Preparation for Demolition of Example Facility

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Mitigation and Monitoring of Radiological Releases to Environment During Demolition

Overview

- Planning ES&H for D&D in open air
  - methods to mitigate release
  - balance risks to workers/public
- Analysis includes case studies, dose analysis, and mitigation for four stages
- Monitoring methods – continuous perimeter air samplers available

Case Study Hanford PFP

- HNF-32414-FP dated May 2007
- Buildings 232-Z and 233-S (6000 ft^2)
- Demolished in open air
  - Prior removal of Pu
- Applied fixatives and foam
  - Misting during demolition
- Goal: control contamination to tight buffer zone
- AlphaTRAC dispersion study

Hanford PFP Condition Prior to Demo

- Less than 1 g Pu in each building
  - Plus 12 g Pu in one large process cell
- 1 M dpm/100 cm^2 on walls and floors
- 100 M dpm/100 cm^2 hot spots
- PBS fixative; foam; 6” sand on floors
- Plastic sheet on adjacent buildings
- Strict area entry/exit controls

Hanford Contamination Suppression

- Selective Pu removal and fixative
- Sand on floors as filter medium
- Misting during destruction and load out
  - Wind speed limit 8-12 mph
  - (No mention of windscreen or tack agent)
- Monitor by lapel A/S,CAMs, fixed plates
- No spread of contamination

Hanford Conclusions

- ISM evaluation: "personnel exposures to radiological and physical hazards was significantly reduced by using heavy equipment rather than "hands on" techniques"
- With good planning, open air demolition is "safe, cost effective, and efficient"
- No contamination spread

Only Criticism :)

- Mitigations were so effective that no contamination was detected
- Therefore no means to validate emission and dispersion models
- PFP is an example of worker risk reduction but we do not know if it approaches the optimum balance

Case Study RFETS

- In some cases, size reduction or repackaging to improve waste packing density was too costly
- Manual work in HCAs involved worker safety disadvantages
- Demolition by tracked excavators avoids “putting workers in harm's way” and improves efficiency
- Substitute machinery for hands-on cutting where contamination can be controlled

RFETS Rad Controls

- Prior use of fixative and misting during demolition controlled dust
- Air monitoring showed no release
- Temporary movable structures mitigated windborne dispersion during soil remediation (windy, treeless environment)

Case Study K-25

- Building one mile long
- LEU in pipes & vessels
- Systems were filled with foam prior to open air demolition with tracked excavators
- Water mists and fire hoses suppress dust
- Essentially no spread of contamination

K-25 Use of Water Mist

Overall Approach for Example Site

- Remove high level concentrates from systems under double HEPA control
- Inspect/drain remaining tanks and vessels
- Apply fixative to floors of cells and other rooms with major sources
- Fog all other contamination with glycerin
- Demolish buildings and vaults in open air
- Soil remediation in open air

Mitigation Measures Applied

- Apply fixative to all contaminated surfaces
- Fog HVAC, tanks, attached piping
- Demolish structures with excavators
  - Crimp pipes with shears during cutting
  - Apply “Dust Boss” style misting
  - Consider tacking agent for resuspension
- Open tent is windscreen for cell demolition
- Building have major components below grade

Mitigation Measures Rejected

- Decontamination – Extensive Removal
  - Slow and expensive
  - Workers at risk of injury & intake
  - Skin contamination concerns
- Fill systems with foam –
  - Difficult to ensure complete elimination of void spaces, so backup needed regardless
  - Workers at risk

Misting Contaminates Soil?

- Increasing soil contamination adds risk to project budget/schedule success
  - Water hose/mist contaminates soil
  - Project must remediate
  - Scope of soil remediation work not known or limited, as compared to known size of buildings
  - Radionuclide movement in soil known issue at project site
- Solution – avoid fire hoses and use building basements as “ponds”

Systems Clean Out Analysis

Systems Clean Out	Cs-137	Sr-90	Pu-239	Am-241
Inventory (Ci)	200	200	20	20
Suspension from project activity	1.0E-03	1.0E-03	1.0E-03	1.0E-03
HEPA One	0.01	0.01	0.01	0.01
HEPA Two	0.01	0.01	0.01	0.01
Respirable fraction	N/A	N/A	N/A	N/A
Release (Ci)	2.0E-05	2.0E-05	2.0E-06	2.0E-06
MESOI dose (mrem)	0.001	0.001	0.012	0.008
Nearby Worker Dose (mrem)	0.000	0.001	0.178	0.178
Deposition (dpm/ccm2/day)	0.00	0.00	0.00	0.00

Cell Demolition Analysis

Open Air Cell Demo	Cs-137	Sr-90	Pu-239	Am-241
Inventory (Ci)	20	20	20	20
Suspension from project activity	1.0E-03	1.0E-03	1.0E-03	1.0E-03
Fixative	0.2	0.2	0.2	0.2
Dust Boss	0.2	0.2	0.2	0.2
Wind speed/tacking	0.2	0.2	0.2	0.2
Respirable fraction	0.35	0.35	0.35	0.35
Release (Ci)	5.6E-05	5.6E-05	5.6E-05	5.6E-05
MESOI dose (mrem)	0.004	0.002	0.330	0.213
Nearby Worker Dose (mrem)	0.000	0.004	4.978	4.978
Deposition (dpm/ccm2/day)	0.01	0.01	0.01	0.01

Building Demolition Analysis

Building Demolition	Cs-137	Sr-90	Pu-239	Am-241
Inventory (Ci)	50	50	20	20
Suspension from project activity	1.0E-03	1.0E-03	1.0E-03	1.0E-03
Fixative	0.2	0.2	0.2	0.2
Dust Boss	0.2	0.2	0.2	0.2
Respirable fraction	0.35	0.35	0.35	0.35
Release (Ci)	7.0E-04	7.0E-04	2.8E-04	2.8E-04
MESOI dose (mrem)	0.047	0.025	1.652	1.064
Nearby Worker Dose (mrem)	0.004	0.044	24.889	24.889
Deposition (dpm/ccm2/day)	0.07	0.07	0.03	0.03

Soil Remediation Analysis

Soil Remediation	Cs-137	Sr-90	Pu-239	Am-241
Inventory (Ci)	100	0	0	0
Suspension from project activity	1.0E-03	1.0E-03	1.0E-03	1.0E-03
Dust Boss	1	1	1	1
Wind speed/tacking	1	1	1	1
Respirable fraction	0.35	0.35	0.35	0.35
Release (Ci)	3.5E-02	0.0E+00	0.0E+00	0.0E+00
MESOI dose (mrem)	2.345	0.000	0.000	0.000
Nearby Worker Dose (mrem)	0.194	0.000	0.000	0.000
Deposition (dpm/ccm2/day)	3.5	0	0	0

Summary

- Total beta/gamma deposition
  - 4 dpm/100 cm2/day
- Total alpha deposition
  - 0.1 dpm/100 cm2/day
- MEOSI dose less than 10 mrem
- Nearby worker less than 100 mrem

Considerations

- MEOSI and nearby worker dose based on conservative assumptions about mitigation effectiveness
- Workers entering cells for decon face known hazards
- How to balance protection of worker safety with environmental protection?

How to Monitor?

- CAMs are expensive but only known means to detect unplanned releases?
- Continuous samplers are inexpensive and suitable for low dose actions?
- Surface deposition monitoring is simple and inexpensive, can be performed anywhere on project site, and indicates breaches of control?