ISOTOPIC ANALYSIS

PRELIMINARY Isotopic Concentrations and Dose Assessment

FY00 RFETS Prescribed Grassland Test Burn

QA'd on 4/27/00

Analytical Results

Location	Sample Time min	Sample Volume m^3	Isotope	Filter Activity[1] dpm	Error dpm	MDA[2] dpm	Sample Conc[3] pCi/m^3	Conc. Error pCi/m^3
In-plume (AQM-TB-H1)	82	78.72	U233/234	-0.556	0.328	0.435	-0.006357	0.003750
			U235	0.047	0.149	0.189	0.000537	0.001704
			U238	-0.390	0.356	0.450	-0.004459	0.004070
			Pu239/240	0.069	0.117	0.173	0.000789	0.001338
			Am241	0.021	0.093	0.192	0.000240	0.001063
Upwind (AQM-TB-H2)	64	65.60	U233/234	-0.600	0.344	0.462	-0.008232	0.004720
			U235	-0.005	0.109	0.216	-0.000069	0.001495
			U238	-0.366	0.412	0.477	-0.005021	0.005652
			Pu239/240	-0.011	0.014	0.167	-0.000151	0.000192
			Am241	-0.024	0.015	0.173	-0.000329	0.000206

It is worth noting that, though dose will be calculated based on the indicated activities, the activities reported are statistically indistinguishable from zero -- the analytical results are "non-detects" Therefore, dose is also presented based on the MDA.

Dose Assessment

Exposure Factor Description	Factor Units	Factor Value
Sample Activity, by isotope	pCi	(from above)
Sample Volume	m^3	78.72
Exposure Duration	min	82
Inhalation Rate[4]	m^3/hr	1.0

Isotope	Air Concentration[5] µCi/m3	Annual Intake[6] µCi	Inhalation Dose Conversion Factor[7] mrem/µCi	Radiation Dose by Isotope[8] mrem	Total Dose mrem
U235	5.37E-10	7.34E-10	1.23E+05	9.03E-05	
Pu239	7.89E-10	1.08E-09	4.29E+05	4.63E-04	0.000699
Am241	2.40E-10	3.28E-10	4.44E+05	1.46E-04	
[9] *U235*	*2.16E-09*	*2.95E-09*	*1.23E+05*	*3.63E-04*	
[9] *Pu239*	*1.98E-09*	*2.70E-09*	*4.29E+05*	*1.16E-03*	*0.002855*
[9] *Am241*	*2.20E-09*	*3.00E-09*	*4.44E+05*	*1.33E-03*	

[1]Blank-corrected by the laboratory, using a blank population of 30 filters from the same filter lot

[2]Minimum Detection Level, the lowest activity level that is distinguishable from zero

[3]pCi/m3 = 2*((dpm*0.45)/sample volume) [multiplier of 2 used because only half of filter analyzed for activity]

[4]From EPA's 1997 "Exposure Factors Handbook"

[5]Air Concentration = (Sample Concentration in pCi/m^3)*(1E-06 µCi/pCi)

[6]Annual Intake = ((Air Concentration)*(Exposure Duration)*(Inhalation Rate))/(60 min/hr)

[7]From EPA's Federal Guidance Report #11 for dose assessment

[8]Radiation Dose = (Annual Intake)*(Inhalation Dose Conversion Factor)

[9]Dose assessment using MDA as the actual activity

PRELIMINARY

Estimated EDE at HVOL H1 (In-plume, within 100 feet of burn plot perimeter)

Isotope	Air Concentration[5] µCi/m3	Radiation Intake[6] µCi	Inhalation Dose Conversion Factor[7] mrem/µCi	Radiation Dose by Isotope[8] mrem	Total Dose mrem
U235	5.37E-10	7.34E-10	1.23E+05	9.03E-05	
Pu239	7.89E-10	1.08E-09	4.29E+05	4.63E-04	0.0007
Am241	2.40E-10	3.28E-10	4.44E+05	1.46E-04	
[9] *U235*	*2.16E-09*	*2.95E-09*	*1.23E+05*	*3.63E-04*	
[9] *Pu239*	*1.98E-09*	*2.70E-09*	*4.29E+05*	*1.16E-03*	*0.0029*
[9] *Am241*	*2.20E-09*	*3.00E-09*	*4.44E+05*	*1.33E-03*	

[5]Air Concentration = (Sample Concentration in pCi/m^3)*(1E-06 µCi/pCi)

[6]Radiation Intake = ((Air Concentration)*(Exposure Duration)*(Inhalation Rate))/(60 min/hr)

[7]From EPA's Federal Guidance Report #11 for dose assessment

[8]Radiation Dose = (Annual Intake)*(Inhalation Dose Conversion Factor)

[9]Dose assessment using MDA as the actual activity

PRELIMINARY

Dose Assessment to Public Receptors Using ISC Model and Reported Concentrations

Location	ISC Scaling Factor	Dose from Pu239 mrem	Dose from Am241 mrem	Dose from U235 mrem	Total Dose mrem
HVOL H1	1	4.63E-04	1.46E-04	9.03E-05	7.0E-04
Intersection - West Access Road & Hwy 93	0.22	1.02E-04	3.21E-05	1.99E-05	1.5E-04
Rocky Flats Lounge	0.0038	1.76E-06	5.55E-07	3.43E-07	2.7E-06
Hwy 93 Sawmill	0.0001	4.63E-08	1.46E-08	9.03E-09	7.0E-08

Comparative Dose Contributions[10]

Source	Dose mrem/yr
False teeth	0.07
LCD watch	0.06
Airport X-ray	0.002
Smoke Detector	0.008

[10]Source: National Council on Radiation Protection and Measurements

PRELIMINARY Comparison of Isotopic Concentrations to TSP

FY00 RFETS Prescribed Grassland Test Burn

Isotopic vs. Gravimetric Analysis

Location	Pu239 Concentration pCi/m^3	Am241 Concentration pCi/m^3	TSP Concentration mg/m^3	Pu239 Conc. pCi/mg TSP	Am241 Conc. pCi/mg TSP	In-plume Pu239 Conc.[11] pCi/g TSP
In-plume (H1)	0.000789	0.000240	1.65	4.78E-04	1.45E-04	4.78E-07

Gravimetric Results

Filter ID	Sampler Location	Sampler Flowrate (m^3/min)	Sample Time min	Sample Volume (m^3)	Tare Weight (mg)	Post-burn Weight (mg)	TSP Weight (mg)	TSP Conc. (mg/m^3)
H1	In-plume	0.960	82	78.72	2792.8	2922.95	130.15	1.65
H2	Upwind	1.025	64	65.60	2801.1	2809.45	8.35	0.13

[11]NOTE: The low activity per unit total suspended particulate mass (TSP) is appears to result from "dilution" of soil particles by ashed plant material. That is, the burned plant material, with negligible radioactive content comprises the bulk of the TSP. The mean soil concentration of Pu239 in the burn plot was estimated at about 0.137 pCi/g.

Smoke emissions from the burn were sampled for radionuclide contaminants of concern at Rocky Flats. Air samplers operated by DOE and others operated by the EPA were positioned where they were essentially fully immersed in the smoke downwind of the test burn area for the duration of the burn. Other air samplers were positioned out of the plume, but near the burn area, to provide information about background concentrations. Both alpha/beta analyses and isotopic analyses have been performed on the air samples that were collected.

The results of both the DOE's analyses and the independent analyses performed by the EPA show that the amounts of plutonium, americium and uranium were below the minimum detectable activities for these analyses (data are attached). Had the isotopes in the DOE samples been detected at the laboratorie's minimum detectable activity, the resulting effective dose-equivalent (EDE) from that amount of material, breathed continuously for the entire period of the burn, would have been less than 0.003 millirem EDE. The dose is calculated for all isotopes reported from the laboratory with activities greater than zero. Dose is estimated using the inhalation dose conversion factors from EPA's Federal Guidance Report #11, and the calculation is weighted for the specific period of exposure (the entire period of the burn plus a short period afterward while smoke was still present at the sampler).

Putting this in perspective with site operations, the most recent Annual Radionuclide Air Emissions Report (June 1999) reports the maximum annually averaged fenceline concentration of radionuclides to be equivalent to an EDE of about 0.14 millirem for the year. This burn, at MDA concentrations measured near the burn area, would have contributed around 2% of that amount; the actual concentrations were less and would be reduced even more before reaching the fenceline.