

Michael Ketterer's air filtration measurements, April 2024

D. M. Wood, Emeritus Associate Professor
 Department of Physics, Colorado School of Mines
 December 2024

Data

Ketterer's affidavit (dated 21 May 2024) is available from [Rocky Mountain Peace and Justice](#). It provides key information about methods and samples. He used a 1590 cubic feet per minute air blower with two back-to-back very fine furnace filters attached to the inlet. Average sampling times were about 21 minutes, during which about 9.46×10^5 liters of air passed through the filters. The parent sample with highest pCi/g (subsample 1, 1.19 pCi/g) weighed 46.5 mg (the weight of dust after both filters were entirely burned away) and was taken from near the former east gate of the Rocky Flats plant.

We treat each cited pCi/g value as an independent measurement to be applied to the same parent sample (each at a particular location). Total masses: Sample 1: 46.5 mg; sample 2: 127.7 mg; sample 3:

location	samp	subsamp	wgt (mg)	pCi/g	fCi/m ³
east gate	01	1	25	1.19	0.059
"	01	25	15	0.69	0.034
SE gate	02	2	25	0.85	0.12
"	02	21	25	0.20	0.027
"	02	22	25	0.15	0.0203
"	02	22	25	0.18	0.024
CO 128 (Rock Creek)	03	3	25?	ND	-

63.9 mg. Thus each subsample will contribute a different estimate of the total Pu activity of dust filtered at each location.

By comparing the histogram of measured Pu soil values in pCi/g for the Ketterer samples with the corresponding histogram for Jefferson Parkway samples [Fig. 1] we see that what Ketterer measured was consistent with what is expected on the eastern boundary of the Refuge. A value as high as 1.19 pCi/g is relatively unlikely according to the much more detailed Parkway sampling. This reinforces the usual assumption, that airborne dust reflects what is present on the surface of the soil.

Table 1: Ketterer air sampling data. ND = none detected. Weights in mg are for subsamples.

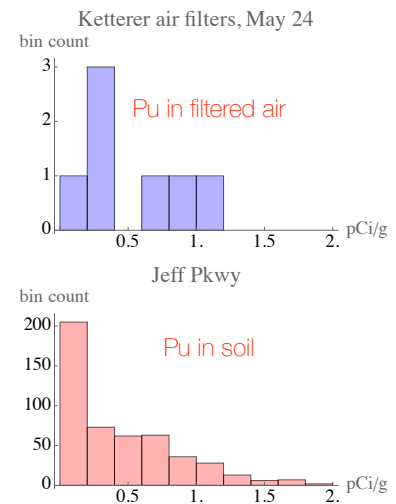


Figure 1: Histograms of Pu in soil from 7 Ketterer samples (1 with no Pu detected) compared with sampling on eastern Refuge boundary for the Jefferson Parkway.

Conversion to Pu activity per unit volume

As an example: sample 01 had an activity of $1.19 \text{ pCi/g} \times 0.0465 \text{ g}$, or 0.0553 pCi . The average Pu concentration in the air for this sample was thus $0.0553 \text{ pCi} / (9.46 \times 10^5 \text{ liters}) = 5.85 \times 10^{-8} \text{ pCi per liter}$. In terms of Bq/m^3 [$1 \text{ pCi/liter} = 37 \text{ Bq/m}^3$] this is $2.16 \times 10^{-6} \text{ Bq/m}^3$. The graphic below was used because it is free of copyright restrictions, so we adopted its units in order to plot Ketterer's re-

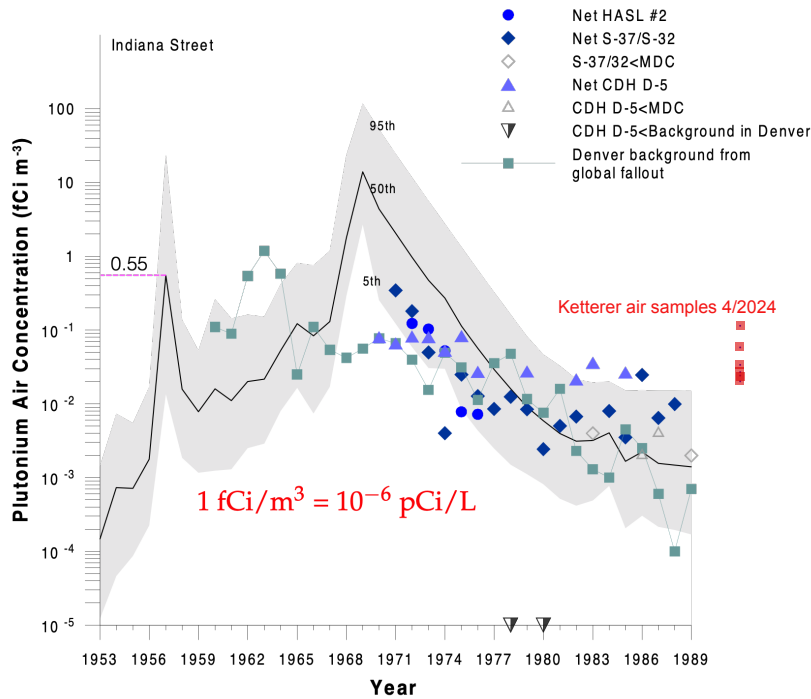


Figure 2: 6 Ketterer data points displayed with historical plutonium air concentration data. Original figure [1] here, Figure 16.

sults. Ketterer's data is toward the high end of post-1970 measured air-sampling data in the figure, but well below maximum values measured during the operating lifetime of the Rocky Flats plant (which peaked during the 1969 plant fire). These data were accumulated via full-year continuous monitoring rather than on a single day. Ketterer selected a very windy day with "particularly strong steady winds and violent gusts occurring at Rocky Flats on the afternoon of that date." [April 6, 2024]. It is estimated [2] that dust resuspension begins at wind speeds of 5-7 meters/sec (14 or 15 mph), with maximum dust emissions at about 27 mph. Section 5 (Air Monitoring Program) of the Rocky Flats Environmental Test Site document notes that "Wind speeds greater than 20 mph occur between 500 and 600 hours per year." This amounts to 6-7% of the time. Thus conditions permitting large soil resuspension are fairly rare over Rocky Flats.

Health impacts

When comparing Ketterer's data with other tabulations for the area around Rocky Flats, several different sets of units have been commonly used, for which conversion factors are

$$1 \text{ fCi/m}^3 = 10^{-6} \text{ pCi/L}$$

$$1 \text{ Bq/m}^3 = \frac{1}{37} \text{ pCi/L.}$$

We have given conversions to pCi/liter (pCi/L) since these are the units in which household (or outdoor) radon levels are cited. CSU reports that average indoor (we assume *unmitigated*) radon levels in Colorado are about 6.3 pCi/liter, and outside, about 0.4 pCi/liter according to the EPA. Using the largest value (0.12 fCi/m³) measured by Ketterer, radon levels outdoors are about 3.3 million times larger than what is contributed by airborne plutonium. Both are alpha particle emitters, making this a fair comparison.

Takeaways

- Ketterer's values of dust pCi/g are consistent with what was expected for the eastern boundary of the Refuge, but his highest value is probably not typical (using larger data sets)
- Translated into pCi/L of air the maximum value among all sub-samples was 0.12 fCi/m³ or 1.2×10^{-7} pCi/L. Given that external radon levels in air are about 0.4 pCi/L, the suspended Pu in air contributes about 3.3 million times less than radon.
- Usual conclusion: Just because a quantity is measurable does not mean it represents a health hazard.
- Even *without* doing a calculation of radiation *dose*, it is obvious that radon is the larger risk by factors of millions.

References

- [1] Jill M. Weber Helen A. Grogan, Patricia D. McGavran, Kathleen R. Meyer, H. Robert Meyer, Justin Mohler, Arthur S. Rood, Warren K. Sinclair, Paul G. Voillequé. *Technical Summary Report for the Historical Public Exposures Studies for Rocky Flats Phase II; Part of Task 6: Technical Support for Public Involvement*. Tech. rep. 1999. URL: http://s197420.gridserver.com/wp-content/uploads/2014/12/Rocky_Flats_Technical_Summary.pdf.

- [2] Y. Kurosaki and M. Mikami. "Threshold wind speed for dust emission in east Asia and its seasonal variations". In: *Journal of Geophysical Research Atmospheres* 112.17 (2007), pp. 1–13. ISSN: 01480227. DOI: [10.1029/2006JD007988](https://doi.org/10.1029/2006JD007988).