

# ***US EPA Decontamination and Risk Communication Strategies***

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**International Symposium on Remediation of Contaminated Site Caused by the Fukushima Accident**

Fukushima, Japan

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# Outline

- EPA Superfund Program
- Decontamination Strategies
- Risk Communication Strategies
- EPA Resources
  - Chernobyl Short Videos
  - Key Documents

# EPA Regulations



- Comprehensive Environmental Response, Compensation & Liability Act (CERCLA or “Superfund”)
- National Contingency Plan
- National Response Framework
- Robert T. Stafford Disaster Relief and Emergency Assistance Act
- EPA is lead agency within US to coordinate off-site cleanup



# Wide-Area Decontamination Strategy



- Decontamination decisions and actions should be commensurate with the size, urgency, and risk to the affected populations.
- Incorporate balanced holistic approach
- Empower the population to make appropriate decisions toward controlling individual exposures.
- Protect special populations
- Long-term vision with constant assessment
- Partnerships (including international)



# Media Contamination



Media	Uranium	Radium	Thorium	Plutonium	Strontium	Tritium	Cesium	Americium	Cobalt	Technetium	Radon	Other Radionuclides*
	<b>Number of NPL Sites</b>											
Soil	47	50	37	11	10	13	9	8	8	6		62
Sediment	13	15	12	2	2	1	4	3	3	2	1	8
Sludge	4	2	3	2	4	2	3	2	3	1		7
Tailings	7	8	5									
Solid Waste/ Debris	12	12	10	4	2	2	3	1	2	1		9
Groundwater	39	37	23	8	14	16	6	5	4	9	5	25
Surface Water	24	15	16	8	7	10	8	2	5	4	1	6
Leachate/Liquid Waste	2	1	2	2	1					3		3
Air						1					28	

<http://www.epa.gov/radiation/docs/cleanup/media.pdf>

# Various Cleanup Levels



Site specific cleanup levels based on future land-use assumptions

Site	Scenario								
	Resident	Rancher	Farmer	Park/Open Space User	Commercial/Industrial	Fish & Wildlife Service	Ecotourist	Homesteader	Subsurface
Brookhaven	✓				✓				
Enewetak	✓		✓						✓
Fernald			✓	✓					
Ft. Dix	✓				✓				
Hanford	✓		✓		✓				
Johnston Atoll	✓					✓	✓	✓	
Linde Site					✓				
Nevada	✓	✓	✓		✓				
Oak Ridge					✓				
Savannah River					✓				
Rocky Flats	✓			✓	✓	✓			
Weldon Spring	✓		✓	✓		✓			

<http://www.itrcweb.org/Documents/RAD-2.pdf>

## Decision Criteria

1. Overall protection of human health and the environment
2. Compliance with relevant requirements
3. Long-term effectiveness and performance
4. Reduction of toxicity, mobility, or volume through treatment
5. Short-term effectiveness
6. Implementability
7. Cost
8. State acceptance
9. Community acceptance

# Different Cleanup Challenges?



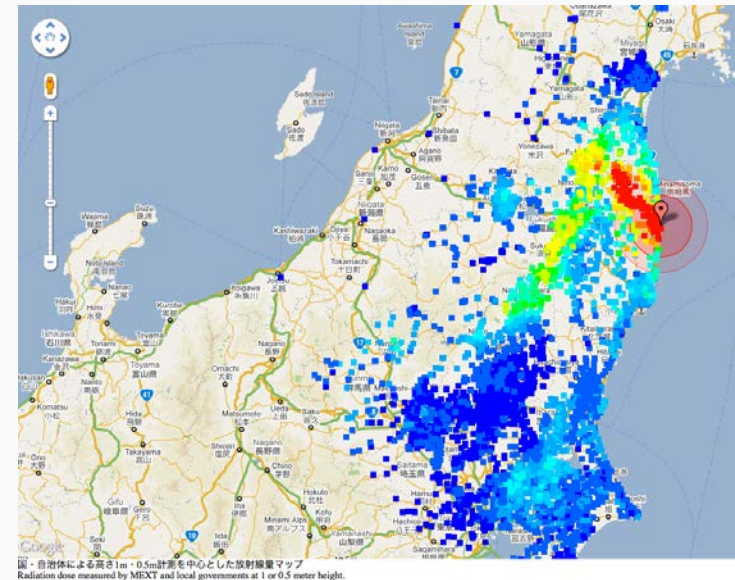
## EPA Superfund Sites

- Contamination extends deep into the soil and underlying groundwater
- Residential cleanup generally for Radium, Thorium, and Radon.
- Smaller sites with more controls



## Japan Situation

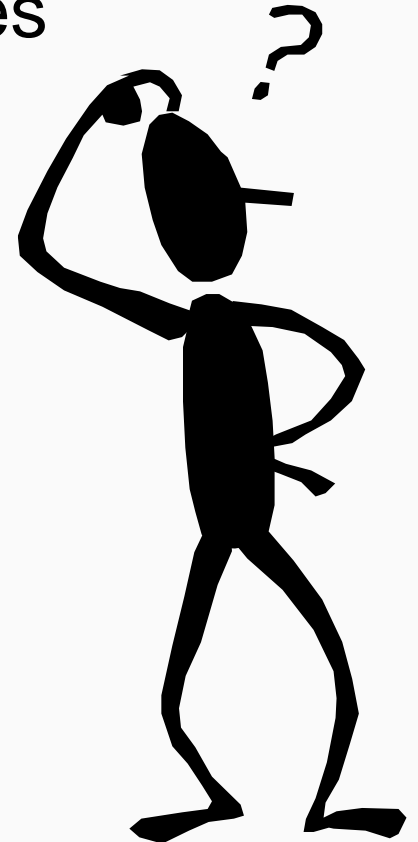
- Widespread surface contamination
- Cesium-134 & -137
- Other fission products (Sr-90)?



# Similar Cleanup Challenges?



- Selecting Decontamination Technologies
- Controlling spread of contamination
- Speed of implementation and cost
- Re-contaminating “cleaned” areas
- Determining appropriate exit strategy
  - When to terminate sampling/monitoring
- Large surfaces/media to survey/decon
- Health and Safety (i.e., dose limits)
- Many others...





# Montclair/West Orange Radium Sites

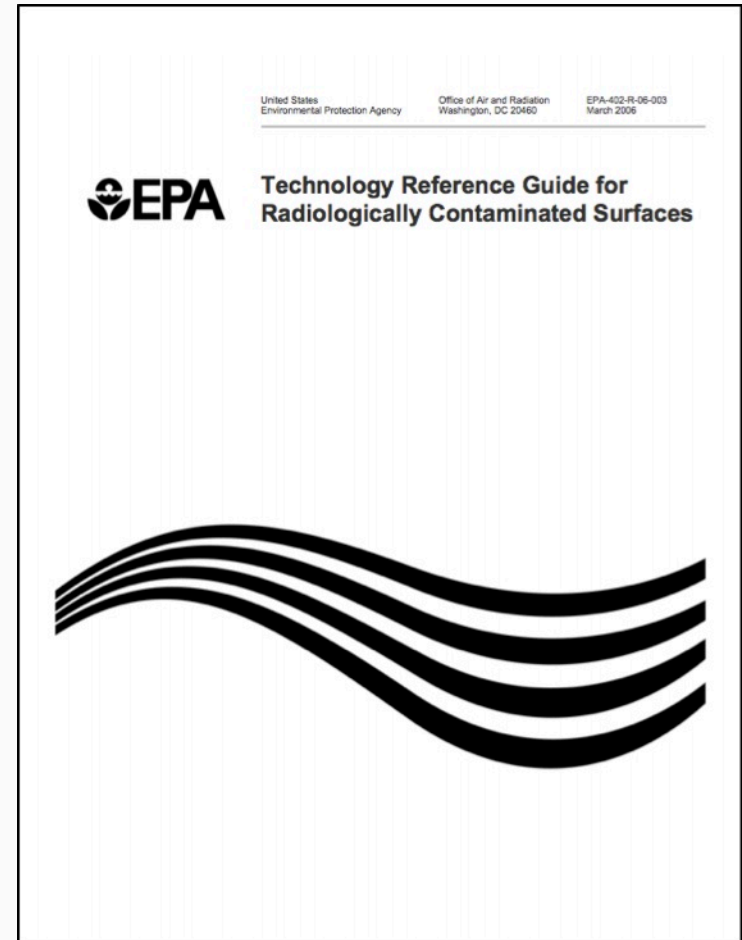


# EPA Surface Decon Reference



Five **chemical** decontamination technologies:

1. Chelation and organic acids
2. Strong mineral acids and related materials
3. Chemical foams and gels
4. Oxidizing and reducing agents
5. TechXtract



<http://www.epa.gov/radiation/docs/cleanup/402-r-06-003.pdf>

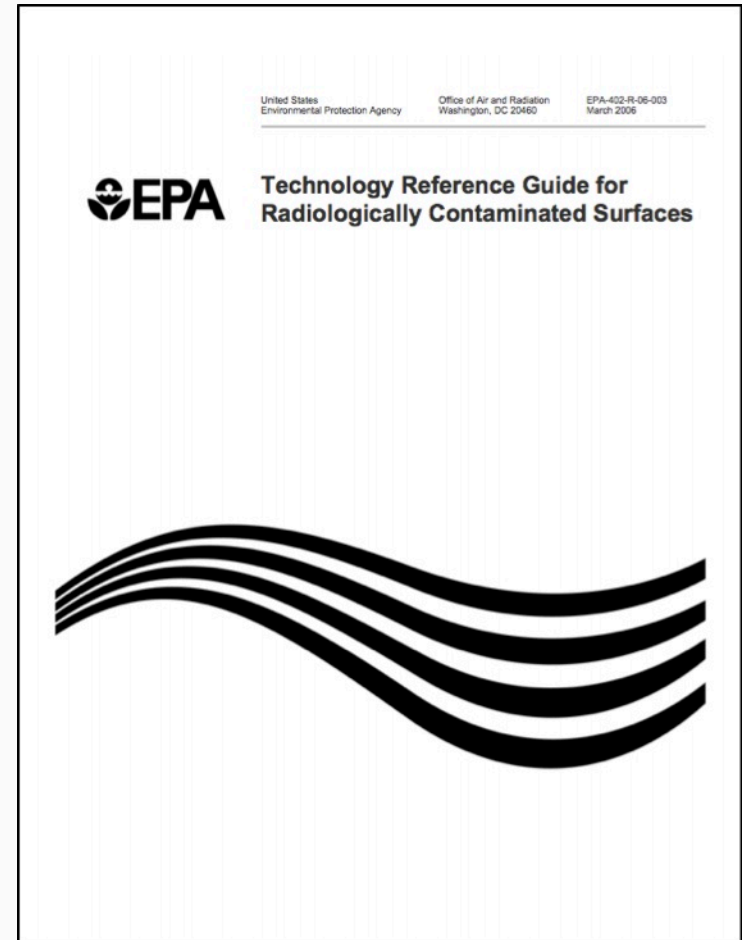
# EPA Surface Decon Reference



## Thirteen **physical** decon technologies:

- 1.Strippable coatings
- 2.Centrifugal shot blasting
- 3.Concrete grinder
- 4.Concrete shaver
- 5.Concrete spaller
- 6.Dry ice blasting
- 7.Dry vacuum cleaning
- 8.Electro-hydraulic scabbling
- 9.En-vac robotic wall scabbler
- 10.Grit blasting
- 11.High pressure water
- 12.Soft media blast cleaning (sponge blasting)
- 13.Steam vacuum cleaning

<http://www.epa.gov/radiation/docs/cleanup/402-r-06-003.pdf>

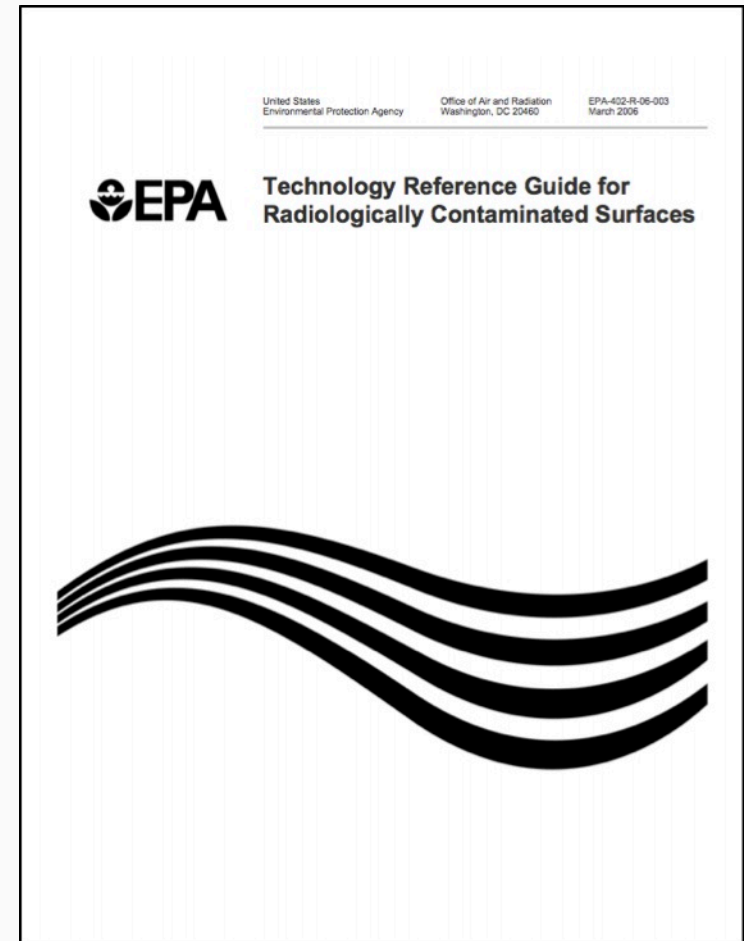


# EPA Surface Decon Reference



Each technology profile presents the relevant information under eight sections:

1. Description of Technology
2. Target Contaminants
3. Applicable Media and Surface Characteristics
4. Waste Streams and Waste Management Issues
5. Operating Characteristics
6. Performance
7. Capital and Operating Costs
8. Commercial Availability



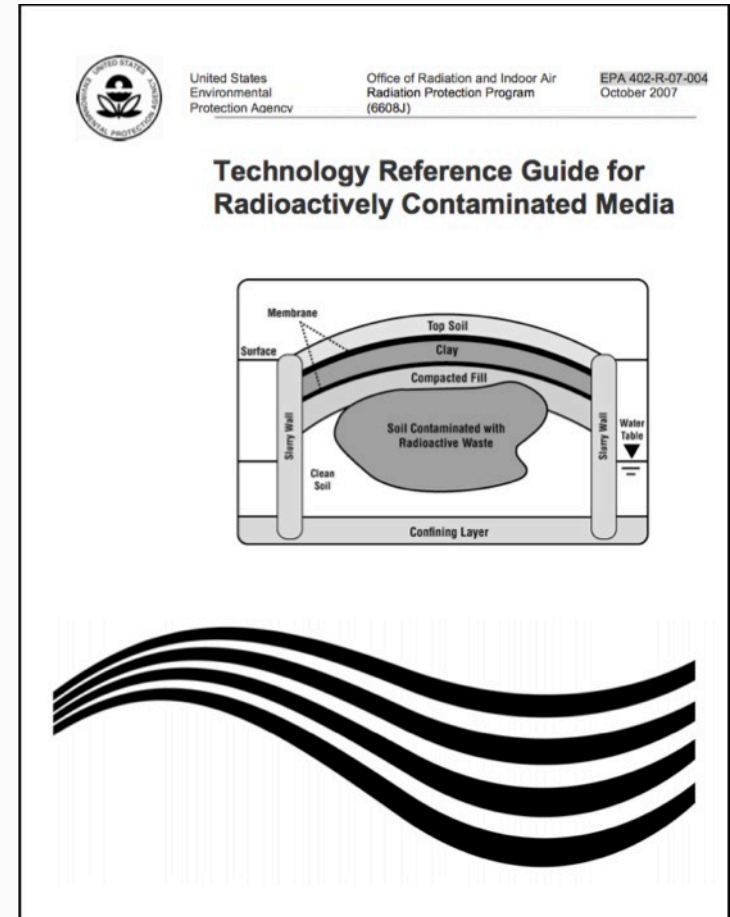
<http://www.epa.gov/radiation/docs/cleanup/402-r-06-003.pdf>

# EPA Contaminated Media Treatment Reference



13 technologies associated with **contaminated solid media** that are grouped into six categories:

1. containment,
2. solidification/stabilization,
3. chemical separation,
4. physical separation,
5. vitrification, and
6. biological treatment.



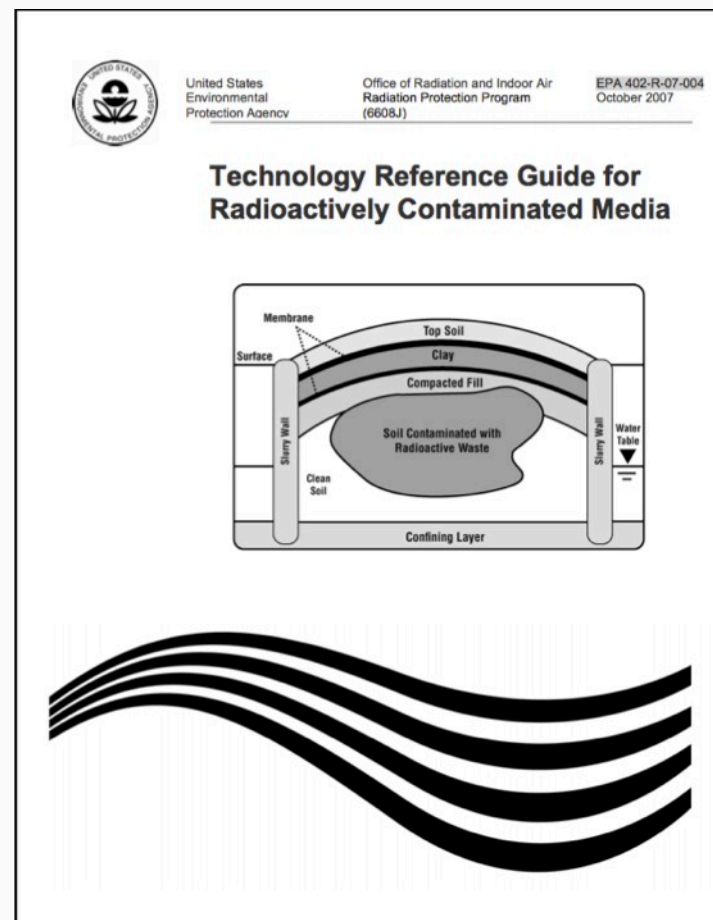
<http://www.epa.gov/radiation/docs/cleanup/media.pdf>

# EPA Contaminated Media Treatment Reference



Eight technologies associated with **contaminated liquid media** that are grouped into four categories:

1. chemical separation
2. physical separation
3. biological treatment
4. natural attenuation



<http://www.epa.gov/radiation/docs/cleanup/media.pdf>

# Sample Decon Matrix



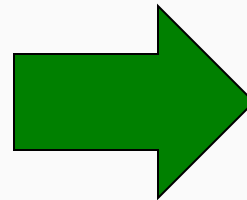
Conservative;  
\$\$\$\$\$

Cleanup Number

Centrifugal Shot Blasting Concrete Grinder/Shaving/Spalling	Physical Removal
Electro-hydraulic scabbling En-vac robotic wall scabbler	
Dry Ice Blasting	
Strippable Coatings Chemical Decon	
Soft Media Blast Cleaning Grit Blasting	Biological Treatment
Dry vacuum High Pressure water	Natural Attenuation

Practical; \$

Small areas  
Controlled access  
Individual Protection  
Site-specific Cleanup  
Return to Normal  
\$



Large wide-areas  
Free access  
Population Protection  
Iterative Cleanup  
Accept a "new normal"  
\$\$\$\$\$

# Waste Disposal Options



- Near-surface disposal:
  - Very low-level waste (VLLW)
  - Short-lived low and intermediate level waste (LILW-SL)
- Geologic (deep) disposal:
  - High-level waste (HLW)
  - Long-lived intermediate level waste (LILW-LL)
- Exempt materials with a low radionuclide content that can be recycled, reused or disposed of as non-radioactive waste.

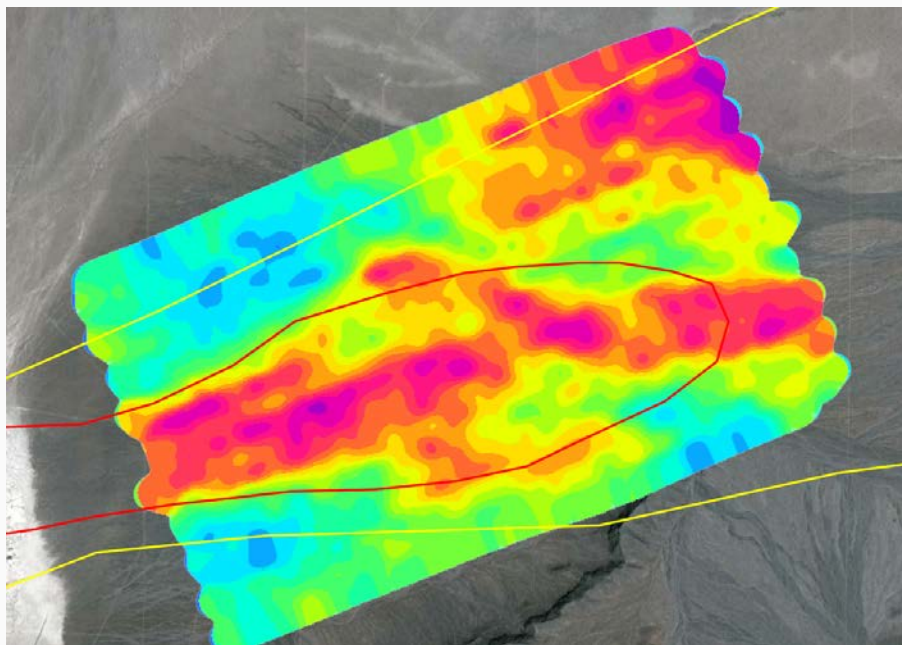




# Advanced Processing Algorithms (distributed contamination)



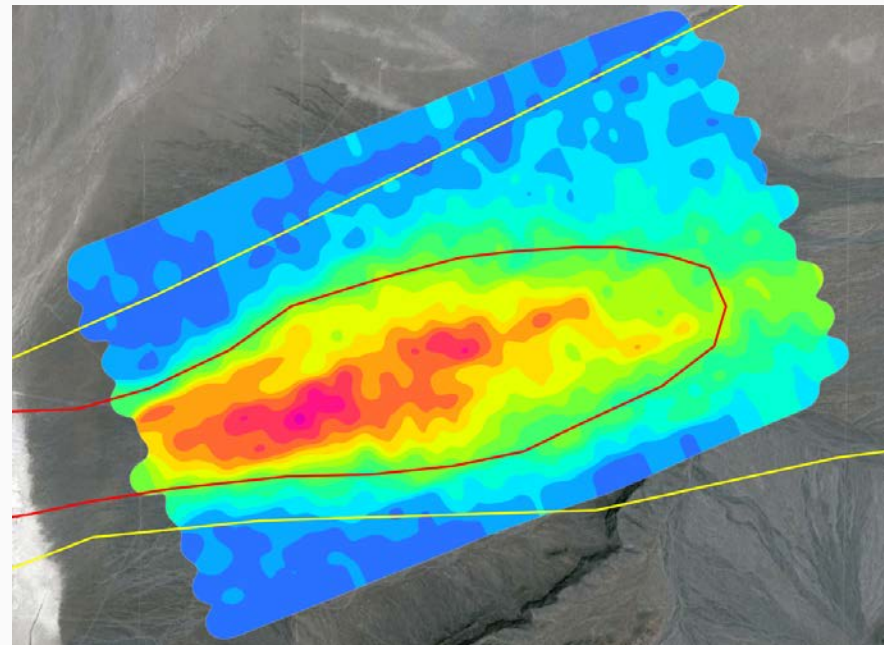
## Cs-137 ROI



Total counts in ROI for specific isotopes

Product produced **quickly**

## NASVD : Cs-137 contour



Noise Adjusted Singular Value Decomposition

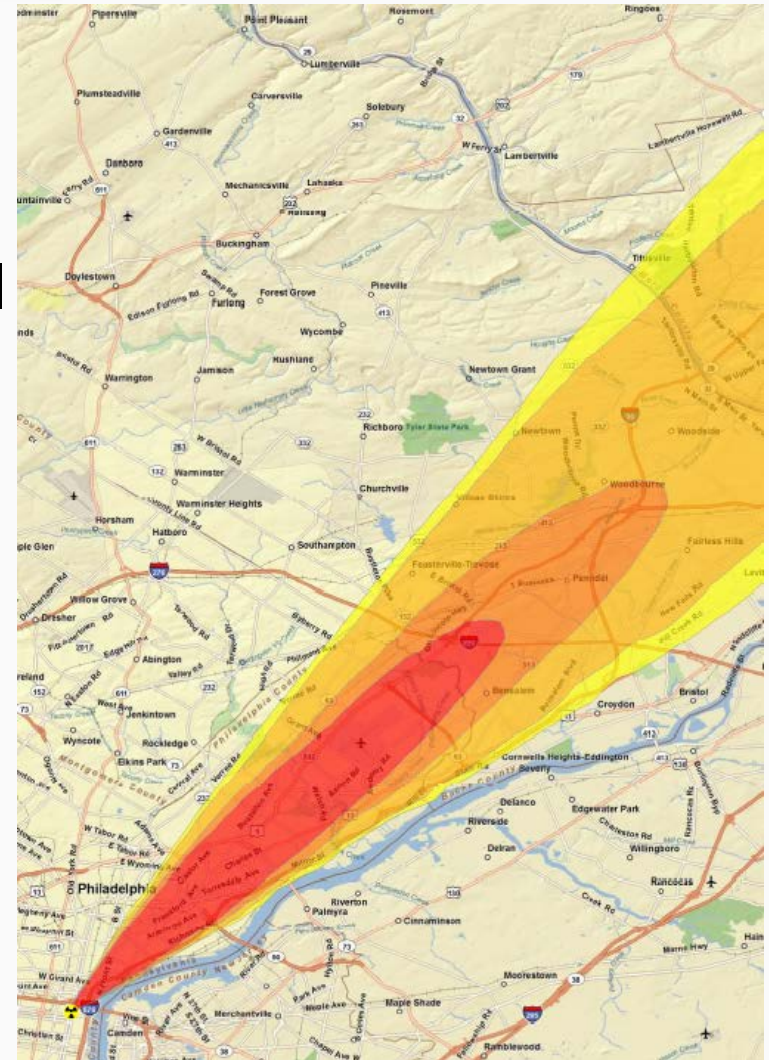
Post processing requires **subject matter expertise**

[www.epaosc.net/aspectgem](http://www.epaosc.net/aspectgem)

# Liberty RadEx Exercise



- April 2010
- Cs-137 Dispersal Device Attack
- 1<sup>st</sup> EPA - sponsored national level exercise
  - 1,000 participants
  - 35 Federal Agencies
  - 9 community groups
  - 14 business
  - 2 universities
  - 6 foreign countries
- 1<sup>st</sup> to focus on late-phase  
<http://www.epa.gov/libertyradex/>



# Disaster Risk Communication



*The public is the most important stakeholder in any public health emergency, because people must ultimately take care of themselves.*

# Disaster Risk Communication



- Risk perceptions
  - Risk perception theory  $\neq$  “facts speak for themselves”
  - Less acceptable if: *involuntary, inequitably distributed, poorly understood, danger to small children, man-made vs. natural*
- Trust determinant
  - Competence and expertise
  - Openness and honesty
  - Dedication and commitment
  - Caring and empathy
- Mental Noise
  - 80% reduction to process messages during severe stress



# Know Your Audience



- **Country and Culture - RISK**
  - Australia vs. China vs. Malaysia
- **Western culture expressed:**
  - higher level of confidence in technology
  - lower concern over their vulnerability to risk exposure
- **Eastern culture expressed:**
  - Higher levels of trust in mass media and non-governmental organizations as information providers.



# Know Your Audience



- Rejectors
- Disagree-ers
- Neutrals
- Agree-ers
- Advocates



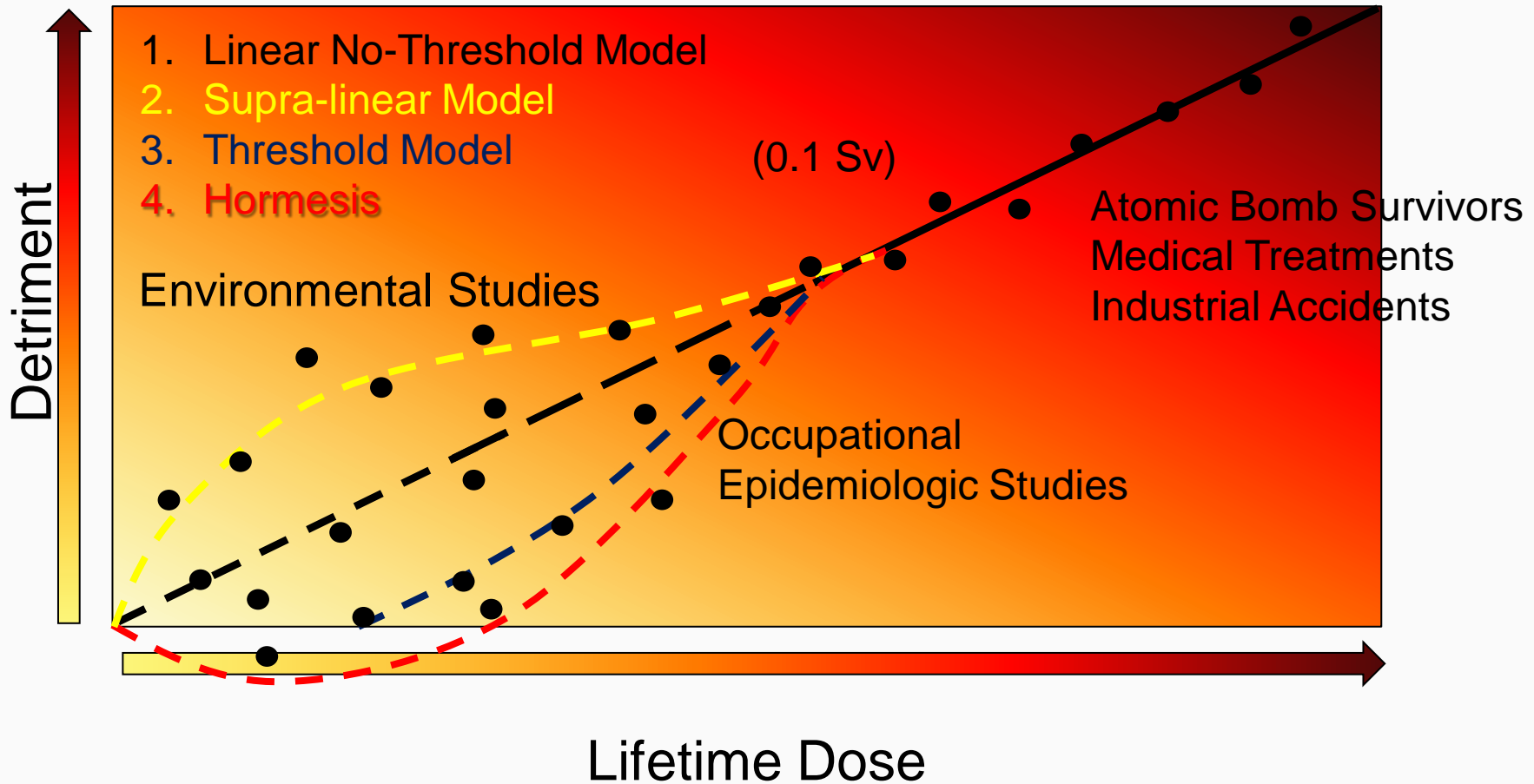
# Communication Strategies



- Cultural Drivers for Eastern Countries
  - Long-term orientation
  - Prioritize the collective benefits and responsibilities
  - Stress tolerance of uncertainties
- Message Development
  - Societal attitudes about man-made risks
  - Highlight benefits of technology
- Scientific valid and accurate
- Candidly acknowledge limitations of risk analysis mechanisms



# Radiation Risk Models





# Extreme Stress Impacts



- **Cognitive**
  - Confusion
  - Disorientation and hopelessness
  - Heightened anxiety, etc.
- **Physical**
  - Headaches
  - Nausea
  - Intestinal upset and fatigue
- **Behavioral**
  - Difficulty sleeping
  - Appetite changes
  - Substance abuse
- **Emotional**
  - Fear and shock
  - Irritability
  - Anger



Photo Source: [http://www.cnbc.com/id/42024887/Scenes\\_From\\_the\\_Japan\\_Earthquake\\_and\\_Tsunami?slide=1](http://www.cnbc.com/id/42024887/Scenes_From_the_Japan_Earthquake_and_Tsunami?slide=1)

# Communicating to individuals who experience extreme stress



- Communication success depends upon
  - A trusting relationship
  - The attitude and knowledge of the communicator
  - The clarity and salience of the message
- Tailor messages to specific groups
  - First responders
  - Health care workers
  - Victims
  - Families of victims
  - Parents
- Consider messages that
  - Create a feeling of competence (help people to help themselves)
  - Encourage people to create support systems to supplement formal and external assistance
- Channel negative responses into positive action



# Promoting TRUST



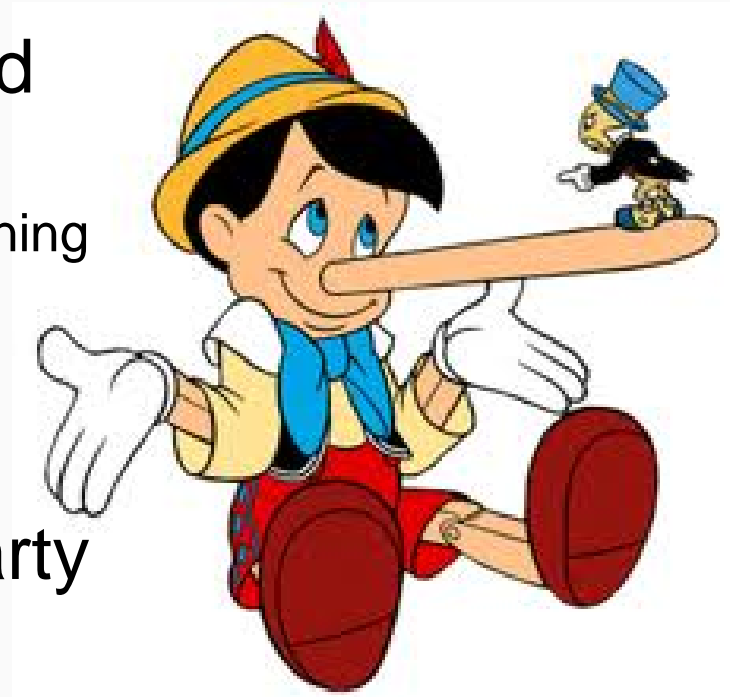
- “Say what you mean” and “mean what you say”
- Key messages should be timely, accurate, clear, concise, credible, and memorable.
- Clarity and brevity
  - Focus on three messages at a time
  - Use examples to illustrate and clarify your message.
- First and Last
  - Provide the most important items first and last



# Promoting TRUST



- “I Don’t Know” (IDK)
  - Honest response that can lead into information you can talk about
- Compassion, conviction, and optimism (CCO)
  - Display verbal and non-verbal listening skills
- One Negative equals three positives (1N-3P)
  - Endorse credible third party interaction



# Short videos on Chernobyl accident & EPA preparations



## Managing the Food Supply (50 second clip)



Larisa Leonova



Vira Yakusha

## 11 Short videos

1. Lesson Learned
2. Radiation and Radioactivity
3. Types of Radiation Incidents
4. The Initial Response
5. Learning from Chernobyl Recovery
6. Reducing Risks
7. Managing Food Supply
8. Coping with Health Concerns
9. Importance of Information
10. Being Prepared
11. Conclusion

<http://www.epa.gov/oem/content/community/multimedia.htm>

# Disaster Risk Communication Strategies Summary



- Knowledge
- Understanding
- Trust
- Cooperation
- Constructive dialogue
- Informed decisions
- Appropriate health behaviors

# Theory of “Recovery”



$$E = mc^5$$

E =

**efficiency**

m =

**massive amounts of**

c =

**coordination**

**communication**

**collaboration**

**cooperation**

**cash**

# Questions?

