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### Statement of Capabilities – Measurements of Plutonium in Soils and Dusts

I am an environmental/radiochemist with 17 years of experience measuring plutonium activities in a wide variety of sample types. I have provided these services to a wide variety of Government, academic, industrial and private citizen clients during this time. This letter offers these services to any/all interested members of the community. It is my philosophy that Government agencies should not hold a monopoly position on generating/disseminating information regarding environmental contamination; the informed public needs to protect its own interests, and that all community members should have access to timely and legally/scientifically defensible sampling, chemical analysis, and interpretation of environmental data.

Materials that can be tested for plutonium activities include: surface soil (grab samples, composite samples, soil cores), dust from vacuum cleaner bags, dust-laden insulation from attics, and “wipes” of dust accumulated on undisturbed surfaces. I can offer suggestions and guidance on how to collect these samples, and/or can provide sample collection services, based upon many years of experience in environmental sampling.

Samples for plutonium measurements are analyzed destructively; the ideal quantity of material for analysis is ~ 2 grams; however, satisfactory results can sometimes be obtained with smaller quantities. Samples are subjected to a dissolution process; the isotope  $^{242}\text{Pu}$  is added artificially to the sample as a “yield tracer”, and Pu is chemically separated to yield a concentrated sample solution that is analyzed by inductively coupled plasma mass spectrometry (ICPMS). The ICPMS technique is an atom-counting method that independently measures concentrations of  $^{239}\text{Pu}$  and  $^{240}\text{Pu}$  (originating from the sample) relative to the added known quantity of  $^{242}\text{Pu}$ . Additional details on the analysis are given in the accompanying paper “*ICPMS Studies of Plutonium in the Environment*” (Spectroscopy Magazine, 2005).

Results for  $^{239+240}\text{Pu}$  activity are reported in picocuries per gram (pCi/g); detection limits for 2 gram samples are expected to be on the order of 0.01 pCi/g. By comparison, “background”  $^{239+240}\text{Pu}$  activities in the Colorado Front Range (from 50’s-60’s nuclear weapons tests) are about 0.03-0.10 pCi/g. Hence, it is possible to measure Pu at background as well as elevated levels in soils from the Rocky Flats proximity.

The data generated by ICPMS provide independent measurements of both  $^{239}\text{Pu}$  and  $^{240}\text{Pu}$ ; the “atom ratio” or “isotope ratio”  $^{240}\text{Pu}/^{239}\text{Pu}$  is determined from the ICPMS results. The  $^{240}\text{Pu}/^{239}\text{Pu}$  ratio serves as a fingerprint for distinguishing between Pu from nuclear weapons tests ( $^{240}\text{Pu}/^{239}\text{Pu} \sim 0.18$ ) vs. Rocky Flats Pu ( $^{240}\text{Pu}/^{239}\text{Pu} \sim 0.05-0.06$ ). The percentage of the Pu originating from Rocky Flats is calculated from the atom ratio in the sample.

The sample preparation and ICPMS measurements are conducted at the Department of Chemistry and Biochemistry, Northern Arizona University. The NAU lab is licensed through the State of Arizona for handling the  $^{242}\text{Pu}$  tracer solution and for analyzing  $^{239}\text{Pu}$  and  $^{240}\text{Pu}$  in environmental samples using ICPMS. I have full access to the NAU lab facilities as a benefit of my position therein as Professor Emeritus.

The cost per sample is \$100.00. Sample collection and further consultation are available at additional expense. It is my philosophy that no one of limited financial means should lack access to analytical results; I anticipate (and strive for) conducting approximately 20% of my analytical work as *pro bono*. The per-sample price includes all expenses for travel to NAU and laboratory costs therein. Analyses are conducted on a ~ bimonthly basis using the NAU facility. At this time, I am not able to measure Pu in biological tissue samples; however, I foresee offering these capabilities by mid-2019.

I am currently working on developing partnerships with other qualified scientists, to collaborate in fieldwork, sample custody management, laboratory work, and reporting. We are in the process of establishing Pu measurements at additional laboratory facilities for future use. Interested individuals may contact me at 928.853.7188 or by email ([Michael.E.Ketterer@gmail.com](mailto:Michael.E.Ketterer@gmail.com) or [Michael.Ketterer@nau.edu](mailto:Michael.Ketterer@nau.edu) ).