

# CDPHE presents: review of potential radiation doses during construction of the Jefferson Parkway

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CDPHE Hazardous Material & Waste Management Division  
August 3, 2020

# Overview

- Jen Opila- Division Director
  - Welcome and overview of report
- Ralf Sudowe-Associate Professor, Health Physics
  - CSU Environmental & Radiological Health Sciences
- Jim Grice- Radiation Program Manager
  - Assessment of potential radiological dose from road work activities
- Lindsay Archibald-Environmental Protection Specialist
  - Literature review

# Thank You!

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More questions?

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# Rocky Flats Stewardship Council

CDPHE radiation control program: assessment of potential radiological dose from road work activities

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Jim Grice  
Radiation Program Manager  
August 3, 2020

# Overview

- Radiation Control Program
- Radiological Dose Assessments
- RESRAD Computer Code
- Regulatory Dose Limits
- Assessment
  - Scenarios
  - Receptors
  - Results
  - Evaluation
  - Conclusions

# Radiation control program

- Statutory authority to issue licenses pertaining to radioactive materials
- Regulatory requirements for licensing based on potential hazard to public health and safety
- Limitations on potential radiological exposure or dose to individual members of the public

# Radiological dose assessments

- Use a variety of health physics approaches and methods to evaluate dose
- Scientific and regulatory guidance and reference documents
- Specific and general health physics calculations to evaluate potential doses
  - Manual performed directly by staff
  - Computer models

# Radiation computer code



- Developed at Argonne National Laboratory
- Analyze potential human radiation exposures from environmental contamination
- Residual Radioactive materials
- Pathway analysis used to:
  - Evaluate radiation exposure and associated risks
  - Derive cleanup criteria or authorized limits for radionuclide concentrations in the contaminated source medium
- Widely used by regulatory agencies, the risk assessment community, and universities in more than 100 countries around the world for these purposes



# RESRAD computer code

- RESRAD-ONSITE:
  - used to assess radiation exposures of a human receptor located on top of soils contaminated with radioactive materials
- RESRAD-OFFSITE:
  - used to assess radiation exposures of a human receptor located on top of or at some distance from soils contaminated with radioactive materials



# Radiological dose limits

100 mrem  
annually to  
a member  
of the  
public



As a result  
of licensed  
operations

25 mrem  
annually



Criteria for  
release of a  
site for  
unrestricted  
use

# Radiological dose assessments: scenarios

- Road work and associated construction activities
- Approximately 2.8 miles by 300 feet
- 5 year project
- Pu-239 in soil
  - 264 pCi/g - 2019 maximum
  - 5 pCi/g - exposure point concentration

# Radiological dose assessment: receptors

## Roadwork

- 2000 hours per year
- On-site

## Off-site resident farmer

- Adult
- Youth (infant-15 yrs)

# Radiological dose assessment: results

Scenario	Plutonium Concentration (pCi/g)	Result (mrem/year)
Road Worker	264	11.52
Offsite Resident (Adult)	264	1.977
Offsite Resident (Youth Max)	264	2.589
Road Worker	5	0.2183
Offsite Resident (Adult)	5	0.03745
Offsite Resident (Youth Max)	5	0.04903

# Radiological dose assessment: evaluation

Scenario	Plutonium Concentration (pCi/g)	Result (mrem/year)	% of dose criteria for unrestricted use	% of public dose limit for licensed operations
Road Worker	264	11.52	46.08%	11.52%
Offsite Resident (Adult)	264	1.977	7.91%	1.98%
Offsite Resident (Youth Max)	264	2.589	10.36%	2.59%
Road Worker	5	0.2183	0.87%	0.22%
Offsite Resident (Adult)	5	0.03745	0.15%	0.04%
Offsite Resident (Youth Max)	5	0.04903	0.20%	0.05%

# Radiological dose assessment: conclusion

- Radiological dose:
  - Potential radiological doses to road workers or offsite residents as a result of uncontrolled roadwork and construction activities would not likely exceed 0.25 mrem per year
  - The radiation control program would not consider the potential doses to the road workers or the nearby residents as a result of these activities to be an undue hazard to public health from a radiologic hazard perspective
- Radioactive materials licensing:
  - Considering the potential dose to members of the public from this activity compared to the regulatory thresholds that would indicate a need for oversight of situations involving radioactive materials, the radiation control program would not require a license for these activities

# Thank You!

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More questions?

Jim Grice

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# Literature Review

Purpose - review published literature on particles vs. homogenous concentrations

- Starting point was 2017 article on self-shielding effects
- Limited in scope looking at 1) last decade of published articles and 2) historic articles used to evaluate against the Parkway data
- Articles were grouped by three concepts - LNT, particle characteristics, historic studies

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Lindsay Archibald

Hazardous Materials & Waste Management Division, Corrective Action Unit

# Literature Review

## Conclusions:

1. Remaining plutonium in the Jefferson Parkway corridor presents a risk, but small and within the regulatory limits
2. Heterogeneous distribution of plutonium seen from current data set and was seen in historic data
3. No uniform position on radioactive particle dose assessment

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