

Declaration of Michael E. Ketterer, PhD

Detection of airborne plutonium in air filters collected along Indiana Street under the episodic high-wind conditions of April 6, 2024

I am Michael E. Ketterer, an analytical/environmental chemist who holds the position of Professor Emeritus of Chemistry and Biochemistry at Northern Arizona University. I currently serve as an Adjunct Professor of Chemistry and Biochemistry at the University of Denver. I reside in both Colorado and Arizona and am a registered voter in Rep. Joe Neguse's Congressional district. I hereby declare as follows:

1. I am a specialist in the chemical analysis of trace and ultra-trace elements using mass spectrometry; I have approximately 25 years of experience in its use for the detection of low levels of long-lived radioisotopes of uranium, neptunium and plutonium. I have conducted many extensive field and laboratory investigations of these elements in the Earth's surface environment at localities around the world, and have studied well-known sites including Chernobyl affected areas of eastern Europe, the Nevada Test Site regional/tropospheric fallout-affected zones of the western US, and Trinity Test-affected portions of New Mexico. In my career, I have analyzed on the order of 50,000 individual environmental samples to determine quantities of plutonium-239 and plutonium-240 present; in all of these samples where sufficient Pu was detected, I have used the measured atom ratio $^{240}\text{Pu}/^{239}\text{Pu}$ to distinguish between the ubiquitous "global fallout" background atom ratio of 0.18 vs. local/regional sources such as "weapons-grade" plutonium. The latter, used at Rocky Flats, is characterized by a much lower (0.02-0.07) $^{240}\text{Pu}/^{239}\text{Pu}$ ratio. My work is founded upon well-known established science, much of which has been conducted and/or funded by the United States Department of Energy (e.g., the above quoted $^{240}\text{Pu}/^{239}\text{Pu}$ figures are based on the following 1999 Pacific Northwest National Laboratory paper:

<https://www.sciencedirect.com/science/article/pii/S0048969799001606>

2. The plutonium measurements are conducted at a licensed radioisotopes laboratory in Building 36 at the Chemistry/Biochemistry Department at Northern Arizona University. I collaborate with the

Radiation Safety Officer, James Biddle, to maintain the security and conduct licensed usage of the plutonium-242 tracer solution, as essential to our laboratory's work (refer to Attachment 1). I collaborate with NAU chemistry faculty and students to maintain the Thermo X2 inductively coupled plasma mass spectrometer, the chemical preparation facilities and equipment, and the laboratory infrastructure. In the NAU labs, I perform fee-for-service plutonium analytical work, and receive part-time salary through the Trace Element Analysis Center, directed by Prof. Jani C. Ingram (Regents Professor of Chemistry and Biochemistry). From mid-2022 to present, the Center has provided plutonium activities and isotopic provenance of fallout and/or other Pu sources, for approximately 2000 samples, to external researchers from the US, Canada, Spain, Iceland, Denmark, Germany, and New Zealand. Nearly always, the plutonium being detected is "global fallout" from 1950's-1960's thermonuclear tests; the TEA's clients are using these data for Anthropocene tracer applications such as soil erosion modeling, soil profile development, and sediment chronology. Much of the Anthropocene tracer work I have performed at NAU is represented in collaborative publications, where I have contributed the experimental data and interpretations as an integral part of an interdisciplinary research team.

3. Examples of my peer-reviewed publications on the subject matter of plutonium and related elements, their detection/source ID, and usage as environmental tracers may be viewed at: https://scholar.google.com/scholar?hl=en&as_sdt=0%2C6&q=Ketterer+flagstaff+plutonium&btnG=

4. I am familiar with the history of the Rocky Flats plutonium and neptunium pit production site in Colorado, now containing the US DOE-managed CERCLA (Superfund) site referred to as the "Central Operating Unit". The COU is surrounded on four sides by the former plant buffer zone, now known as the "Rocky Flats National Wildlife Refuge" or RFNWR. I lived at three different Boulder County locations in Boulder County between 1980-1986, and was cognizant of the plant's environmental problems with plutonium at that time. I was a GS-11 Chemist working for the US EPA in June 1989, at the time when my organization, the National Enforcement Investigations Center, provided field and lab technical assistance to USEPA's Special Agents and the FBI team of Special Agents. During the time of my EPA employment, I contributed limited-scope technical advice to EPA and FBI personnel, but was mainly assigned by the Laboratory Services Division to other casework during my

1987-1993 employment with EPA. During my work at USEPA, I gained an understanding of forensic sciences as applied to environmental questions, and practices for the collection/preservation of physical evidence. In the early 1990's, EPA sent me to short courses in environmental sampling methods, and I completed a mandatory 40-hour OSHA certification for working in the field at hazardous waste sites. At EPA-NEIC, I acquired experience in the collection of many types of environmental and hazardous waste samples as part of field work in onsite investigations, including criminal search warrants, at contaminated sites across the United States. As an EPA employee, it was my duty to testify, when required, in Federal or State legal proceedings as an expert and/or fact witness on behalf of the Government.

4. Since 2000, I have been using mass spectrometry in the labs at Northern Arizona University to study soils in non-Federal lands near the Rocky Flats COU and buffer zone; I have personally collected and/or analyzed hundreds of samples from the Indiana Street Corridor and areas emanating away from the buffer zone. To summarize this work, the mass spectrometry confirms that essentially 100% of the "excess plutonium" has a weapons-grade signature, has been added to the soils located east of the buffer zone, and is without question, derived from Rocky Flats. Within an identifiable zone of effect, this added Pu from Rocky Flats overwhelms the "global fallout" background. To wit, I have measured plutonium inventories (depth-integrated content per unit area) in 2002-collected soil cores to 30 cm depth from the Westminster Dog Park that were between 1000 and 10,000 Becquerels of plutonium-239+240 per square meter, as compared to fallout-derived inventories of less than 150 Becquerels per square meter in unaffected, similar environments elsewhere in Colorado (e.g., the Kathy Fromme Prairie in Larimer County). In a 2003 paper, I identified uranium-236 as another Rocky Flats-derived radionuclide present in soils in contaminated areas on non-US Government property east of the RFNWR buffer zone:

https://www.sciencedirect.com/science/article/abs/pii/S0265931X02001868?casa_token=2X2AXO9VTkkAAAAA:FoeM83GD-kuTmN1wcs4FYvieYrkAzV92AdLS7GyP5tYyBOMT5KQnKOfuwAGf2CIAa9oOX5ck. My work concurs

with Federal and State studies of the same areas, all of which indicate, that within the 1970's "Krey-Hardy map" contamination plume (Attachment 2), elevated activities and inventories of plutonium are indeed still present in the 2020's. Both my work, as well as studies conducted by the US

Government (for example: https://journals.lww.com/health-physics/abstract/1976/02000/remote_plutonium_contamination_and_total.9.aspx) have used mass spectrometry to “fingerprint” the plutonium near the site, showing it is “weapons-grade” Pu originating from Rocky Flats. My own studies also concur with the Government’s recognition of the 903 Pad as a major point source; both US Government-funded studies and my own work also demonstrate the presence of additional plutonium dioxide particles from fires and incineration that routinely took place during the 1952 – 1989 pit production operations.

5. Commencing in 2019, I have been conducting research aimed at the detection/size characterization of plutonium dioxide (PuO_2) particles in Rocky Flats-affected soils, using chemical procedures and mass spectrometry accessible to me at the NAU lab. In work that is ongoing and not published in peer-reviewed literature, I have developed an assay which can systematically identify and size-characterize PuO_2 particles exceeding a size detection threshold of approximately 0.2 microns. The particle work has demonstrated the widespread presence of plutonium dioxide particles with mass-equivalent diameters between 0.2 and 2.0 microns, in soils from the Indiana Street corridor and Westminster Dog Park (Attachment 3). Several larger PuO_2 particles with diameters between 2.0 and 3.4 microns have also been identified in soils on Jefferson County right-of-way west of Indiana St., and in 2002-collected soils from the Westminster Dog Park; however, this ongoing work has yet to observe any particles quite as large as the 8.8-micron diameter “Bill Ray Particle” of plutonium dioxide that was disclosed to the public in August 2019 by the Jefferson Parkway Public Highway Authority. The assembled evidence indicates that it is very reasonable to assume that wherever significant Rocky Flats plutonium is identified *via* $^{240}\text{Pu}/^{239}\text{Pu}$ provenance, plutonium dioxide particles from nanometers to a few microns can be assumed to be present in the surface soils and dusts.

6. In June 2023, I became aware that my Rep. Joe Neguse and Rep. Brittany Pettersen had written a letter to DOE Secretary Jennifer Granholm and EPA Administrator Michael Regan (Attachment 4). In their letter, Reps. Neguse and Pettersen requested that the DOE conduct ambient air monitoring along the Indiana Street corridor and points east, in order to ascertain if windborne transport of plutonium-contaminated dust was occurring. I am cognizant that this request was made by two

members of Congress, addressed to two Cabinet-level appointees, following DOE Legacy Management career employee Carmelo Melendez's written refusal to conduct air monitoring, as had been requested by Mayor Guyleen Castriotta (Attachment 5). The Broomfield Mayor and other local elected officials urged DOE to conduct air monitoring at Rocky Flats, on account of downwind residents' concerns following the aftermath of the catastrophic December 2021 Marshall Fire, recognizing the possibility of a similar fire at Rocky Flats.

7. As of early 2024, it was my understanding that the DOE had been unresponsive to the local community, as well as to Congressional requests for air monitoring. It was my understanding from a fellow Coloradan, who learned from email conversations with DOE and Fish and Wildlife Service officials, that both Federal agency stewards had essentially zero fire contingency plan for response in the event of a large wildfire occurring in the Pu contaminated soil areas; instead, my colleague related the Federal officials' position: ***the local communities would be the first responders***. I also was also familiar, as a Boulder County resident, with the catastrophic December 2021 Marshall Fire, and the speed and intensity with which a similar wildfire could develop anywhere along the Front Range, including on Pu-contaminated soils at the COU and RFNWR. I was also aware of scientific studies pointing to surface soil radionuclide inventory loss during wildfires, controlled burns, and high-wind events. It is not difficult to imagine a scenario, where a Tesla being charged at a residence along the north perimeter of Arvada's Candelas neighborhood ignites during a high-wind event, whereupon swirling winds ignite several homes and blow the sparks from the ensuing 25 kg lithium metal fire onto the RFNWR, igniting a fire conflagration that burned through the entire Refuge and COU in minutes, spreading contaminated smoke over dozens of square miles into Boulder and Broomfield counties, in a north-to-east 90-degree arc pattern.

8. I therefore concluded that it was my individual responsibility as a knowledgeable, proactive United States citizen, and as resident of Colorado possessing appropriate professional skills and with access to the essential lab capabilities, to address the following question: ***is there plutonium, originating at the Rocky Flats COU and/or buffer zone, being carried towards non-Federal lands and populated areas, under the episodic high-wind conditions that occur regularly onsite?***

9. On April 6, 2024, the Denver metropolitan area experienced an extended period of high winds, with particularly strong steady winds and violent gusts occurring at Rocky Flats on the afternoon of that date. Local Coloradans will recall news reports of the unexpected, proactive, precautionary electrical grid shutdowns experienced on that date by residents in some areas along the foothills.

10. On April 6, 2024, I was accompanied by Jon S. Lipsky, MAS/FBI Retired, and we visited the Rocky Flats proximity. We observed that there had been recent excavation and earthmoving on Federally-managed Refuge lands at the eastern edge of the contaminated buffer zone. We both observed large, rapidly moving suspended dust clouds extending from ground level up to heights of hundreds of feet, originating from areas on the COU and/or contaminated buffer zone. These clouds persisted for some minutes and traveled/dissipated in multiple directions in a stochastic manner. Photos of the wind conditions present are given in Attachment 6. I affirm that Mr. Lipsky was present during all of the sample collections; retired Special Agent Lipsky is able to recount/confirm my description of the conditions, and corroborate my photos with additional video and high-resolution still photos.

11. On April 6, 2024, Jon Lipsky and I collected three samples of the particulate matter present in the ambient air near Rocky Flats. We used a laboratory-constructed portable high-volume air particulate sampler, consisting of a 1590 cfm Harbor Freight 8" cylindrical blower, and two thicknesses of 3M MERV-12 furnace filter affixed to the inlet to retain airborne particles. The inlet of the sampler was pointing to directly into the wind, originating mainly from the west. The sampler was powered by a 1 kWh portable power station (Jackery), and was stationed on the tailgate of Mr. Lipsky's vehicle with the inlet situated approximately three feet above ground height. A photo of the sampling unit and its usage in the field on April 6 is shown in Attachment 7.

12. The sampler was operated for periods of 20 to 22 minutes to obtain individual air filter samples at three locations:

- i) Sample 01, west shoulder of Indiana St. at the former East Gate of the weapons plant;
- ii) Sample 02, west shoulder of Indiana St. at the posted southeast gate of the RFNWR;
- iii) Sample 03, north shoulder of Colorado 128 at the Rock Creek culvert underpass.

The three air filter samples were retained in my continuous custody following collection. A copy of my original field notes is given in Attachment 8.

13. Following the operation of the sampler, the individual sample filters contained visibly evident material, despite the brief operational periods of less than 30 minutes (Attachment 9). The samples were secured and transferred in my custody *via* locked private vehicles and padlocked containers to the NAU laboratories in Flagstaff, AZ, where the samples were handled, stored, processed, and analyzed in a secure, ID card-accessed laboratory area on the NAU campus.

14. At the NAU labs, a series of preparation steps were required to process the samples into a two-milliliter volume of aqueous solution needed for analysis by the mass spectrometer. The filter material was placed in a Pyrex beaker; samples were ashed individually using an electric muffle furnace at 600 degrees Centigrade placed in a fume hood. The ashing of the April 6th filters was completed on April 29, 2024. For Sample 01 (former East Gate), 02 (RFNWR SE Gate) and 03 (Rock Creek), the respective amounts of ash recovered were 46.5, 127.7, and 63.9 milligrams. Attachment 10 is a photo of the vials containing the inorganic material recovered from these air filters after ashing; this is the material that is subsequently dissolved/extracted to yield a 2 mL Pu “nectar”.

15. The ash material recovered from air filter Samples 01, 02, and 03 was weighed into 40 mL Pyrex vials prior to fusion with sodium hydrogen sulfate. A known quantity (28 picograms) of licensed plutonium-242, prepared as a dilute aqueous solution from NIST SRM 4334i, was added to each weighed ~ 25 mg sub-sample; the mixtures were heated for 45 minutes in a muffle furnace at 450 degrees Centigrade, and then the cooled, solidified flux was dissolved with dilute aqueous nitric acid. Purified plutonium fractions of 2 mL volume were produced from each sample using a commercially available solid-phase extraction reagent (EiChrom TEVA resin, <https://www.eichrom.com/>); the chemical procedures were completed on May 2, 2024. A photo of the final chemical purification setup for chemical isolation of Pu from the air filter solutions with TEVA resin is shown in Attachment 11; the columns labeled 1, 2, 3 correspond to the respective April 6th samples; 21, 22, 23 and 25 represent three additional 25 mg preparations of Sample 2, and one additional 15 mg preparation

of Sample 1. Columns 4 through 9 in this photo consist of a negative control along with several positive control samples exhibiting global fallout and/or other Pu sources; Columns 10 through 20 and 24 are being used for another project's similar matrix, small-mass unknown samples that were processed/analyzed in parallel with the April 6 air filter study.

16. The samples were analyzed using a Thermo X2 quadrupole inductively coupled plasma mass spectrometer, depicted in Attachment 12. Using the instrument's software, a dataset containing mass spectral scanning instructions and a data storage space for the results was constructed to acquire atom count rate information from the sample solutions. Signals were collected at masses 237, 238, 239, 240, and 242, representing the isotopes neptunium-237, uranium-238, plutonium-239, plutonium-240, and plutonium-242. The isotopes neptunium-237, plutonium-239, and plutonium-240 are being determined as unknown analytes in the air filter samples; uranium-238 is a ubiquitous natural component of the Earth's crust, which is being monitored to confirm sufficient uranium removal *via* the TEVA chemical separations. The signal at mass 242 calibrates the mass spectrometer's response by acting as an "internal standard" or "tracer" based upon the mass spectrometer's response for the Pu recovered from 28 picograms of an equilibrated Pu-242 spike addition; it is noted that plutonium-242's indigenous content in the Rocky Flats samples is negligible in comparison to the added 28 pg spike. The instrument's software repeatedly switches the quadrupole mass analyzer's transmitted m/z between the five selected isotopes with 10 millisecond dwell times, and collects multiple 58-second integration "runs", each representing the accumulated average atom count rate per second for that sample from 1000 sweeps of the five selected masses. The output from the analyses of the sample solutions was stored in a digital dataset on the instrument computer entitled "Ketterer Desert Glow 02 May 2024.tee".

17. The mass spectrometer was used to collect results for the April 6th air filter samples, along with ion count data for relevant positive and negative controls. A portion of the instrument output from the air filters as it appears in real-time on the computer screen is shown in Attachment 13. Therein, ion count results are shown for Samples 03 (Rock Creek culvert), and two different preparations of Sample 01 (former East Gate), with time stamps 1:53:54 PM, (1:59:57 and 2:04:56 PM), and 2:08:55 PM, respectively.

18. The ion count rate data, with reference to the columns underlying the “Pu239” and “Pu240” labels, show that plutonium is “not detected” in the 1:53:54 PM scan sequence of Sample 03 (Rock Creek underpass). The mass spectrometer’s average response is less than 2 counts per second at mass 239, and less than one count per second at mass 240. These responses are consistently seen for samples known to lack plutonium-239, as well as for samples containing amounts of plutonium-239 that cannot be detected under the instrumental conditions. Similar responses for plutonium-239 and plutonium-240 are also routinely observed in analyses with this mass spectrometer for “negative control” samples such as Moenkopi Sandstone, a Triassic-age sedimentary rock prevalent in Flagstaff. During the time of collection of Sample 3, the wind was coming from Boulder County lands to the north and northwest of our sampling locations, and appeared to be crossing over areas well northwest of Rocky Flats. ***The isotopes plutonium-239 and plutonium-240 are not detected in airborne dust collected at the Rock Creek location during the April 6, 2024 sampling episode.***

19. Six complete scans of Sample 01 (former East Gate) were collected in the series of 58-second runs with time stamps 1:59:57 and 2:04:56 PM; one partial scan was collected at the end of the 2:04:56 PM acquisition as the solution expended. The ion count data demonstrate that both plutonium-239 and plutonium-240 are present at levels well above instrumental detection thresholds (corresponding to 2 counts per second at mass 239 and 1 count per second at mass 240). Further, the ratio of ion counts collected at mass 240 vs mass 239 demonstrates that the Pu in the air filter material not “global fallout”, but appears to consist of “weapons grade” composition, consistent with Rocky Flats contamination.

20. A second independent preparation of ashed material from Sample 01 was produced, and its ion count rate results are also seen in Attachment 13, with the time stamp 2:08:55 PM. This preparation was completed with 15.3 milligrams of Sample 01, as compared to the 23.5 mg of material dissolved in the preparation for time stamps 1:59:57 and 2:04:56 PM. Hence, the lower ion count rates for the 2:08:55 PM preparation reflect the smaller sample mass; however, the integrations of a second Sample 01 preparation also resulted in the detection of both plutonium-239 and plutonium-240.

21. Four preparations of approximately 25 mg of the ashed material from Sample 02 (RFNWR Southeast Gate) each resulted in the positive detection of Rocky Flats-originating plutonium-239 at the second monitoring location along Indiana Street during the episodic high winds of April 6, 2024. The ion count rates for plutonium-240 in three of these preparations are insufficient to positively detect plutonium-240 in addition to the detected plutonium-239; however, considering the 0.05-0.06 atom ratio exhibited by Rocky Flats material, one does not expect to be able to detect plutonium-240 for Rocky Flats-related samples exhibiting less than approximately 20 counts per second for plutonium-239.

22. Two air filter samples (01 and 02) collected at different locations from the Indiana Street corridor on April 6, 2024 have been analyzed *via* a total of six independent sub-sample preparations. All of these mass spectrometric results positively and unequivocally indicate the presence of plutonium, of proven Rocky Flats origin, as has been exemplified in the Attachment 13 screenshot. ***It is concluded, to a reasonable level of scientific certainty, that Rocky Flats plutonium is being dispersed under episodic high-wind conditions prevalent at the site, from contaminated source areas on the COU and/or RFNWR, and is being transported eastward towards non-Federal lands and populated areas.***

23. Using the plutonium-239 and plutonium-240 signals from each integration of the unknown samples, and the corresponding plutonium-242 signals obtained from 28 picograms of added NIST 4334i “spike”, the amounts of plutonium-239 and plutonium-240, atom ratios, and detection limits in the unknown samples can be estimated:

$$\text{Mass of Pu-239} = (239 \text{ signal} / 242 \text{ signal}) * (28 \text{ picograms})$$

$$\text{Mass of Pu-240} = (240 \text{ signal} / 242 \text{ signal}) * (28 \text{ picograms})$$

$$^{240}\text{Pu} / ^{239}\text{Pu} = (240 \text{ signal} / 239 \text{ signal})$$

$$\text{Detection limit for Pu-239} = (2 / 3060) * (28 \text{ picograms})$$

$$\text{Detection limit for Pu-240} = (1 / 3060) * (28 \text{ picograms})$$

where the number 3060 is the matrix-specific average count rate obtained from for the 28 picogram plutonium-242 tracer as was added to each of the air filters analyzed in the May 2 analytical run. The above calculation is considered to be demonstrative in nature, while not including known/understood effects such as background subtraction, mass discrimination originating in the ICPMS ion extraction/transmission system, uranium hydride isobar corrections at mass 239, and the differing nuclidic masses of these specific Pu isotopes. The results of these demonstrative calculations are given in Attachment 14.

24. The activity result for Sample 01, Lab ID 1, is 1.19 ± 0.05 pCi/g $^{239+240}\text{Pu}$, expressing the sum of the activities for the two most abundant isotopes, as is conventional in reporting plutonium measured by alpha spectrometry and in US regulations. ***The $^{239+240}\text{Pu}$ activity of particulate matter in the air on April 6, 2024 thus exceeds the State of Colorado “construction standard” of 2 decompositions per minute of $^{239+240}\text{Pu}$ per gram of soil***, equivalent to 0.88 pCi/gram. The Colorado “state construction standard” is noted in the following communications: <https://Impublicsearch.lm.doe.gov/SiteDocs/OU01-A-000859.pdf> and <https://www.osti.gov/servlets/purl/4264339>. The “construction standard” recommends that areas exceeding this threshold remain undisturbed, and if disturbed, “special techniques” are required including dust suppression, ceasing excavation on windy days, minimizing vehicular spread of contaminated soil, and mandated usage of PPE by workers. Colorado’s “state construction standard” is very unusual as a State-level regulation for $^{239+240}\text{Pu}$ in soil; this statute likely originated out of an abundance of caution during the 1970’s, shortly following publication of the Poet/Martell study in 1972. The Poet-Martell study, conducted at a private research organization (NCAR) in Boulder, closely followed the public’s growing recognition of the 1969 Mother’s Day fire and the true function of Rocky Flats as a plutonium fabrication plant. The work of Poet and Martell was an important event that compelled Rocky Flats contractors and the US Government to stipulate to the presence of off-site Pu from Rocky Flats, including disclosing the contaminated area known as the 903 Pad: https://journals.lww.com/health-physics/abstract/1972/10000/Plutonium_239_and_Americium_241_Contamination_in.12.aspx.

25. The summed activity of $^{239+240}\text{Pu}$ in Preparation 1 of Sample 01 exceeds, and the activity in Preparation 3 is approximately equal to the Colorado “construction standard” level of 0.88 pCi/g, further indicating that a dust transport situation regularly exists that would, under Colorado statutes, require respiratory protection and dust suppression techniques, along with direct workers to avoid soil disturbance activities under high-wind conditions such as existed at Rocky Flats on April 6, 2024. Moreover, the results are indicative of the ambient air quality experienced by persons traveling along Indiana St. under episodic high-wind conditions, as well as persons on public open space at the Westminster Dog Park and/or Rocky Flats National Wildlife Refuge.

26. The elevated activities in *all* of the preparations of Samples 01 and 02 point to non-fallout sources of Pu-bearing material containing higher $^{239+240}\text{Pu}$ activity than explicable by fallout-containing Front Range surface soils (i.e., 0.1 pCi/g $^{239+240}\text{Pu}$ or less). The measured $^{239+240}\text{Pu}$ activities, ranging from 0.15 to 1.19 pCi/g, in the particulate matter in Samples 01 and 02, are not credibly explainable as being derived from fallout-containing surface soils; the activities, independent of the Pu provenance, invoke the presence of a non-fallout source.

27. For Preparation 1 of Sample 01 (former East gate), the signals observed at mass 240 were adequate to measure a $^{240}\text{Pu}/^{239}\text{Pu}$ atom ratio of 0.057 ± 0.009 (one standard deviation). This value completely negates the possibility that the plutonium is of non-Rocky Flats origin; the results are instead congruent with the atom ratio of 0.056 ± 0.009 , which was measured in a positive control in this study. The positive control was 25 mg of sieved/ashed soil from a composite sample I personally collected in July 2019, from Jefferson County right-of-way property, west of Indiana St. near the April 6 Sample 01 location.

28. The four separate ~ 25 mg preparations for air filter Sample 02 (RFNWR Southeast Gate) yielded results interpretable as revealing the presence of a discrete PuO_2 particle in one of the trials. Note that Attachment 16 reports activities of 0.15 to 0.20 pCi/g, while Preparation 2 exhibited 0.85 pCi/g $^{239+240}\text{Pu}$. The “excess activity” of 0.67 pCi/g in Preparation 2 is accounted by the presence of a PuO_2 particle in the 0.85 pCi/g subsample, having a mass equivalent diameter of 0.35 microns. Although additional measurements are planned, so as to collect more sample mass under additional episodic

wind conditions, this initial result suggests that the same PuO₂ particles detected in surface soils along the Indiana St. corridor and in the Westminster Dog Park are being entrained into the ambient air under high-wind conditions, such as existed on April 6, and are transported away from the RFNWR and Central Operating Unit.

29. For the three air filters collected on April 6, there remains a small portion of material, ranging from a few mg to a few tens of mg that is now in locked storage at NAU. This writer is familiar with DOE-EM's and DOE-LM's bad-faith responses of denial, incredulity, ridicule and retaliation following releases of important environmental findings to community members. Accordingly, the following pledge is made: I will work directly with staff in the DOE Office of the Undersecretary for Science and Innovation, ***and arrange for DOE to receive a split of 50% of the remaining material for each of the three April 6th air filter samples.*** However, I will not supply any additional information to DOE beyond the contents of this Declaration, nor will I communicate with any other DOE or CDPHE officials and/or their contractors. The splitting would be performed by me personally, under DOE supervision while in-person at Northern Arizona University, or if DOE prefers, observed by video link. The DOE would be responsible for advancing costs for all travel expenses and *per diem* for conducting the splitting, for supplying the sample to DOE, and for subsequent in-person observation of a similar mass spectrometric analysis at a DOE National laboratory with the same or superior capabilities as were used herein. The DOE would also agree to reimburse me for professional time at hours at charge-out rates that are similar to senior staff in National laboratories performing similar analytical work. Any observations of DOE's own analytical work on the split samples would also be open to attendance by Mr. Jon Lipsky (also participating at DOE's travel/*per diem*/charge-out time expense), as well as additional observers that DOE wishes to invite.

I hereby affirm that these statements are true to the best of my knowledge, and that I am aware that knowingly false statements are predicate acts under 18 USC 1001, subject to potential criminal prosecution and penalties, including substantial fines and incarceration.

By:

Michael E. Ketterer

Michael E. Ketterer, PhD

MAY 21, 2024

State of Colorado, County of Boulder

Signed and sworn to [or affirmed] before me on

May 21, 2024

by Michael E. Ketterer (name(s) of individual(s)
making statement).

Scott Kassner

(Notary's official signature)

Notary Public

(Title of office)

07/24/2026


(Commission Expiration)

SCOTT KASSNER
NOTARY PUBLIC
STATE OF COLORADO
NOTARY ID 19944011774
MY COMMISSION EXPIRES 07/24/2026

COPIES EFFECTIVE AS ORIGINALS: Photocopies of this document shall be effective and enforceable as originals, and third parties shall be entitled to rely on photocopies of this document for the full force and effect of all stated terms.

Attachment 1. Radioactive materials license posted in laboratory area at Northern Arizona University

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ARIZONA DEPARTMENT OF HEALTH SERVICES
BUREAU OF RADIATION CONTROL
RADIOACTIVE MATERIAL LICENSE

Pursuant to Chapter 4, Title 30, Arizona Revised Statutes, and Title 9, Chapter 7 of the Arizona Administrative Code, and in reliance on statements and representations made to the Department by the licensee, a license is hereby issued authorizing the acquisition, reception, possession, use and transfer of the radioactive material listed in this license for the purposes and at the places specified. This license is subject to all applicable rules and Department orders now or hereafter in effect and to the conditions specified. **In accordance with application dated November 29, 2021 signed by Bjorn Flugstad, License Number 03-026 is hereby renewed in its entirety to read as follows: ALL CHANGES ARE IN BOLD**

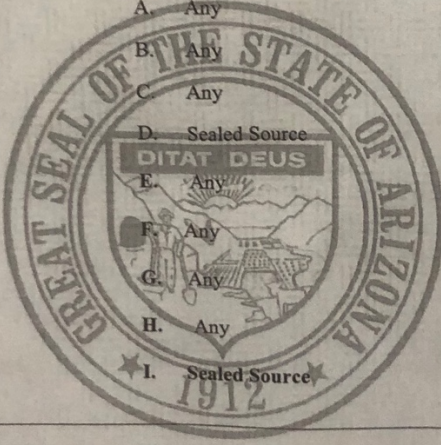
LICENSEE

1. NAME:	Board of Regents d/b/a Northern Arizona University	3. a. LICENSE NUMBER:	03-026
		b. AMENDMENT NO.:	44
2. ADDRESS:	Office of Regulatory Compliance P.O. Box 4137 Flagstaff, AZ 86011-4137	4. EXPIRATION DATE:	December 31, 2026
		5. CATEGORY:	A4-Limited Academic

6. Radioactive material (element and mass number)	7. Chemical or physical form	8. Maximum quantity licensee may possess at any time
A. Hydrogen-3	A. Any	A. 3.7 GBq (100 millicuries)
B. Carbon - 14	B. Any	B. 925 MBq (25 millicuries)
C. Phosphorus-32	C. Any	C. 1.85 GBq (50 millicuries)
D. Nickel-63	D. Sealed Source	D. 3.7 GBq (100 millicuries)
E. Iodine-125	E. Any	E. 370 MBq (10 millicuries)
F. Plutonium-242	F. Any	F. 1.85 GBq (50 millicuries)
G. Uranium-233	G. Any	G. 3.7 kBq (100 nanocuries)
H. Thorium-229	H. Any	H. 3.7 kBq (100 nanocuries)
I. Cadmium-109	I. Sealed Source	I. 3.7 GBq (100 millicuries)

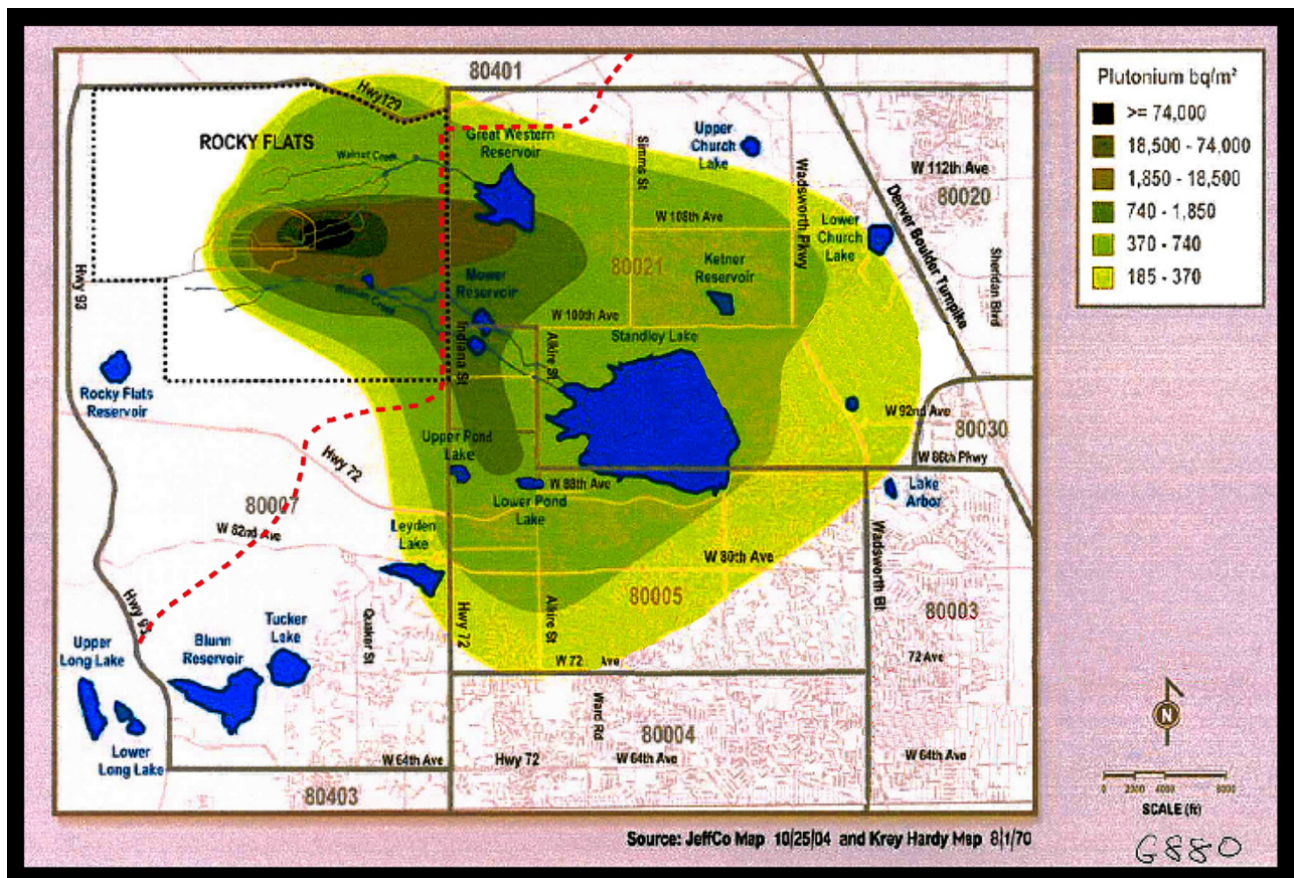
9. Authorized Use:

A. through C. Laboratory demonstrations, exercises, experiments, and research and development.


POST IN ACCORDANCE WITH R9-7-1002

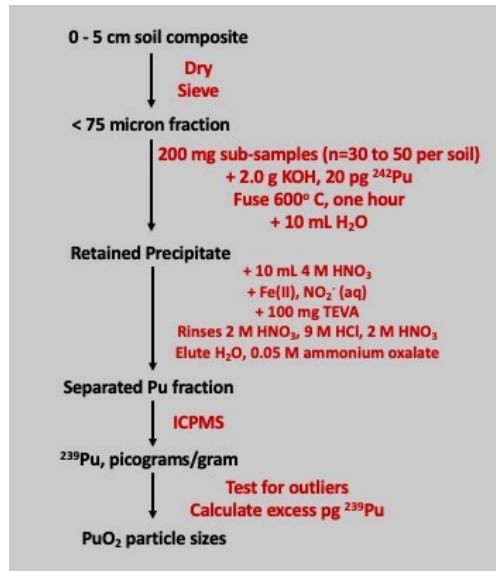
Attachment 2. Krey-Hardy map, constructed in the 1970's using limited data and revealed to the public following the 1969 fire.

Image source: <https://www.psrcolorado.org/news/wwe0yp56yg5n4n0kqe9nhs1r31alfp>



Attachment 3. Presentation materials from an April 2022 symposium hosted by Colorado Physicians for Social Responsibility, describing detection of PuO₂ particles

**Dissolution assay for PuO₂ (s) in particulate solids:
soil, dust, sediment**

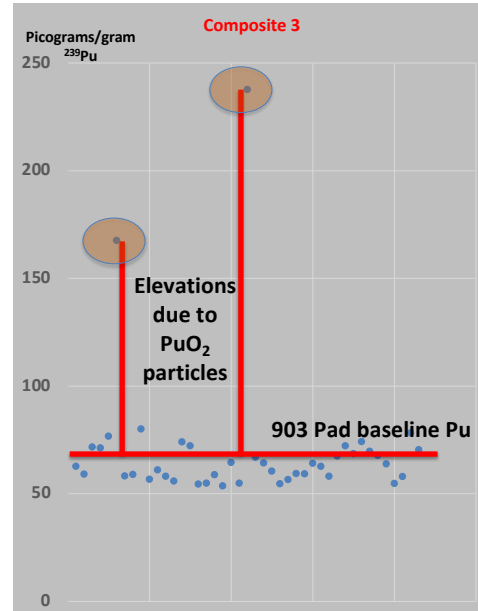


Large number of repeat
dissolutions of many
individual aliquots of a
specific soil sample
reveal the presence of
individual Pu-bearing
particles –
operationally assumed
to be PuO₂ (s)



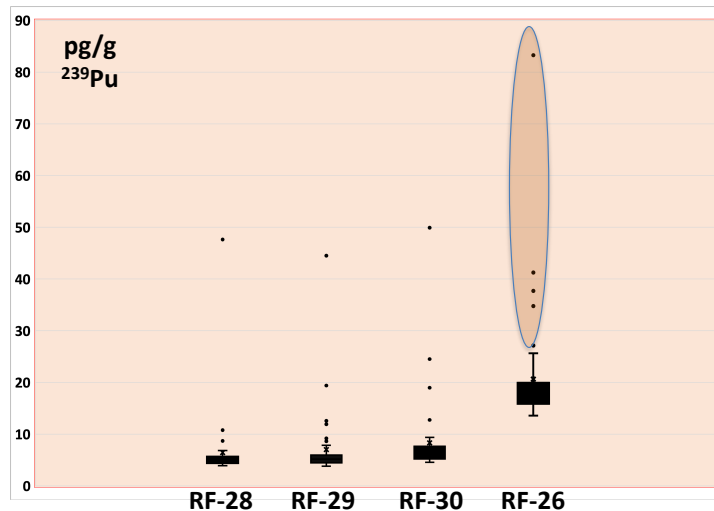
Attachment 3. Presentation materials from an April 2022 symposium hosted by Colorado Physicians for Social Responsibility, describing detection of PuO₂ particles

	A	B	C	D	E	F
2		Composite 3				
3		pg/g ²³⁹ Pu	pg/g ± sd			
4		62.68	5.29		53.58	
5		59.08	0.46		54.42	
6		71.70	4.93		54.54	
7		71.30	1.75		54.80	
8		76.69	1.44		54.88	
9		167.59	2.75		54.88	
10		58.31	3.43		55.89	
11		58.97	2.28		56.63	
12		80.01	3.25		56.65	
13		56.65	4.81		58.02	
14		61.02	5.39		58.13	
15		58.13	0.51		58.15	
16		55.89	1.21		58.31	
17		74.09	1.60		58.76	
18		72.30	1.34		58.97	
19		54.42	0.65		59.08	
20		54.88	1.48		59.25	
21		58.76	0.30		59.31	
22		53.58	2.23		60.43	
23		64.58	1.20		61.02	
24		54.88	1.84		62.68	
25		237.67	6.65		62.72	
26		66.98	2.36		63.78	
27		64.20	4.29		64.14	
28		60.43	12.48		64.20	
29		54.54	4.77		64.58	
30		56.63	1.88		66.98	
31		59.31	4.63		67.45	
32		59.25	2.89		67.74	
33		64.14	3.92		68.54	
34		62.72	1.99		69.72	
35		58.15	2.81		70.37	
36		67.45	0.92		71.30	
37		72.17	1.53		71.70	
38		68.54	1.75		72.17	
39		74.13	2.80		72.30	
40		69.72	3.91		74.09	
41		67.74	1.40		74.13	
42		63.78	2.65		76.69	
43		54.80	1.48		78.23	
44		58.02	1.37		80.01	
45		78.23	3.90		167.59	
46		70.37	1.05		237.67	
47					Exceed 3*SD threshold	
48						



PuO₂ (s) is present in all of the 2019 surface soil composite samples from the Jefferson County right-of-way (immediately west of Indiana Street)

PuO₂ (s) is also present in all of the 2001 surface soil composite samples from the Colorado Hills Open Space (City of Westminster)



Attachment 4. Letter to DOE Secretary and EPA Administrator from Reps. Pettersen and Neguse

Congress of the United States
Washington, DC 20515

June 20, 2023

The Honorable Jennifer M. Granholm
Secretary
U.S. Department of Energy
1000 Independence Avenue SW
Washington, DC 20585

The Honorable Michael S. Regan
Administrator
U.S. Environmental Protection Agency
1200 Pennsylvania Avenue NW
Washington, DC 20460

Dear Secretary Granholm and Administrator Regan,

We write regarding the need for robust federal investments in air quality monitoring at the Rocky Flats Plant and surrounding communities in Colorado. In 1989, the EPA declared Rocky Flats a Superfund site. In 2005, the physical cleanup was completed except for the central area, which remains a Superfund site. The ongoing risks from Superfund sites are pervasive even after the completion of the clean-up at the Rocky Flats Superfund site, and we continue to hear concerns from the communities we represent.

In December of 2021 the Marshall Fire swept through Colorado—destroying over 1,000 structures in Boulder County as winds barreled across the state with gusts of up to 100 miles per hour. The impacts of the Marshall Fire have been lasting, and our communities are continuing to recover. The Marshall Fire particularly devastated communities north of Rocky Flats and underscored the risks, including wildfire and air quality, posed to those living near contaminated sites.

In response to requests made by local municipalities and counties, including the cities of Arvada and Broomfield, and Boulder County, we request that the Department of Energy (DOE) and the Environmental Protection Agency (EPA) invest in air quality monitoring surrounding the Rocky Flats site. Specifically, the DOE and EPA should share the data collected with the public and local and state governments. The presence of air quality monitors would demonstrate any impacts on our communities resulting from the dispersion of contaminated materials during and following a wildfire. This is a necessary investment to protect the health and integrity of the communities that live alongside Rocky Flats. We encourage you to work with other state and federal partners, including the U.S. Fish and Wildlife Service and the Colorado Department of Public Health and Environment, as you work to develop and implement any air quality monitoring.

Thank you for giving your full and fair consideration to this request in accordance with all applicable rules, regulations, laws, and guidelines. We look forward to hearing from you and working together on this issue.

Sincerely,



Brittany Pettersen
Member of Congress



Joe Neguse
Member of Congress

cc: U.S. Fish and Wildlife Service
Colorado Department of Public Health and Environment

**Attachment 5. Letter to DOE Office of Legacy Management Director Carmelo Melendez from
Broomfield Mayor Guyleen Castriotta**

Mr. Carmelo Melendez
Director, U.S Department of Energy, Office of Legacy Management
1000 Independence Avenue, SW
Washington, DC 20585

Dear Mr. Melendez:

With continued drought and increased fire activity throughout the state of Colorado, the City and County of Broomfield - similar to other communities surrounding Rocky Flats - are concerned about the multilevel impact from a wildfire at Rocky Flats. Our community has suffered public health impacts from the Rocky Flats areas for decades, and now, adding to the potential concerns, includes wildfires.

The Marshall Fire on December 30, 2021, which devastated communities immediately north of Rocky Flats and stopped just shy of our community's border, drives our request to immediately seek the strategic deployment of air quality monitors in the vicinity of Rocky Flats. This deployment would identify, through data collection, any impacts on our communities resulting from the transport of material during and following a wildfire.

Through our extensive air quality monitoring program, the City and County of Broomfield is well versed with the deployment of air quality monitoring devices, data collection techniques, and the power of understanding the air quality impacts on public health. The heightened sense of urgency is twofold - one, knowing that wildfires will be occurring at a much higher rate in the future, and secondly and most concerning, what is buried at Rocky Flats.

If we have learned anything over the last few years of monitoring Oil & Gas operations, gathering data to establish a baseline prior is critical to understanding the actual change in air quality and allows for better public policy and decision making.

We stand ready to share our experience in the air quality monitoring arena: strategic monitoring area deployment, data signatures in the results, understanding public health impacts and community communications, lessons learned, making data driven decisions, and robust stakeholder involvement/engagement.

The City and County of Broomfield is committed to work with DOE, Environmental Protection Agency, Colorado Department of Health and Environment, United States Fish and Wildlife Service, and all community partners to gather data, share resources, and better understand the impact of air quality on Coloradans health.

Thank you for your attention to this important issue.

Mayor Guyleen Castriotta

Cc: Jill Hunsaker Ryan, Executive Director, Colorado Department of Health and Environment
Kathleen Becker, Regional Administrator, EPA Region 8
Congressman Ed Perlmutter, U.S. House of Representatives, Colorado District 7
Congressman Joe Neguse, U.S. House of Representatives, Colorado District 2
Rocky Flats Stewardship Council
City and County of Broomfield City Council

Attachment 6. Photos of prevailing wind conditions at the Rocky Flats air sampling locations along the west shoulder of Indiana Street on April 6, 2024



Attachment 7. Photo of the air sampler in operation on April 6, 2024 at the location of Sample 01



Attachment 8. Field notes for the air filter collection activities of April 6, 2024 near Rocky Flats

MEK
4-6-2024

Accompanied by Jon Lipsky
in his vehicle, we used
a 8" cylindrical blower sampler
assembled by Brian Perez.

Collected 3 samples on
media (MERV-12 double
thickness) ~~MEK~~ ^{MEK} 20±2 gMEK

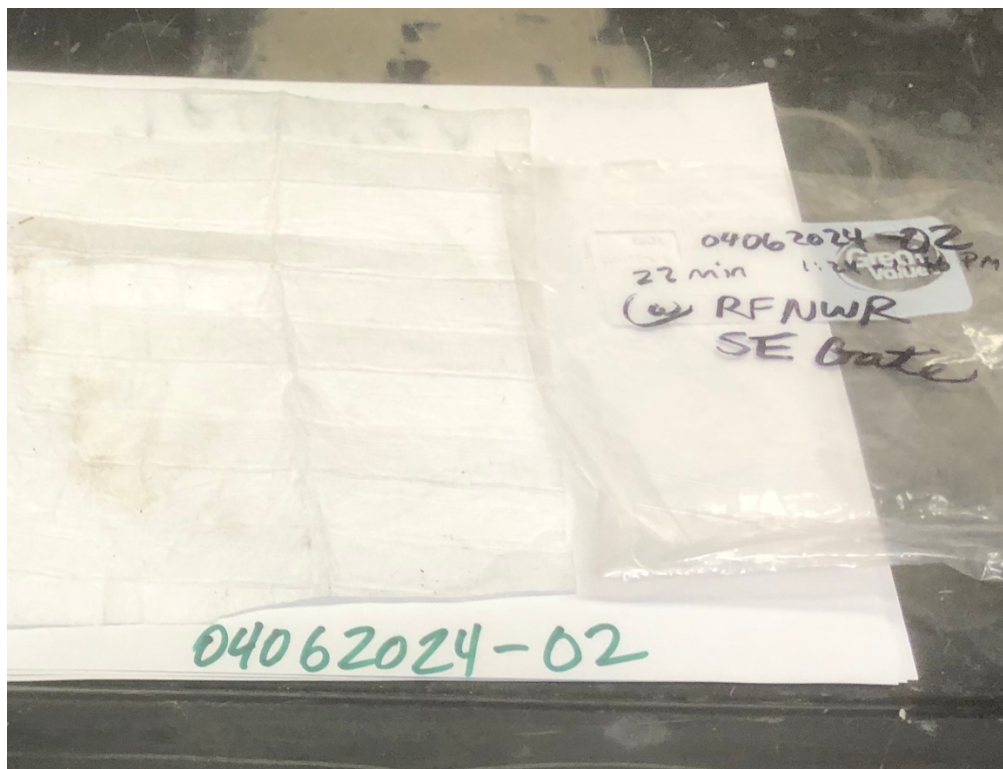
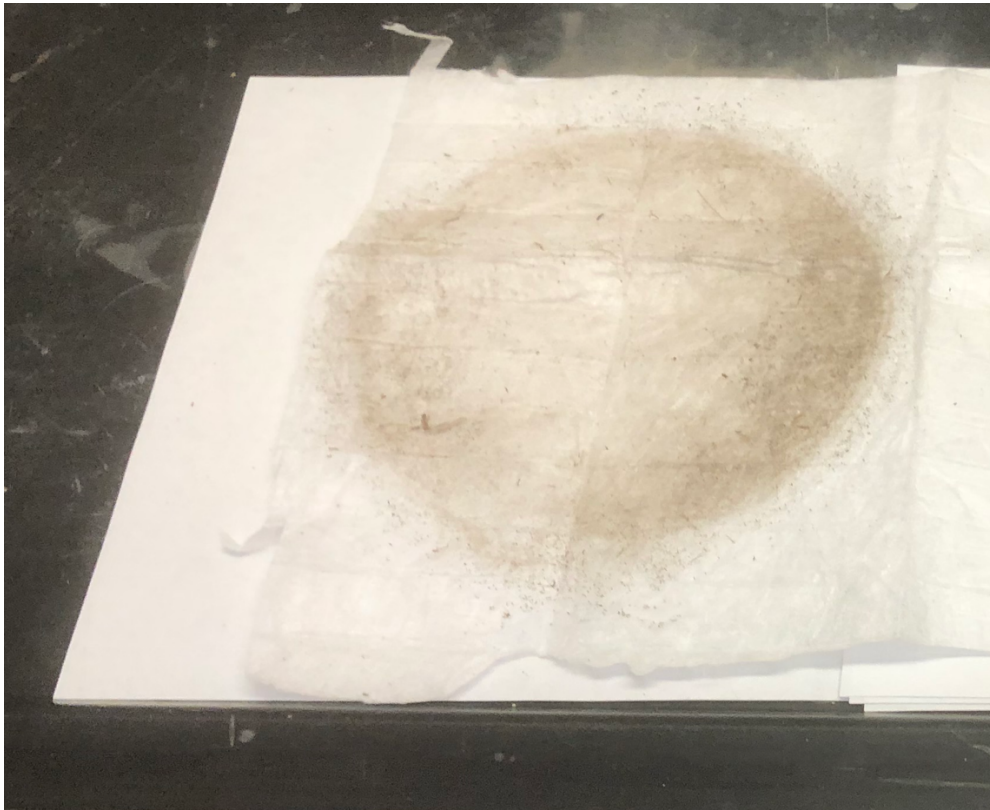
Exposures were ~~(15±1)~~ min
each. ← See times

04062024-01 = Former Plant
East gate Indiana
12:44 → 13:04

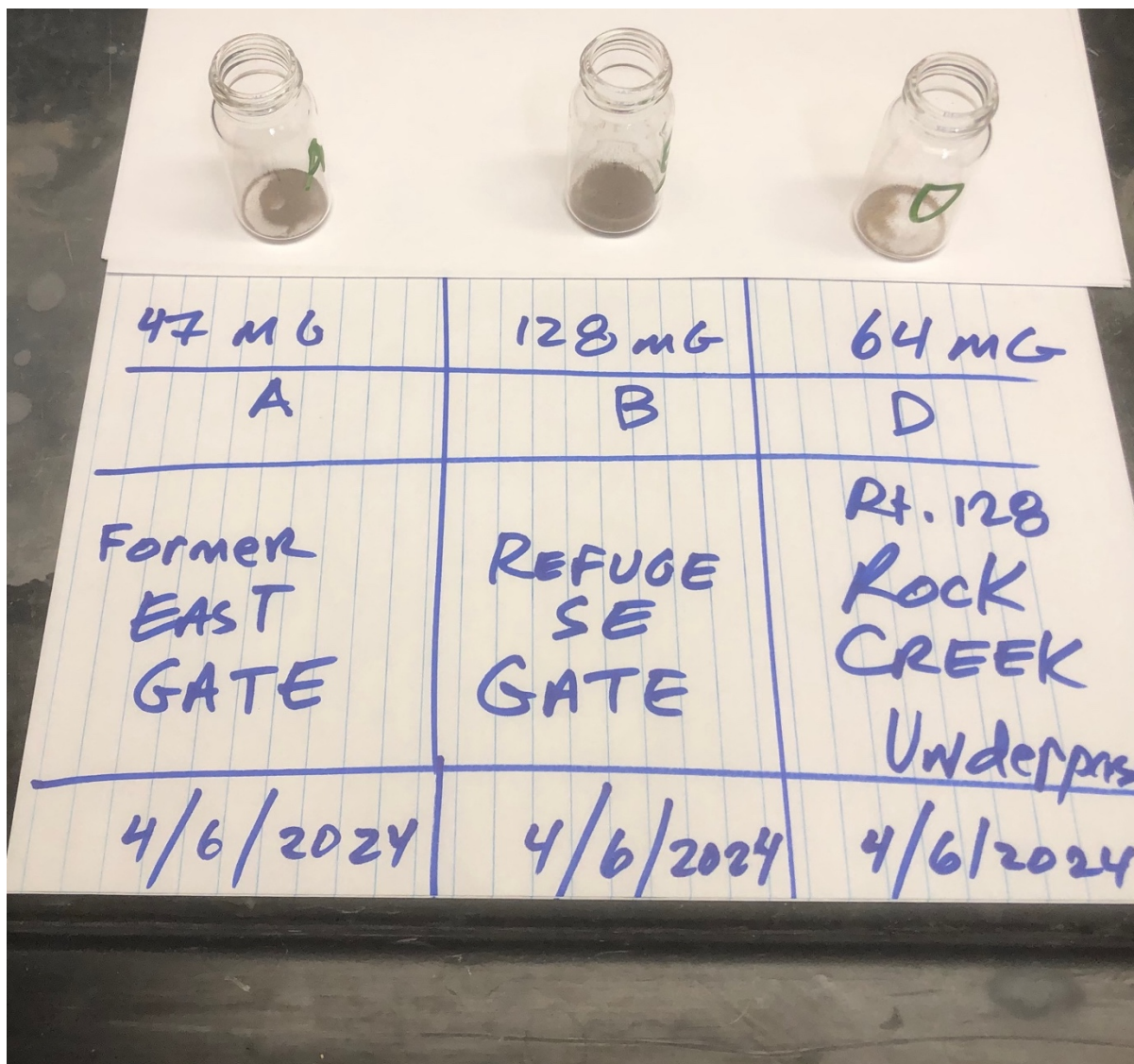
04062024-02 . Current location
of REFUGE SE
Gate Indiana
13:24 → 13:46

04062024-03 Hwy 128 @
Rock Creek
14:24 → 14:44

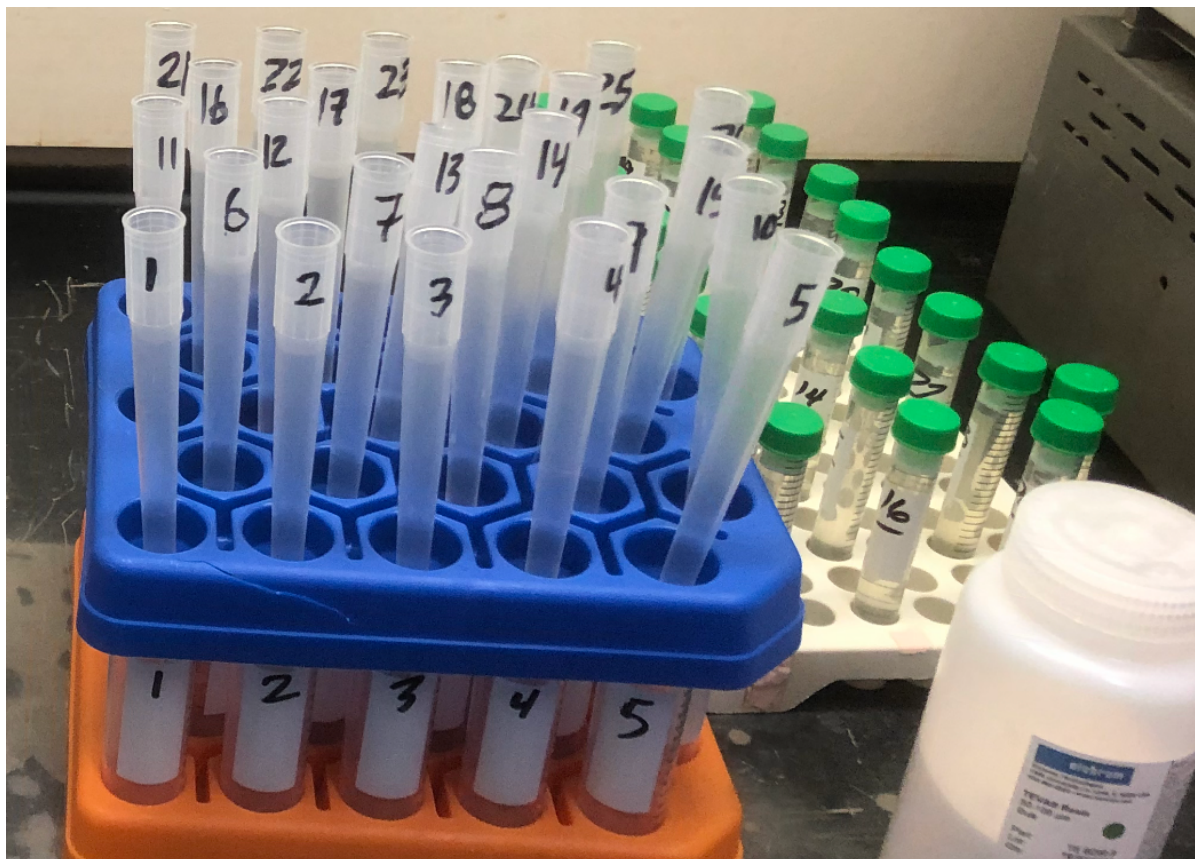
Attachment 9. Photos of MERV-12 air filter substrate, Sample 2, collected with a 22-minute sampling period on April 6, 2024 at the RFNWR Southeast Gate



Attachment 10. Photos of ash recovered from the air filters collected near the Rocky Flats site during high-wind events of April 6, 2024



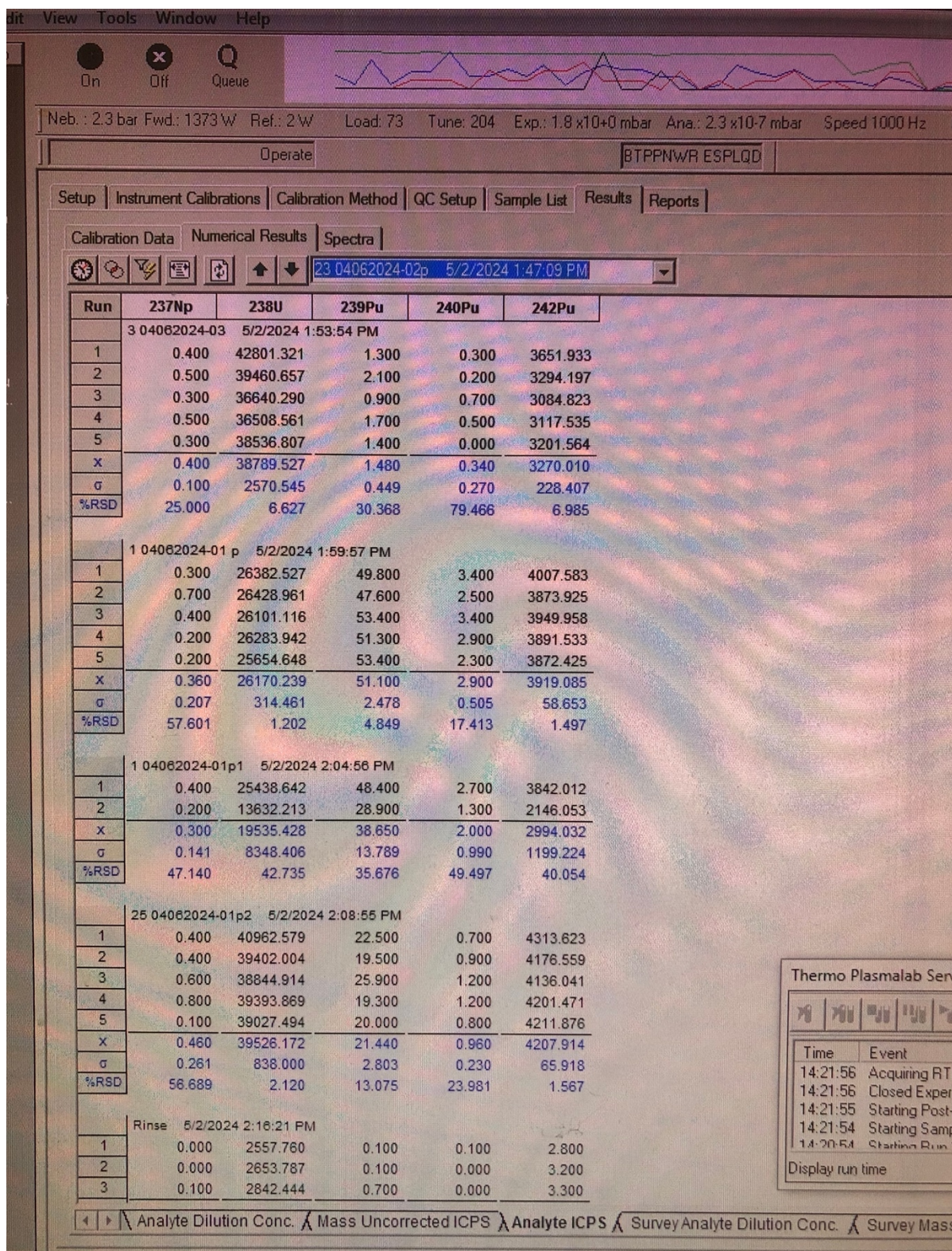
Attachment 11. Photo of solid-phase extraction columns used in the isolation of Pu from the specific samples and controls analyzed in the study; the chemistry and analyses by mass spectrometry were completed on May 2, 2024.



Attachment 12. Photo of the NAU Thermo X2 quadrupole ICPMS and ESI APEX HF sample introduction system used in the study of the April 6, 2024 air filter samples; photo taken on May 3, 2024 on the day following analyses of the samples from the air filter study



Attachment 13. Photo of ion count rate data as presented in real time during the analysis of the Rocky Flats proximity air filter samples on May 2, 2024



Attachment 14. Results for plutonium activities and isotope compositions for Samples 01, 02, and 03 collected on April 6, 2024 along Indiana Street and Colorado Highway 128

Sample	Lab ID	Location	pCi/gram ²³⁹⁺²⁴⁰ Pu ± standard deviation ¹
01	1 ²	Former East Gate	1.19 ± 0.05
01	25	Former East Gate	0.69 ± 0.09
02	2	RMNWR Southeast Gate	0.85 ± 0.06
02	21	RMNWR Southeast Gate	0.20 ± 0.03
02	22	RMNWR Southeast Gate	0.15 ± 0.04
02	22	RMNWR Southeast Gate	0.18 ± 0.02
03	3	Colorado 128 at Rock Creek	Not detected
Detection limit³			0.13

¹Activities were calculated from the masses of ²³⁹Pu and ²⁴⁰Pu found, the sample mass, and the following specific activities: 1 pCi ²³⁹Pu = 15.7 pg ²³⁹Pu; 1 pCi ²⁴⁰Pu = 4.3 pg ²⁴⁰Pu

²For Preparation 1 of Sample 01 (former East Gate of the weapons plant), the counting statistics were favorable enough to permit calculation of ²⁴⁰Pu/²³⁹Pu = 0.057 ± 0.009 (one standard deviation), confirming a definitive Rocky Flats origin.

³The stated detection limit, expressed in picocuries ²³⁹⁺²⁴⁰Pu per gram ashed dust, was computed using the thresholds of 2 and 1 cps for ²³⁹Pu and ²⁴⁰Pu, along with an average ²⁴²Pu signal of 3060 cps and a nominal 25 mg sample.