5th Annual Meeting of SRRCE and International Symposium of Environment Radioactive Contamination

US EPA Views on Radioactive Decontamination, Waste Minimization technologies, and Radiation Risk Communication

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Topics to Cover

- EPA's Protective Action Guides for Late Phase
  - Case studies: exercises and real incidents
- Radiation Risk Communication
- Radioactive Low-Level Waste Minimization
  - Experiences from Radiation Dispersion Device exercises, international real incidents
  - Techniques
  - Tools to reduce volume
  - collaboration

EPA Radiation Cleanup Sites

- **Radiation sites in EPA's Southeast Region 4 [8 states]:**
  - ✓ U.S. Department of Energy Oak Ridge National Lab, Y-12 Nuclear Complex, East TN Technology Park, TN
  - ✓ U.S. DOE Savannah River Site, SC
  - ✓ U.S. DOE Paducah Gaseous Diffusion Plant, KY
  - ✓ Maxey Flats Disposal Site, KY
  - ✓ Phosphates sites, FL, MS, NC, SC

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Oak Ridge Longer-Term Strategic Plan

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East Tennessee Technology Park

- ✓ Complete demolition of the highest risk facilities -- Buildings K-25 and K-27
- ✓ Address remaining facilities after work starts at other Oak Ridge Reservation sites

Y-12 National Security Complex

- ✓ Finalize overall site cleanup strategy/plan
- ✓ Initiate characterization, treatability studies and building demolition preparation
- ✓ Begin decontamination and demolition after K-27 demolition is complete

Oak Ridge National Laboratory

- ✓ Complete U-233 disposition and Transuranic waste processing
- ✓ Initiate cleanup of remaining facilities after work is underway at Y-12

Oak Ridge Near-term Cleanup Goals

- Complete demolition of Buildings K-25 and K-27 at ETTP
  - ➢ Continue to identify ways to address mercury releases at the Y-12 site
- Remove half of the U-233 inventory at ORNL and prepare for processing remaining inventory
- Continue processing transuranic waste (debris) and prepare for sludge processing

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Oak Ridge enrichment K25 Bldg

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East Wing Separation Completed

- Completed separation of Tc^{99} units from portion of East Wing under demolition
  - Simultaneously preparing Tc^{99} units for demolition while demolishing rest of East Wing

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U.S. EPA Protective Action Guides

- A protective action guide (PAG) is the projected dose to an individual from a release of radioactive material at which a specific protective action to reduce or avoid that dose is recommended. A PAG is a guideline. Not a regulatory guidance [example NRC's NUREGs].
- The PAG is not intended to define 'safe' levels of exposure, but rather offers recommendations, for example, to lower or avoid a particular dose.

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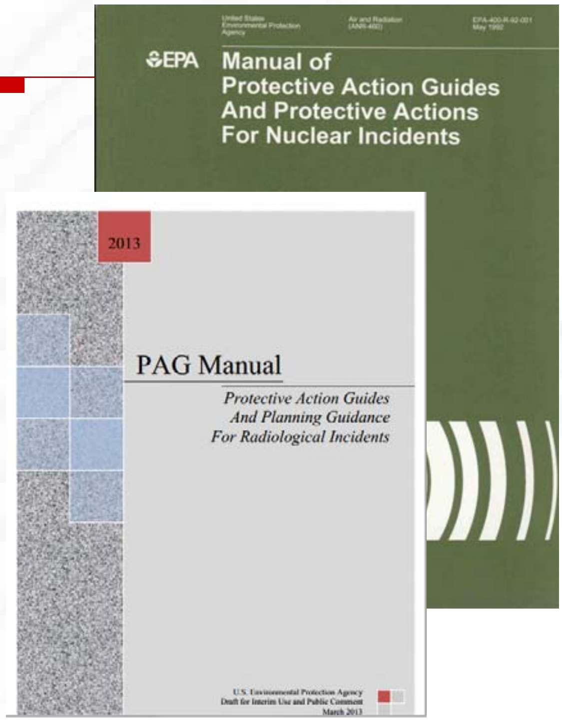
EPA PAG Manual

- 1992 PAG Manual is still good, still in use
- Early, Intermediate Phases only; promised Water and Late Phase (Recovery) PAGs
- 2013 revision issued for comment and interim use



EPA Guidance – PAG Manual

EPA responsible for issuing Protective Action Guides (PAG) Manual (44 CFR 351.22)

- ✓ Guidance on protective actions in emergencies
- ✓ Current document issued 1992
  - Focused on nuclear plant emergencies as most important
  - Addresses only early and intermediate phases
- ✓ Efforts to update have been controversial
  - Addressing late phase/recovery (e.g., cleanup)
  - Drinking water
- ✓ Planning guidance for cleanup and waste disposal
  - Proposes overall framework for decision-making
  - http://www.epa.gov/radiation/rert/pags.html for more information on 2013 proposal

Updated dosimetry

- Updating from ICRP 26 to ICRP 60 series
  - ✓ Age-specific dose conversions
- Setting PAGs levels

  versus
- Implementing PAG recommendations
  - ✓ Protective actions apply to whole communities
  - ✓ Conservatism built in
  - ✓ Don't avoid less dose than intended

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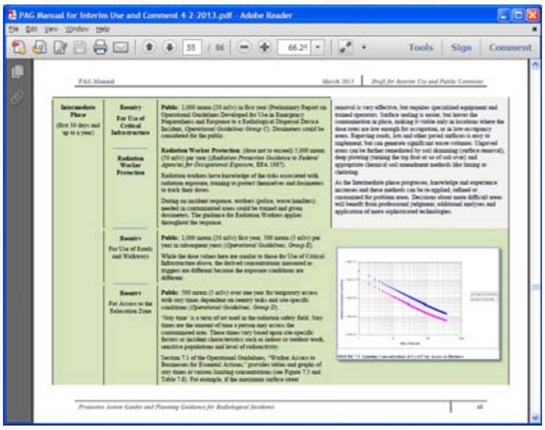
Re-entry Matrix

- New quick reference matrix
- Public, workers re-entering Relocation area to work during cleanup
- Basis: Relocation PAGs
- Assumptions: Detailed exposure scenarios in Operational Guidelines
- Do it yourself: RESRAD-RDD software



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Drinking Water

- National Primary Drinking Water Regulations emergency actions: Increased monitoring & notifications
- Comments requested on whether, and what value, an emergency PAG for water should be considered
- Referred to related guides from WHO, IAEA, DHS, FDA

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Late Phase: Cleanup Goal

- Customer expectation of cleanup goal = background?
- Prescriptive or flexible
- Time, costs, risks, benefits
- Varied legal authorities and funding sources
  - ✓ Depends on the material
  - ✓ Terrorism or not
  - ✓ More than one authority may apply cooperatively

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Late Phase Decision-Making Organizations

- Focus on process for reaching consensus:
  - ✓ Decision Team – might be requesting funding
    - Senior local, state and federal officials
  - ✓ Recovery Management Team
    - Senior leadership in the field recovery effort
  - ✓ Stakeholder Working Group
    - Community leaders, local businesses, nongovernmental representatives, members of the public
  - ✓ Technical Working Group
    - Select subject matter experts, communicators

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Playing it out: Liberty RadEx

- Used Cleanup Advisory Forum (CAF) process to prioritize post-emergency phase cleanup and develop long-term cleanup strategy
- Technical Advisory Panel (TAP)
- Community Advisory Panel (CAP)

Technical Advisory Panel meeting

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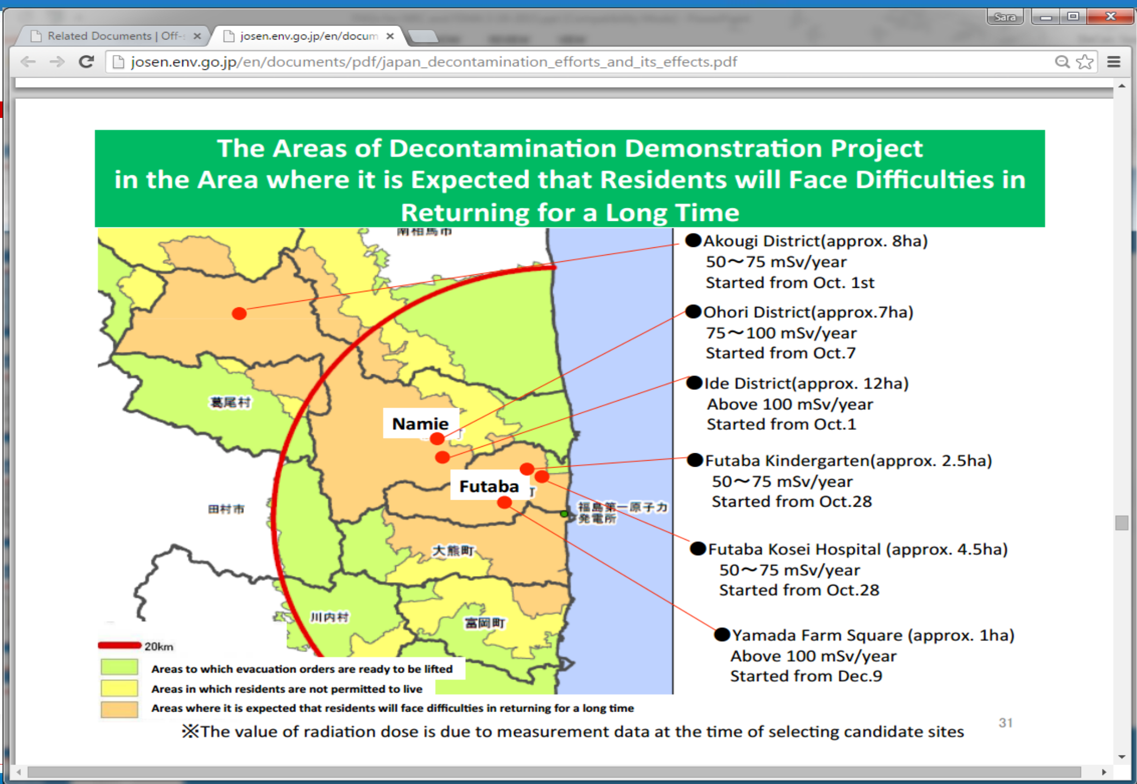
Late Phase: Waste Management

- Waste chapter focuses on options for disposal
  - ✓ Licensed LLRW disposal facilities
  - ✓ RCRA solid and hazardous waste landfills
  - ✓ Federal facilities/sites
  - ✓ Newly developed disposal capacity
  - ✓ Appropriate for level of hazard
- States bear primary responsibility
  - ✓ Waste volumes will drive decision-making
    - Could overwhelm existing disposal capacity (see Japan)
    - Need to be considered in early planning

Real world example: Japan

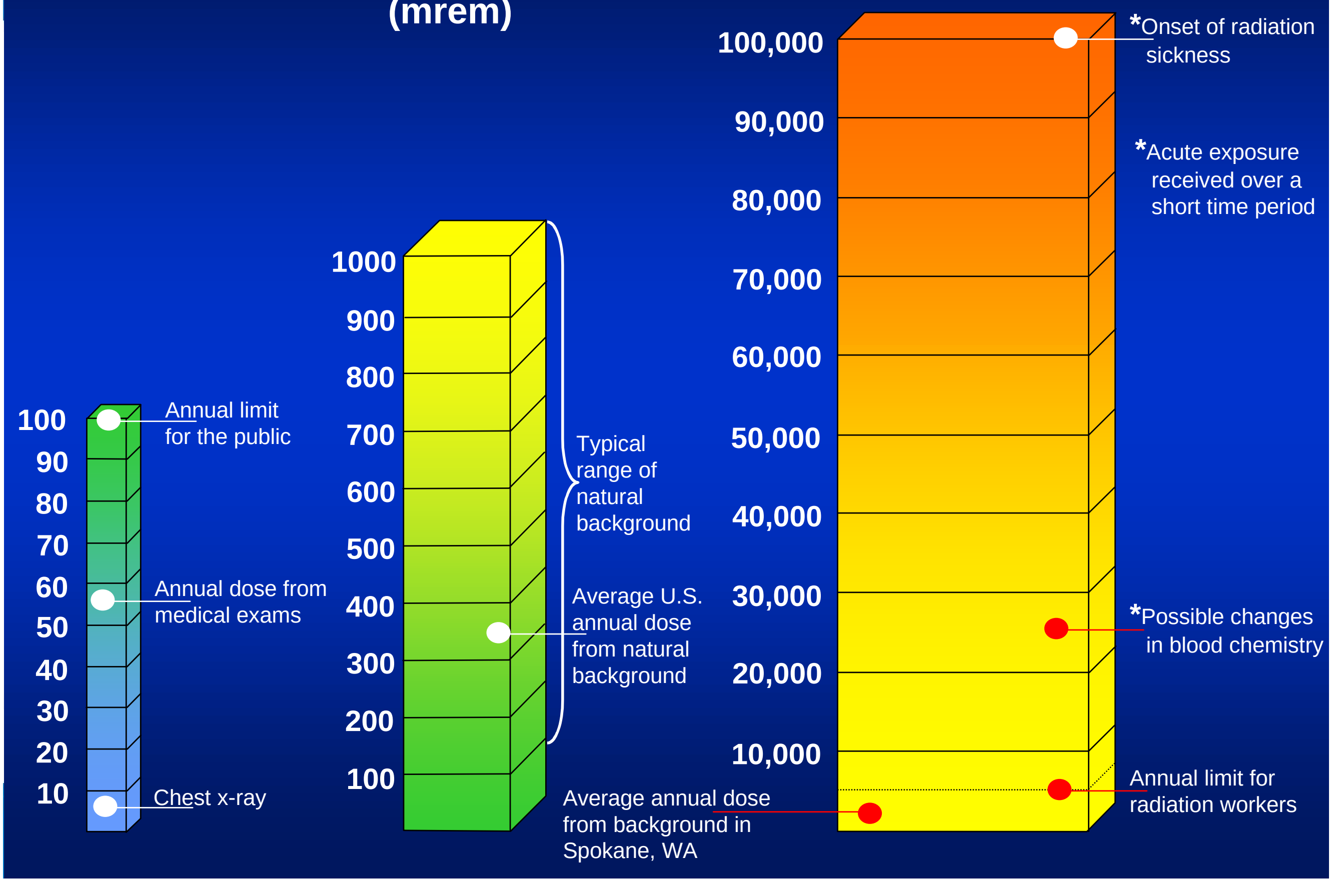


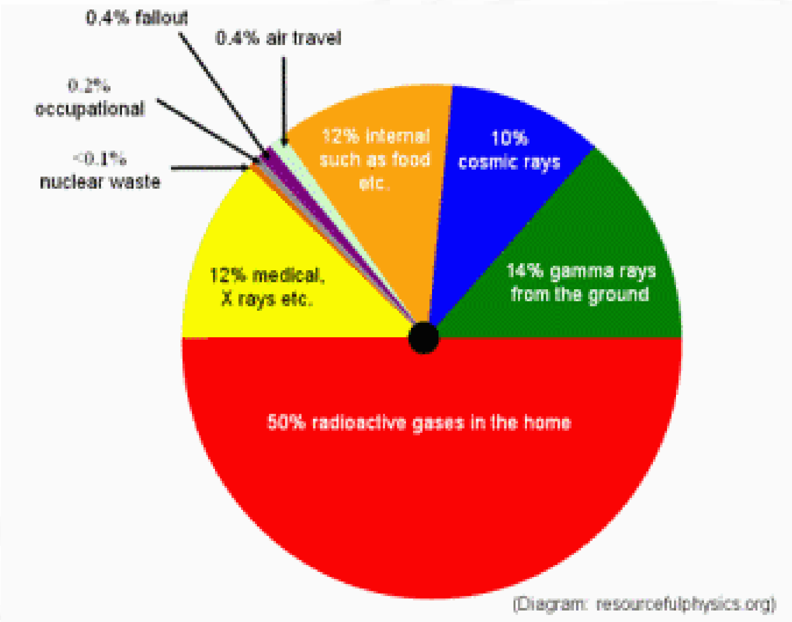
Distribution of Cs-137 in Japan

- Becquerels per kg with color coded map:
  - ✓ 25,000 – 50,000 - red
  - ✓ 5,000 – 25,000 - orange
  - ✓ 1,000 – 5,000 - yellow
  - ✓ 500 – 1,000 - gray
  - ✓ 100- 500 - green
  - ✓ 25-100 - blue
  - ✓ 5-25 - purple
- “Safe limit”=5000, Japanese Food Sanitation;
- 25-50 Bq/kg = global fallout background level, i.e. most of blue & all purple areas are bkgd
- map of ‘contamination’ by Prof. Yasunari of Columbia

Radiation Doses in Perspective

(mrem)





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The Game Changer – A Wide Area Contamination Incident

- Potentially impacts many different areas
  - ✓ Critical infrastructure (including water systems, roads, subways/trains)
  - ✓ Outside of buildings (including sky scrapers)
  - ✓ Indoor areas
- Activities are connected – may cause unintended consequences:
  - ✓ Hazard mitigation/containment
  - ✓ Characterization
  - ✓ Decontamination
  - ✓ Post-decontamination efficacy assessment
  - ✓ Waste management
- We aim to provide data and tools to decision makers, to assist in incorporating systems thinking into environmental response!!

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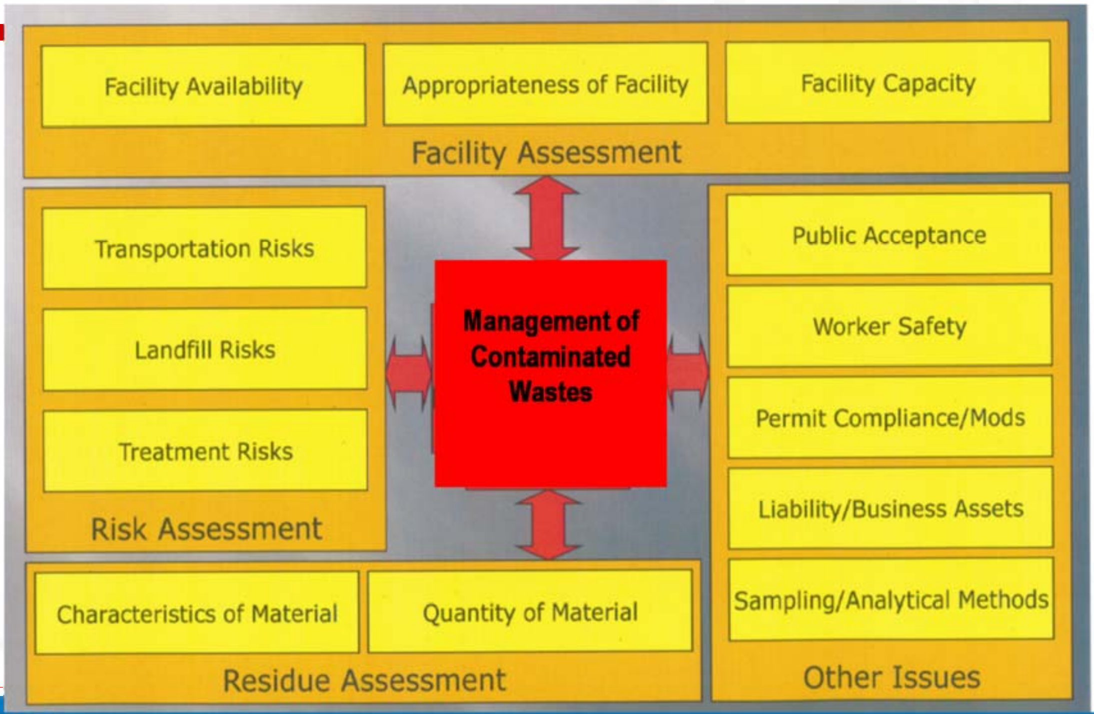
Waste Management Considerations



Waste Management Hierarchy

RDD Waste Management Challenges

Wide-scale radiological incidents present significant and unique circumstances for waste management

- Significant waste volumes
- Time and public pressures for action (days vs. years)
- Logistical and resource limitations (e.g., sampling)
- Coordination of multiple agencies/activities

EPA is the lead Federal agency for long-term recovery and cleanup under National Response Framework (Emergency Support Function #10)

- Events as disparate as 9/11, anthrax, Katrina, BP spill
- What can be done to prepare for waste management?

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Liberty RadEx Scenario

DHS National Planning Scenario 11

- ✓ Center City Philadelphia – Federal Building
- ✓ 1360 kg ammonium nitrate mixed with diesel fuel and 85000 GBq of cesium-137
- ✓ Winds carry radiation contamination NNE through Philadelphia
- ✓ Deposition nearly 50 miles out and into north central New Jersey

Exercise began 30-45 days after blast

- ✓ Already excavating/demolishing 100s tons/day
- ✓ How will cleanup decisions affect waste volumes?

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Liberty RadEx Deposition Zones

Medium Gray Zone	> 100 uCi/m^2
Dark Gray Zone	> 1000 uCi/m^2
Total Affected Area	~ 1 square mile

Estimated Waste Generation 500,000 tons

- 25,000 trucks
- Assumes 10% of buildings, all roofs, 6" soil, 1" pavement, all floors removed/demolished
- Does not address water, trees, blast zone debris

Relocation Zone: Cleanup or Abandon

Based upon Protective Action Guides (PAGs)

- ✓ Zone 2 – First year relocation at .02 Sv (Federal)
- ✓ Zone 3 – Second year relocation at 5 mSv (State)

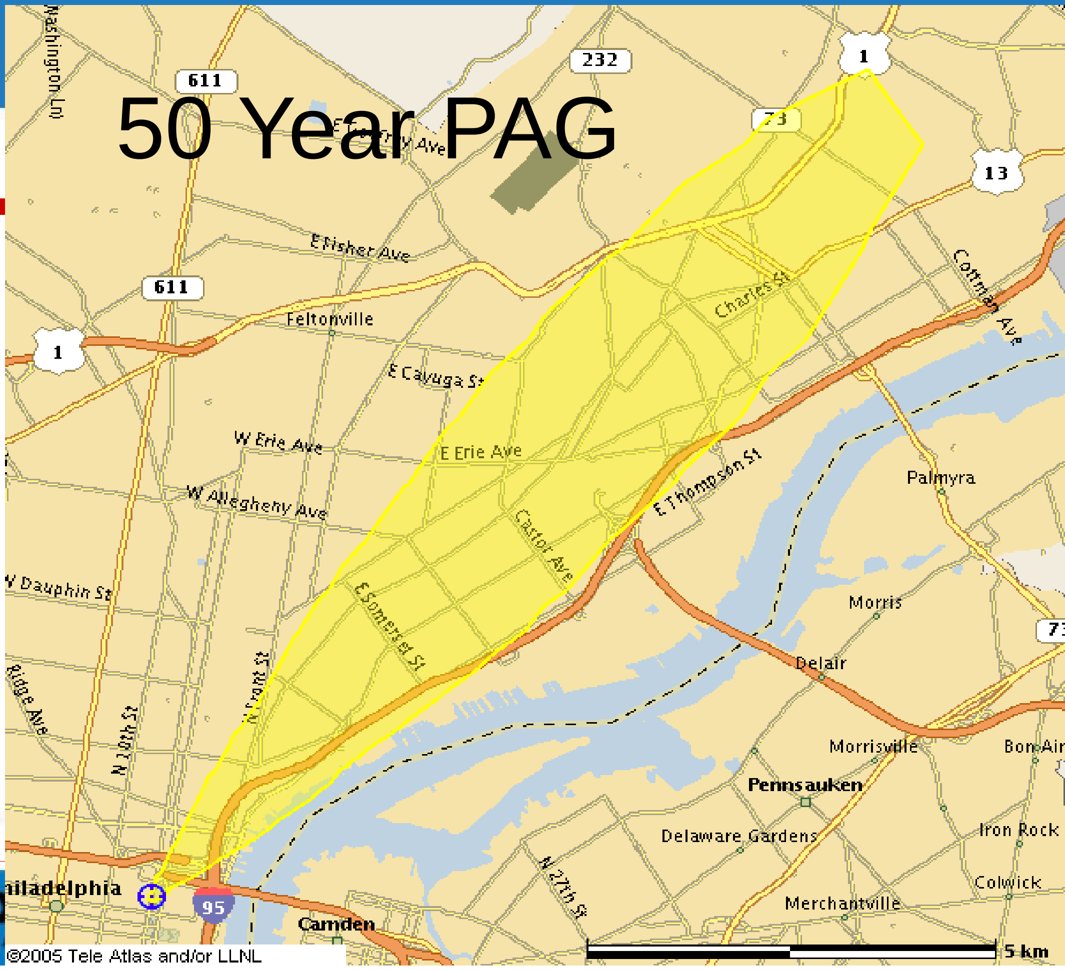
Impacted population ~ 61,000

Affected area 5.5 miles long x 1 mile wide (300-600 city blocks)

~1,400,000 tons of waste (70,000 trucks)

- ✓ ~11 billion gallons of liquid waste

50 Year PAG



50-Year PAG Zone

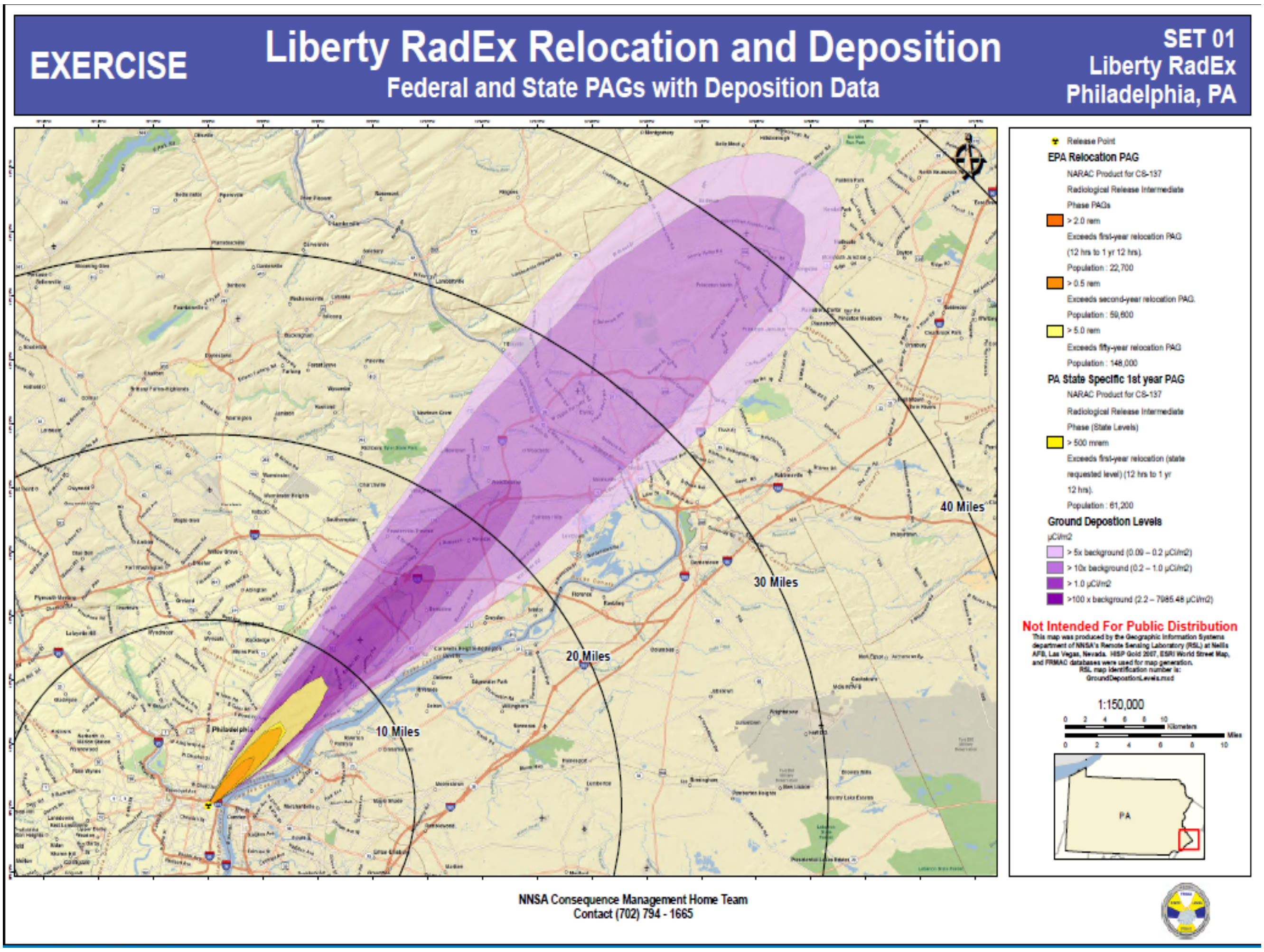
Based on projected 0.05 Sv over 50 years

Impacted population ~ 148,000

Affected area ~ 9 miles long x ~ 2 miles wide

Likely *minimum* cleanup zone

~4,000,000 tons of waste (200,000 trucks)



Additional Cleanup Zone?

For an area at ~5 times background radiation, cleanup to typical Superfund standards results in

- ✓ Impacted population ~ 1,000,000
- ✓ Affected area ~ 50 miles long x ~ 10 miles wide
  - ~ 300 square miles total
- ✓ ~ 40,000,000 tons of waste
  - 2,000,000 tri-axle dump trucks
  - Assuming 1 cubic yard ~ 1 ton, estimated volume is in excess of 1 billion cubic feet

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Operational Protection for the Public

While all this is going on, how is the public protected?

- ✓ Inside the "PAG zone", exposures are likely to be driven by other considerations, e.g.,
  - Stay times calculated using operational guidelines
- ✓ Other guidelines can be used for unrestricted areas, e.g.,
  - NRC limits in 20 CFR 20.1301/1302 for external exposure
    - No more than 20 uSv/hr
    - Demonstrate no more than 500 uSv/yr continuous exposure
- ✓ Consider the need for respiratory protection
- ✓ DOT requirements for packaging and placarding
  - Limits on consignment, concentration, radiation field
- ✓ Unlicensed disposal typically a few uSv/yr at most
  - Workers may need to be considered as members of the public

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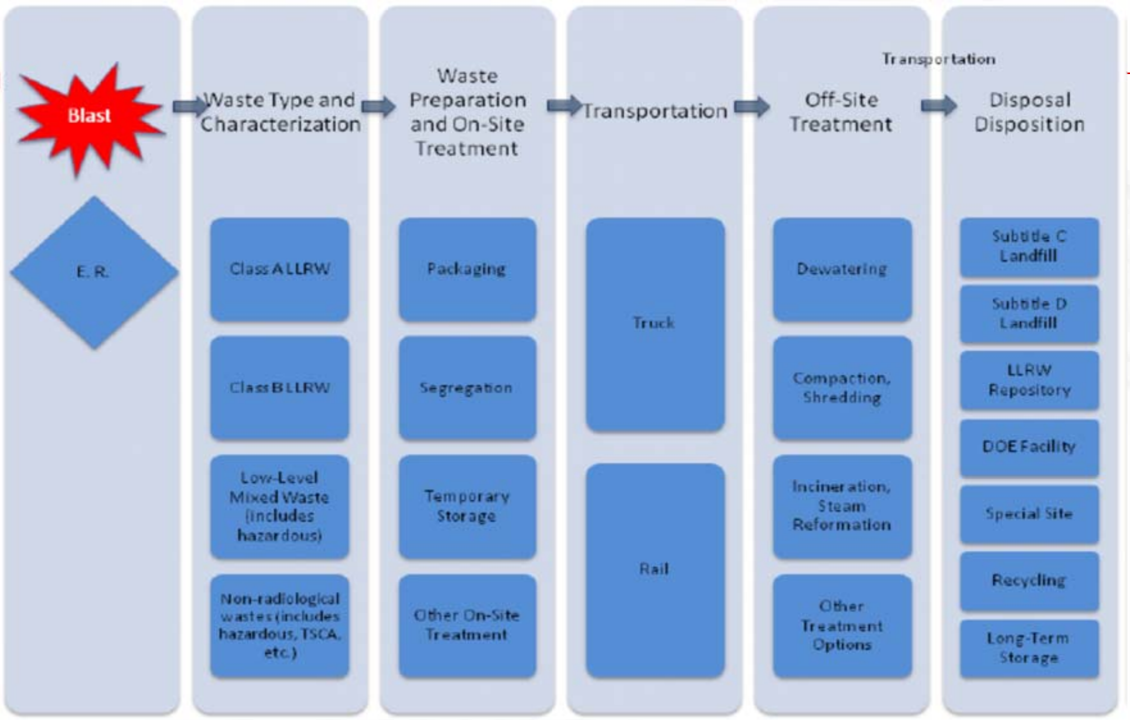
National RDD Waste Management Process



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RDD Workshop Results – Private Sector

Key issues raised:

- ✓ Adequacy of contracting mechanisms and other agreements, e.g., to address liability/indemnification
- ✓ Management of "low-activity" waste, e.g., decision-making, disposal options, laboratory capacity
- ✓ Communication with the public

➢ Priorities identified for EPA:

- ✓ Estimating removal and handling rates
- ✓ Defining exemption or *de minimis* levels
- ✓ Strategizing local vs. out-of-state disposal
- ✓ Establish criteria for characterization and disposal

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RDD Workshop Results – State/Local Sector

Key issues raised:

- ✓ Communication with public and media to ensure credibility, transparency, and technical clarity
- ✓ "Shared sacrifice" making use of all disposal options
- ✓ Impacts on municipal facilities of remediation and decontamination, as well as routine waste generation

➢ Priorities identified for EPA:

- ✓ Develop plans for mass communication
- ✓ Engage with Compacts/States on disposal options
- ✓ Define criteria for emergency measures (e.g., waiver)
- ✓ Planning for decontamination, treatment, and staging

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RDD Workshop Results – Federal Sector

Key issues raised:

- ✓ Translation of EPA's overall ESF-10 responsibilities to waste management (e.g., waste "ownership")
- ✓ Need for overall recovery framework that includes a national waste management strategy
- ✓ Decision criteria for decontamination or demolition

➢ Priorities identified for EPA:

- ✓ Define criteria for alternative disposal options and form working group to develop national strategy
- ✓ Define conditions for access to DOE disposal sites
- ✓ Develop long-term research/exercise program

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RDD Workshop: Conclusions and Summary

Limited sample of three stakeholder groups emphasized different priority areas

- ✓ Suggests that all stakeholder segments need representation to ensure range of priorities is understood and considered in planning process

Transparency, credibility in planning and public communication stressed by all groups:

- ✓ How best to involve the general public?
- ✓ Who speaks for the general public?
- ✓ Liberty RadEx example Community Advisory Panel?

EPA continuing to evaluate workshop results

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Radiation Dispersal Device Waste Management Challenges

Waste Management Phases

Case Studies

- ✓ Fukushima
- ✓ Chernobyl
- ✓ Goiania

Estimating Waste Volumes – NYC Scenario

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RDD Waste Management Challenges

Wide-scale radiological incidents present significant and unique circumstances for waste management

- Significant waste volumes
- Time and public pressures for action (days vs. years)
- Logistical and resource limitations (e.g., sampling)
- Coordination of multiple agencies/activities

EPA is the lead Federal agency for long-term recovery and cleanup (Emergency Support Function #10)

- How will we address events of this nature?
- Agency is studying disposal issues for chem, bio, rad

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U.S. Policy Framework for Incidents

The National Response Framework (NRF) describes the responsibilities for chemical, biological, radiological, and nuclear (CBRN) incidents

- ✓ Nuclear/Radiological Incident Annex assigns lead roles:
  - NRC for release from licensed materials or facilities
  - DOE/DOD for DOE/DOD facilities or nuclear weapons
  - DHS for deliberate attacks involving nuclear facilities/materials
  - EPA for incidents of foreign origin

EPA is the coordinating agency for oil and hazardous materials response (i.e., long-term cleanup) under NRF Emergency Support Function #10

- Events as disparate as 9/11, anthrax, Katrina, BP spill

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What's Involved in Managing Debris/Waste?

Multiple steps need to be integrated:

- Initial debris management
- Waste staging
- Waste characterization
- Waste segregation
- Waste treatment
- Waste disposal

Waste volumes will drive decision-making

- Could overwhelm existing capacity [e.g. Katrina, Fukushima]
- Need to be considered in early planning

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Initial Debris Management

Debris management is an immediate step taken to facilitate emergency response

- ✓ Clearing transportation routes
- ✓ Allowing access for life-saving measures
- ✓ Allowing access to restore critical infrastructure

Part of overall waste management strategy

- ✓ Limit number of movements (facilitate staging)
- ✓ Avoid cross-contamination (some characterization)
- ✓ RDD debris most likely in limited area (blast zone)
- ✓ Fukushima debris primarily from tsunami, not NPP

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Staging of Waste

Staging areas allow for more methodical management of waste, perhaps for extended times

- ✓ Could be inside or outside affected area
- ✓ Ideally large areas strategically located
- ✓ Paved or lined sites that can be controlled
- ✓ Access to transportation routes (road, water, rail)
- ✓ Examples include
  - Rail yards
  - Industrial parks
  - Military installations
  - Warehouses/hangars
- ✓ Citizens Advisory Panel effective at Liberty RadEx

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Characterization of Waste

Disposition of waste depends on what it is, so need to characterize both for waste form and hazard

- ✓ Waste form:
  - Asphalt/concrete
  - Building materials
  - Organic material (soil, shrubs, trees)
  - Automobiles can be problematic
- ✓ Hazard:
  - Radiological/hazardous materials
  - More flexibility for slightly contaminated waste

Characterization in both field and staging areas

- ✓ Field surveys using meters, wipe samples
- ✓ More extensive characterization w/ lab sampling

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Segregation of Waste

Consider ahead of time how to avoid mixing things that are different in either waste form or hazard

- ✓ Leads to most restrictive management path
- ✓ Smaller cleanups may effectively treat everything as radioactive waste for efficiency
  - RDD waste volumes make this a problematic approach
- ✓ Preliminary waste management plan can help scope
  - What types of waste might be generated
  - Whether they contain hazardous materials
  - What radiation levels might be used to separate them
  - Where to locate staging areas
  - How to process the waste
- ✓ EPA Standard Operating Guideline on segregation and minimization technologies available soon

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Treatment of Radioactive Waste

Some types of treatment can be done at staging areas, particularly volume reduction

- ✓ Grinding
- ✓ Shredding
- ✓ Soil washing
- ✓ Ion exchange/reverse osmosis (decon liquids)

Treatment vendors may be able to provide other services, including packaging

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Decon Techniques & Effectiveness example

- For Cesium removal: Very Effective technologies
  - Grinding – ICS diamond
  - vacuuming - Rivertech
  - strippable coating – Isotron [Orion]
  - Chemical Gel – Argonne SuperGel
  - Chemical – Environmental Alternatives Inc

EPA

Disposal of Mixed Waste

Waste will range from radiologically uncontaminated to highly contaminated, so be aware of all options

- ✓ Solid waste landfills
- ✓ Hazardous waste landfills
- ✓ Licensed low-level radioactive waste facilities
- ✓ Waste characterization will need to be thorough

State and local officials have to consider

- ✓ Local disposal – under what conditions? How much?
- ✓ Constructing new disposal capacity
  - EPA workshop report at http://www.epa.gov/nhsrc/pubs.html
- ✓ Other states may object to accepting the entire burden

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Case Studies: Estimated Fukushima Waste from Decontamination

Low case:

- ✓ ~15 million m^3 in Fukushima Prefecture
- ✓ ~1.4 million m^3 outside

High case:

- ✓ ~30 million m^3 in Fukushima Prefecture
- ✓ ~13 million m^3 outside

Waste from decontamination includes combustible and non-combustible waste

- ✓ Soil, trees, shrubs, grass, leaves

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Management of Fukushima Decontamination Waste

Temporary storage (~3-5 years)

- ✓ At or very close to the point of generation
- ✓ Responsibility of prefecture government
- ✓ 372 sites identified in Fukushima Prefecture so far
  - Could be as many as 600-700 total

Interim storage facility (~30 years)

- ✓ Smaller number of consolidated locations (~3-8)
- ✓ Fukushima Prefecture only

Final disposal facility

- ✓ To be located outside Fukushima Prefecture

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Landfill Disposal of Incinerator Ash

	8,000 Bq/kg or under		8,000～100,000 Bq/kg	Exceeding 100,000 Bq/kg
	Other (Criteria of Waste Management Act)	Specified Domestic Waste & Specified Industrial Waste※2		
Structure of landfill site	Controlled type landfill site※1(Landfill site equipped seepage control work and drainage treatment)			Isolated type landfill site (Landfill site equipped outer intercept)
Preventive measures against leaching of radioactive material	None	*Installing the soil layer *Prevention of rainwater penetration into fly ash	*Cement solidification *Installing the soil layer *Establishing the impermeable soil layer	None (No Leaching of Radioactive Material due to Water Blocking)
Monitoring of radioactive material	None	*Discharged water *Groundwater *Air dose rate in the vicinity		*(Non-existence of discharged water) *Groundwater *Air dose rate in the vicinity

Source: Ministry of Environment

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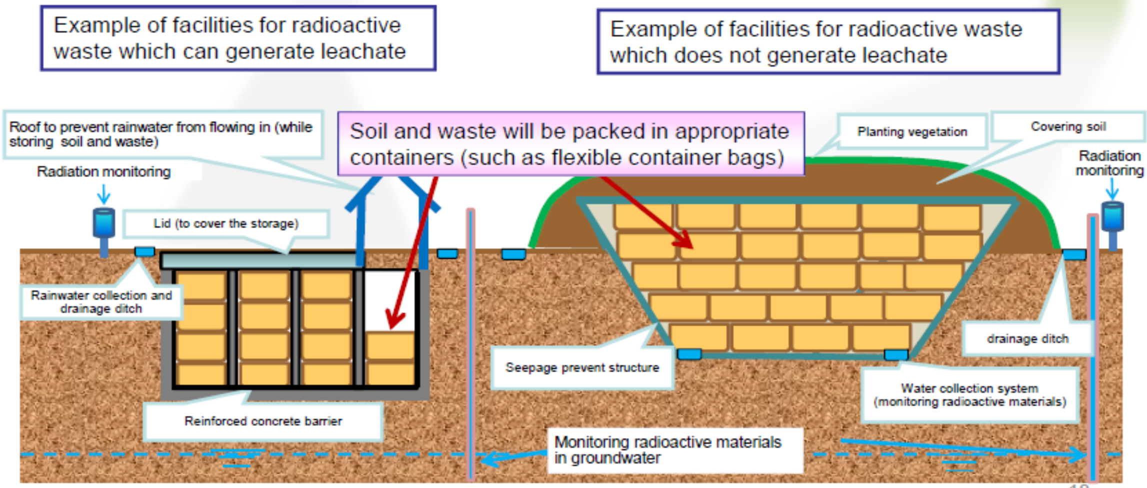
*[1] Isolated type of landfill site is possible to be used.

*[2] Generated from areas with possible accident-origin rad materials ~ 8,000 Bq/kg .

Interim Storage Facility – Concept

- Several types of Storage Facilities may be installed according to the characteristics of stored soil and waste.
  - Level of contamination
  - Leachate traits under various environmental scenario.



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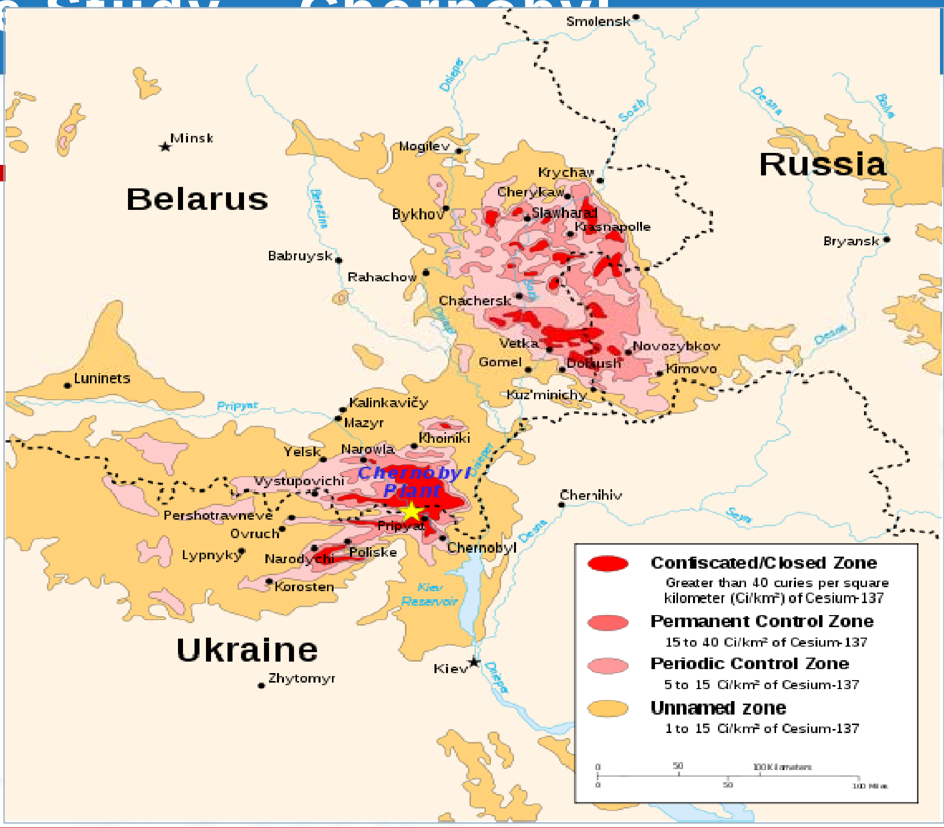
Case Study – Chernobyl



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Extent of Chernobyl Contamination

Exclusion zone:

- ✓ 2040 km^2 in Ukraine
- ✓ 2100 km^2 in Belarus
- ✓ 170 km^2 in Russia
- ✓ ~4300 km^2 total

Contaminated area (>1 Ci/km^2 of Cs-137) totals ~140,000 km^2

Significant areas taken out of production

- ✓ ~8,000 km^2 agricultural land
- ✓ ~7,000 km^2 timber land

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Decontamination and Waste Management

Limited effort to decontaminate except to support reactor decommissioning (even where populated)

- ✓ Several million m^3 of waste from rubble, debris, soil
- ✓ Trees bulldozed and buried
- ✓ ~800 burial areas in Ukraine exclusion zone, largely without characterization or segregation
  - "These facilities were established without proper design documentation and engineered barriers and do not meet contemporary waste disposal safety requirements"
    -- Chernobyl Forum
  - *Vector* site to provide upgraded treatment, sorting, packaging, disposal for long- and short-lived waste
- ✓ Belarus reviewing disposal areas for potential upgrade

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Additional Challenges

Initially

- ✓ Lack of information
- ✓ Lack of detailed planning
- ✓ Lack of technical equipment
- ✓ Lack of engineered storages
- ✓ Lack of experience

Ongoing

- ✓ Lack of funding
  - Exacerbated by collapse of Soviet system
- ✓ No demand for remediation
- ✓ Necessity for reburial of waste

New York City Scenario

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What About Waste Volumes?

EPA has developed a tool to provide first-order estimates of waste from radiological incidents

- ✓ Combines GIS, satellite imagery, FEMA database
- ✓ Estimates would be refined as data comes in
- ✓ Volumes highly assumption dependent, e.g.,
  - Cleanup levels
    - Most activity is in the area nearer the event
    - Most volume from farther out, less contaminated areas
  - Decontamination strategies/methods
    - Decontamination vs. demolition
    - Washing, strippable coatings, surface removal, etc.
    - Water volumes may be on order of annual demand

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Defining the Situation

Characteristics of contaminated area

- ✓ Zones of contamination (e.g., μCi/m^2)
- ✓ Building stock and critical infrastructure, e.g.,
  - Hospitals
  - Police stations
  - Fire stations
  - Educational facilities
- ✓ Surface area between buildings

Media Type	Zone 1	Zone 2	Zone 3
Streets – Asphalt	65%	48%	42%
Streets/Sidewalks – Concrete	9%	12%	4%
Soil/Vegetation	25%	24%	34%
Water	1%	16%	20%

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Planning & Defining the Strategy

Decisions to demolish or decontaminate buildings will be significant in generating waste, e.g.,

- ✓ Zone 1: 90% demolition, 10% decontamination
- ✓ Zone 2: 30% demolition, 70% decontamination
- ✓ Zone 3: 90% decontamination (10% no action)

Decontamination can be specified for building components (walls, roofs) and ground surface

- ✓ Washing (volume can be adjusted)
- ✓ Physical removal (excavation depth can be adjusted)
- ✓ Strippable coatings
- ✓ User can define others and effectiveness factors

Results from the NYC RDD example

Total solid waste estimate ~1.8 million metric tons

- ✓ Volume on the order of 100 million cubic feet
  - ~1/8 of NYC annual solid waste generation
- ✓ Soil is predominant waste form
- ✓ Zone 3 generates largest volume
  - Largest area, lowest contamination (10 µCi/m^2)

Aqueous waste estimate ~700 million gallons

- ✓ Order of magnitude comparable to one day NYC use
- ✓ Water usage for decontamination can be varied
- ✓ Dust suppression usage can also be significant

Managing Large Volumes of Waste

- Previous Experience with Large Volumes
- U.S. Policy Framework for Incidents
- Planning
- Decision Support Tools
- Technical Documents
- Guidance

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Decision Support Tools - Planning

- State and local officials will be primarily responsible for making decisions related to local disposal
  - ✓ Some states will be more prepared than others
  - ✓ Planning ahead will help frame decision needs
- EPA has begun developing a support tool
  - ✓ Intended to be web-based and interactive
  - ✓ Seeking feedback from states on concept to address
    - Waste types and quantities
    - Sampling and analysis
    - Waste management strategies/options, facilities, tracking
    - Transportation
    - Community outreach

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Planning – Previous Experience

What can be learned from non-radiological events?

- ✓ World Trade Center (2001)
  - ~2.16 million cubic meters of debris in small urban footprint
  - Careful sorting for human remains, personal effects, evidence
  - Local disposal in re-opened landfill across river
- ✓ Anthrax (2001)
  - Postal facilities and office buildings
  - Small waste volume, problematic disposal
- ✓ Hurricane Katrina (2005)
  - ~88 million cubic meters of debris over ~230,000 square km
  - ~36 million pounds of rotten meat and other food
  - 350,000 automobiles and 60,000 vessels
  - Opposition to local disposal from overburdened communities

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Putting It Into Perspective

Additional considerations for planners

- ✓ Decontaminating very tall buildings
- ✓ Wash water – capture or release?
- ✓ Size of source term and contaminated area

A significant incident is likely to result in waste volumes exceeding current disposal capacity

- ✓ Can new CBR[chem,bio,rad] capacity be developed quickly?

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Technical Documents – CBR Disposal

EPA workshop convened experts to consider CBR technical issues to support policy decisions, e.g.,

- ✓ Siting criteria
- ✓ Design/construction criteria and schedules
- ✓ Landfill gas/leachate control
- ✓ Persistence of CB agents in landfill
- ✓ Long-term monitoring and post-closure care
- ✓ Transportation infrastructure
- ✓ Report at http://www.epa.gov/nhsrc/pubs.html (2012)

EPA

Technical Documents – Field Technologies

EPA received funding to develop a standard operating guideline for application of decontamination/cleanup technologies in the field

- ✓ Subject matter expert workshop to evaluate and assign qualitative rankings of selected attributes
  - Availability
  - Time to implement
  - Cost
  - Safety, health, and environment
- ✓ Demonstration of selected technologies at project close-out event
- ✓ Report at http://www.epa.gov/nhsrc/pubs.html (2013)

EPA

Technical Documents – Low-Activity Waste

EPA has considered the potential use of hazardous waste landfills for disposal of "low-activity" waste

- ✓ Modeling effort over past several years
  - Scenarios include workers, intruders, long-term performance
- ✓ Technical reports undergoing peer review
- ✓ Provides a technical basis for determining protectiveness
  - Criteria for characterization and disposal over range of options
- ✓ Local disposal likely to be controversial
  - State and local officials must have confidence that the proposed action will protect public health
  - Likely to raise equity issues (undue burden)
  - Technical basis for decisions must be transparent and allow examination by stakeholders

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EPA Guidance – Contaminated Water

In 2012, EPA issued "Containment and Disposal of Large Amounts of Contaminated Water"

- ✓ Support guide for water utilities
- ✓ Chemical, biological, toxic, radioactive contaminants
- ✓ Five disposal methods discussed
  - Direct discharge to surface water
  - Disposal through wastewater treatment plant
  - Transfer to hazardous or medical/infectious waste facility
  - Disposal in underground injection well
  - Volume reduction and solidification

http://water.epa.gov/infrastructure/watersecurity/emerplan/upload/epa817b12002.pdf to obtain document

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Summary

- Existing technologies and methodologies
  - ✓ Potential to enhance cleanup
  - ✓ Reduce waste and/or waste management costs
- Technical Operational Guidance
  - ✓ Avoided policy issues
  - ✓ Policy issues may exist
- Focus on RDD scenario
- May be applicable to other scenarios
- Many technologies useful for waste minimization are not explicitly thought of as waste management technologies (e.g., enhanced surveying)
- Blurred lines between waste minimization and mitigation/gross decon activities

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Technical Reports - references

- To identify existing technologies and methodologies to minimize wastes, segregate waste streams, and cost-effectively treat and dispose waste
- To scope out a standard operational guideline for minimization of waste from a wide area incident
- Technical Reports

1. Subject Matter Expert Meeting Waste Screening and Waste Minimization Methodologies Project
   http://cfpub.epa.gov/si/si_public_record_report.cfm?address=nhsrc/si/&dirEntryId=252037

2. Technologies to Improve Efficiency of Waste Management and Cleanup After an RDD Incident Standard Operational Guideline
   http://cfpub.epa.gov/si/si_public_record_report.cfm?address=nhsrc%2Fsi%2F&dirEntryId=260732

3. Results of Literature Review and Technology Survey of Source Reduction and Waste Minimization Techniques Applied to a Wide Area Radiological Incident
   http://cfpub.epa.gov/si/si_public_record_report.cfm?dirEntryId=283837&fed_org_id=1253&subject=Homeland%20Security%20Research&view=desc&sortBy=pubDateYear&count=25&showCriteria=1&searchall=I+WASTE

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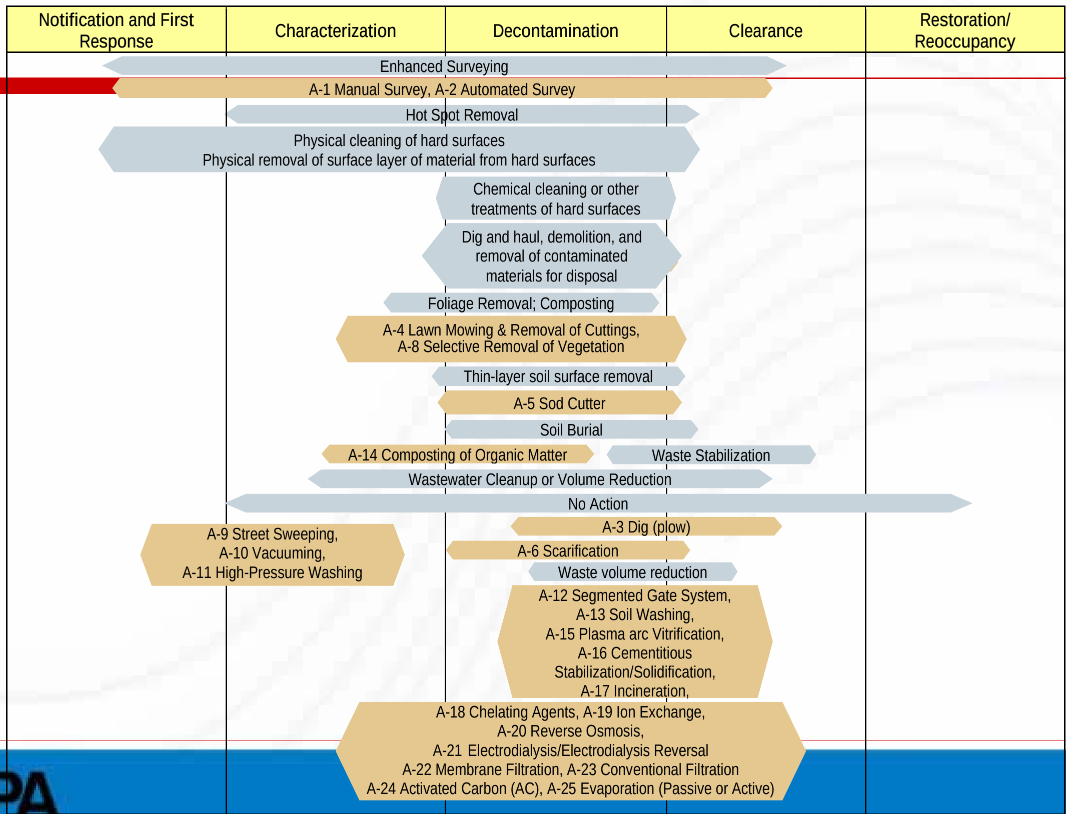
General Types of Options for Waste Minimization

- Enhanced surveying
- Hot spot removal
- Dig and haul, demolition, and removal of contaminated materials for disposal
- Thin-layer soil surface removal
- Foliage removal
- Physical cleaning of hard surfaces
- Physical removal of surface layer of material from hard surfaces
- Chemical cleaning or other treatments of hard surfaces
- Waste volume reduction (e.g., incineration)
- Waste stabilization
- Soil burial
- Composting
- Wastewater cleanup or volume reduction
- Other technologies
  - ✓ Soil Washing
  - ✓ Segmented Gate System
- No Action

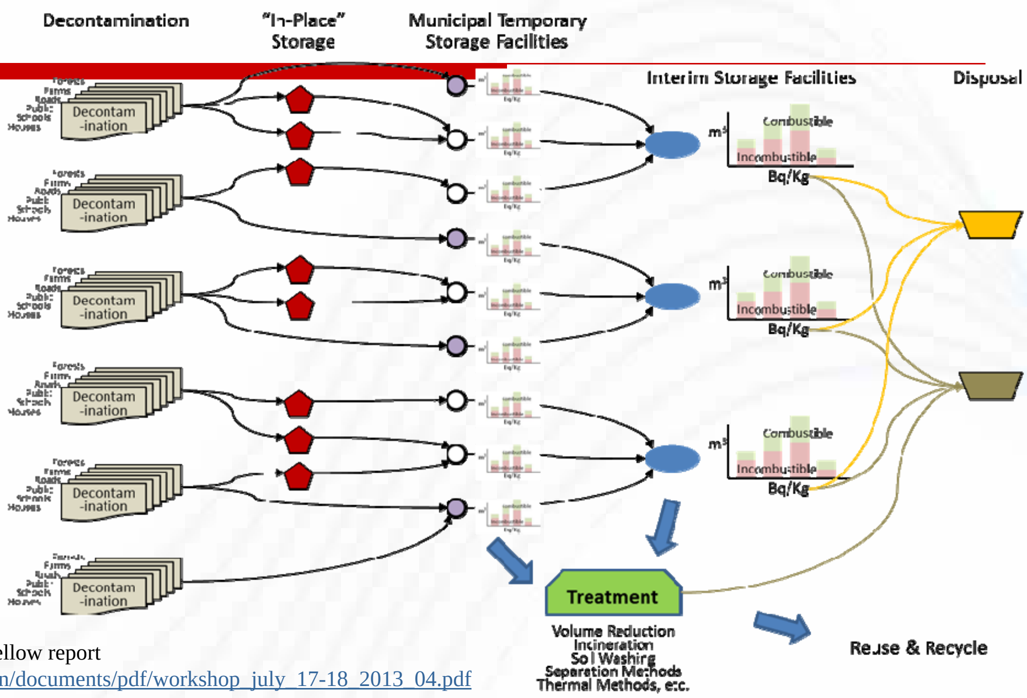
Different Options for Different Places in Waste Response Timeline



Systems Approach for waste minimization

- Source reduction, mitigation, and waste minimization are closely linked for a wide-area remediation effort.
- Toolbox of technologies can increase the options for cost effective treatment of waste; better than mandating fixed approaches (maximum flexibility for decision makers)
- Decision support tools for high profile planning

Conceptual Diagram of an Integrated Waste Management System



US Embassy Science Fellow report
https://josen.env.go.jp/en/documents/pdf/workshop_july_17-18_2013_04.pdf

EPA Tools to Support Waste Management Decisions

Tool 1: Incident Waste (I-WASTE) Online Decision Support Tool

–For chemical, biological, radiological, all-hazards incidents

–Estimation of building contents

–Identification of key decision makers

–Identification of potential facilities

–Repository of relevant guidance

Tool 2: Waste Estimation Support Tool (WEST)

–For radiological incidents

–Identification of affected structures

–Estimation of building structural materials

–Estimation of outdoor media

–Estimation of waste composition and activity as a function of decontamination and demolition strategies

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Decision Support Tools – WEST

EPA has developed a method to generate first-order estimates of potential waste volumes

- Waste Estimation Support Tool (WEST) can be used for planning and response to radiological incidents
- Use commercially available software/databases
  - Plume maps generated by DOE (IMAAC/NARAC)
  - Building information by census tract
  - Satellite imagery, GIS, LIDAR
- Adjust parameters based on decontamination strategy
- Conduct sensitivity analysis on results
- Applied in several exercises and paper scenarios

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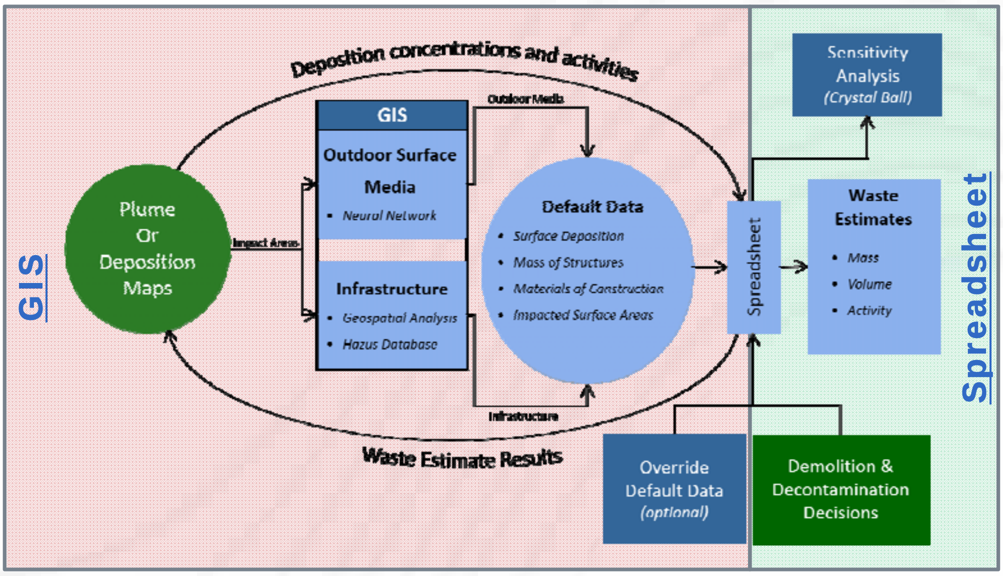
WEST Purpose

- GIS-based tool that can assist in planning/preparedness activities at all levels of government
  - ✓ Radiological Dispersal Device (RDD) waste management issues linked with decontamination and restoration timeline
  - ✓ Waste management decisions need to be made early
- Waste Estimation Support Tool (WEST) Facilitates
  - ✓ First-order estimate of waste quantity and activity
  - ✓ Pre-selection of disposal options
  - ✓ ID of potential triage/staging/storage within each zone or surrounding area
  - ✓ Assessment of impact of decontamination strategies on waste generation
  - ✓ Assessment of impact of waste management strategies on decontamination decisions
  - ✓ Identify resource limitations and response bottlenecks
  - ✓ Identify starting points for policy discussions

WEST Methodology



I-WASTE Overview –Current Features

- Web-based tool with restricted access
- Series of inputs defining scenario
- Calculators available to estimate mass & volume of disaster-generated waste and debris (offices, schools, theaters, shopping malls, residences, hotels, hospitals)
- Database of U.S. treatment/disposal facilities (location, technical information, permits, geolocation)
- Access to contaminant and decontaminant information
- Guidance for worker safety, packaging and storage, and transportation

http://www2.ergweb.com/bdrtool/login.asp

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Decision Support Tools – I-WASTE

I-WASTE is an EPA tool to assist planners and responders in managing incident-related waste

- ✓ Multiple scenarios available, including RDD
- ✓ Calculators to estimate mass and volume of waste
  - Databases of standardized building contents
  - Office buildings, schools, theaters, shopping malls, residences, hotels, hospitals
- ✓ Database of disposal facility information
- ✓ Access to contaminant/decontaminant information
- ✓ Guidance for worker safety, packaging and storage, and transportation
- ✓ Applied for natural disasters (e.g., Hurricane Katrina)

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Previous Experience with Large Volumes

Primarily through legacy cleanups, e.g.,

- ✓ Uranium mill tailings
  - 22 legacy sites
  - ~30 million cubic meters disposed on-site
  - Additional volumes sent off site
  - Current cleanup of 16 million tons at Moab site
- ✓ DOE weapons complex
  - Multiple sites released to legacy management
  - >>10 million cubic meters of waste generated
- ✓ Remediation of Navajo tribal lands
  - Structures, yards, water sources remediated
  - ~2 million cubic meters of waste when complete

How well does it translate to a sudden occurrence?

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Utah Moab Uranium Mill Tailings Site

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Fernald, OH DOE Site – Plant to Preserve

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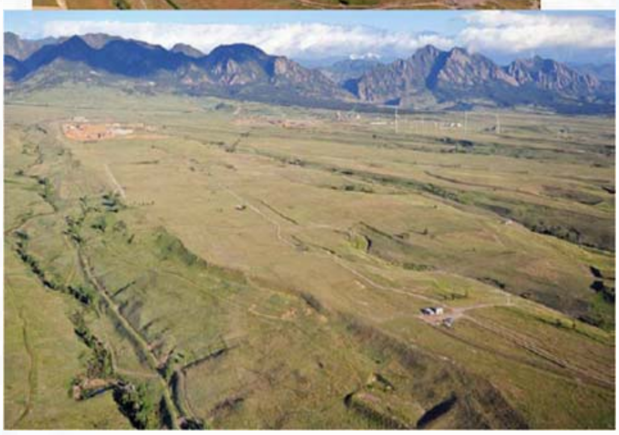
Rocky Flats, CO – Plant to Wildlife Refuge



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Remediation on Indian Tribal Lands

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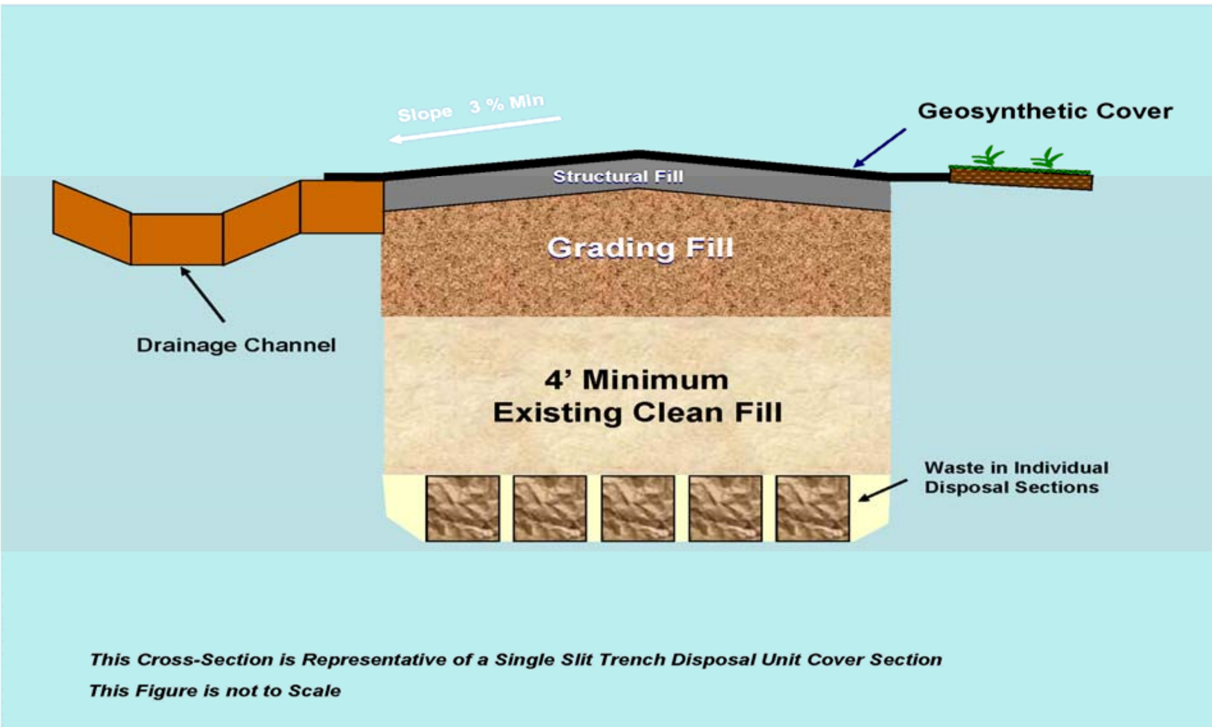
Savannah River Site low level waste disposal example



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EPA Websites

- www.epa.gov/radiation
  - Basics, regulations, guidance, Japan incident
- https://epa-prgs.ornl.gov/radionuclides/
  - ✓ Radionuclide risk scenario calculator
- http://www.epa.gov/superfund/health/contaminants/radiation/index.htm - Superfund Radiation guidance, models

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Thank You !

- Let us know if you have questions
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