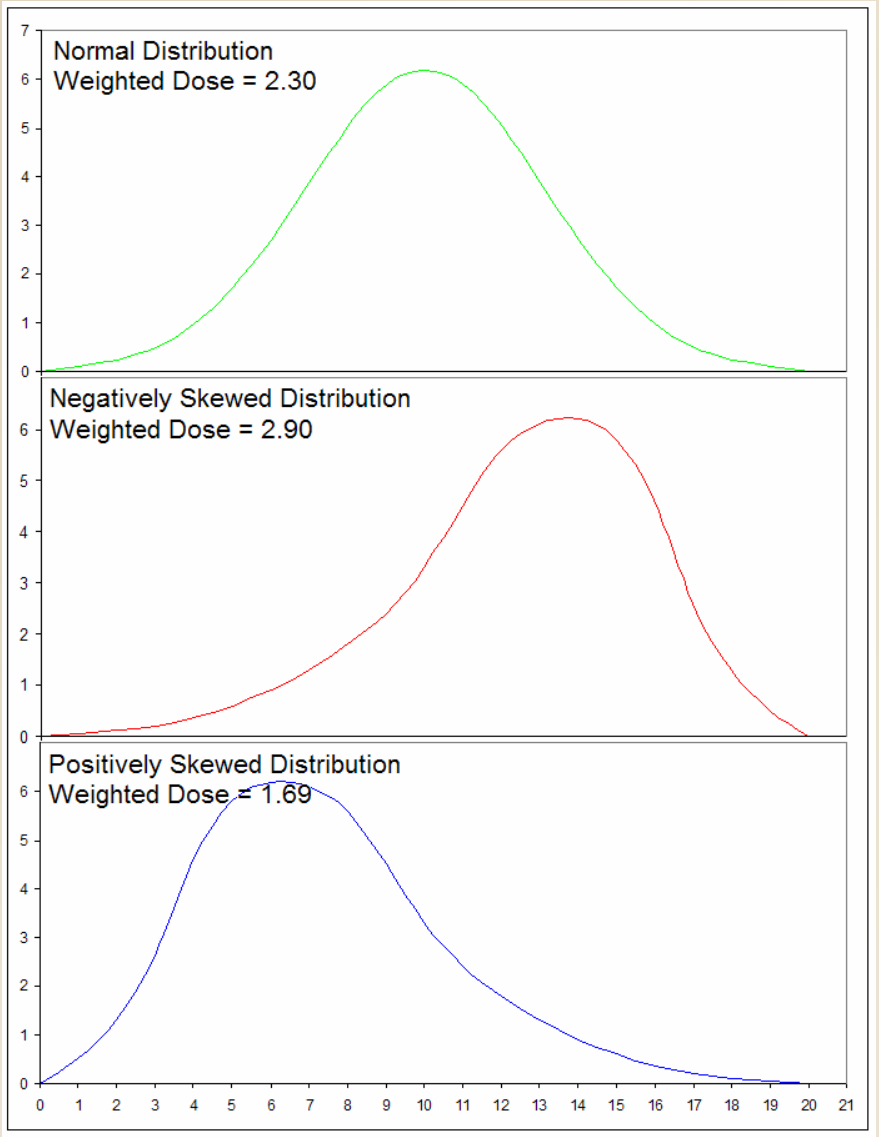


Consequences Depend on:

Dose

AND

Distance



Distance-Weighted Dose

Distance Weighted Dose

- A measure of the significance of a radionuclide in an overall mixture
- Consistent across modeling scenarios
- Easy to calculate

RAD Mixture Tool Features

- Expanding/collapsing information
- Tracking number of isotopes in mixture of mixtures
  - Total and unique isotopes
  - Total curies of mixture of mixtures
  - Number of mixtures
- Change activity by fraction or total amount
- Easy to add consequence database information
- Filter by desired number of isotopes or by threshold of total distance weighted dose

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RAD Mixture Tool

RAD Mixture:

File Options Tools Help

		Scale Multiplier For Entire Mixture:		1.0
+		Filtered Isotopes	Source Term (Ci):	0.0000E+00
+		Mix 123a.mix (Krypton Mixture)	Source Term (Ci):	7.7626E+02
-		Mix 123b.mix (Iodine Mixture)	Source Term (Ci):	6.4531E+02
	+	I-130 D 12.36h	Source Term (Ci):	5.4523E+02
	+	I-132 D 2.30h	Source Term (Ci):	8.4230E+01
	+	I-133 D 20.8h	Source Term (Ci):	1.5846E+01
+		Mix 200.mix (Plutonium Mixture)	Source Term (Ci):	3.0655E+02
+		Mix 201.mix (Misc Products)	Source Term (Ci):	9.9583E+03

Add Mixture | Edit Mixture | Remove Mixture | Remove All Mixtures

RAD Mixture Isotope Filter

Maximum quantity of unique isotopes: [ ] Apply Filter

Threshold percent of Total Weighted Dose: [ ] Remove Filters

Comments regarding this Mixture: [ ]

Export Mixture | Exit

Total Mixtures: 4 | Total Curies: 1.1686E+04 | Total Nuclides: 29 + Filtered Isotope | Min. Percent of T.W.D.: 1.0164E-06 | Unique Nuclides: 28 + Filtered Isotope

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RAD Mixture:

File Options Tools Help

Scale Multiplier For Entire Mixture: 1.0

Edit Mixture:

	Mix 201.mix (Misc Products)	Source Term (Ci): 9.9583E+03
+	Ag-109m 39.6s	Source Term (Ci): 1.2352E+02
+	Ar-41 1.827h	Source Term (Ci): 2.5647E+01
+	Br-82 W 35.30h	Source Term (Ci): 6.9310E+01
+	Cs-135m D 53m	Source Term (Ci): 8.7453E+02
+	I-130 D 12.36h	Source Term (Ci): 5.6423E+03
+	La-142 W 92.5m	Source Term (Ci): 8.9723E+02
+	Mo-99 Y 66.0h	Source Term (Ci): 8.4231E+01
+	P-32 D 14.29d	Source Term (Ci): 1.6520E+02
+	Pr-147 W 13.6m	Source Term (Ci): 5.4930E+02
+	Rb-86 D 18.66d	Source Term (Ci): 3.4214E+01
+	S-35 W 87.44d	Source Term (Ci): 2.1230E+02
+	Sm-153 W 46.7h	Source Term (Ci): 4.1460E+02

Current Mixture's Source Term (Ci): 9.9583E+03

Percent of Current Mixture's Source Term: 100

Restore Mixture To Its Original Source Term

Accept

Cancel

Threshold percent of Total Weighted Dose:

Remove Filters

Export Mixture

Exit

Total Mixtures: 4 | Total Curies: 1.1686E+04 | Total Nuclides: 29 + Filtered Isotope | Min. Percent of T.W.D.: 1.0164E-06 | Unique Nuclides: 28 + Filtered Isotope

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RAD Mixture:

File Options Tools Help

		Scale Multiplier For Entire Mixture:		1.0
+		Filtered Isotopes	Source Term (Ci):	5.1923E+03
+		Mix 123a.mix (Krypton Mixture)	Source Term (Ci):	0.0000E+00
-		Mix 123b.mix (Iodine Mixture)	Source Term (Ci):	5.4523E+02
	+	I-130 D 12.36h	Source Term (Ci):	5.4523E+02
-		Mix 200.mix (Plutonium Mixture)	Source Term (Ci):	3.0655E+02
	+	Pu-238 Y 87.74y	Source Term (Ci):	8.7230E+01
	+	Pu-240 W 6537y	Source Term (Ci):	1.2532E+02
	+	Pu-241 Y 14.4y	Source Term (Ci):	4.3510E+00
	+	Pu-242 W 3.763E5y	Source Term (Ci):	8.9653E+01
-		Mix 201.mix (Misc Products)	Source Term (Ci):	5.6423E+03
	+	I-130 D 12.36h	Source Term (Ci):	5.6423E+03

Add Mixture | Edit Isotope | Remove Isotope | Remove All Mixtures

RAD Mixture Isotope Filter

Maximum quantity of unique isotopes: 5

Threshold percent of Total Weighted Dose:

Apply Filter

Remove Filters

Comments regarding this Mixture:

Export Mixture

Exit

Total Mixtures: 4 | Total Curies: 6.4941E+03 | Total Nuclides: 6 + Filtered Isotope | Min. Percent of T.W.D.: 1.8569E-02 | Unique Nuclides: 5 + Filtered Isotope

Use

- Part of a CAT tool set
- Process for dealing with radiological mixtures:
  - Use pre-defined mixtures
  - Build/modify mixtures from pre-defined mixtures
  - Create mixtures (using HOTSPOT)
  - Use surrogates
    - Defined for radiological facilities
    - Based on hazard category 3 values

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Questions?

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