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Death Valley and Tule Springs: Annual Report for National Park Service Collection Permits DEVA-2018-SCI-0030 and TUSK-2018-SCI-0001

December 2018

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Thomas R. Alexander
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U.S. DEPARTMENT OF ENERGY

Prepared for the U.S. Department of Energy
under Contract DE-AC05-76RL01830

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Pacific Northwest National Laboratory
Richland, Washington 99352

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1.0 Introduction

This report summarizes work conducted at Death Valley National Park and Tule Springs National Monument on September 7, 8 and 9, 2018. This work was conducted under Scientific Research and Collecting permits DEVA-2018-SCI-0030 and TUSK-2018-SCI-0001 (Appendix A). While the work was conducted under two separate permits, the results are being combined into a single report as the scope and methods of the work was the same under both permits. This report satisfies the permit requirement of submitting an annual report; the same report will be submitted for each permit. For this work, soil gas and atmospheric air samples were collected, and characterization of each sampling location was conducted. Fourteen gas samples were collected (11 soil gas, 3 atmospheric air) at three locations for argon-37 analysis (Figure 1); four soil gas samples at DV3, four soil gas samples at DV9, three soil gas samples at TS1, and a single atmospheric air sample at each location. A summary of samples collected, and site information data, is provided (Table 1).

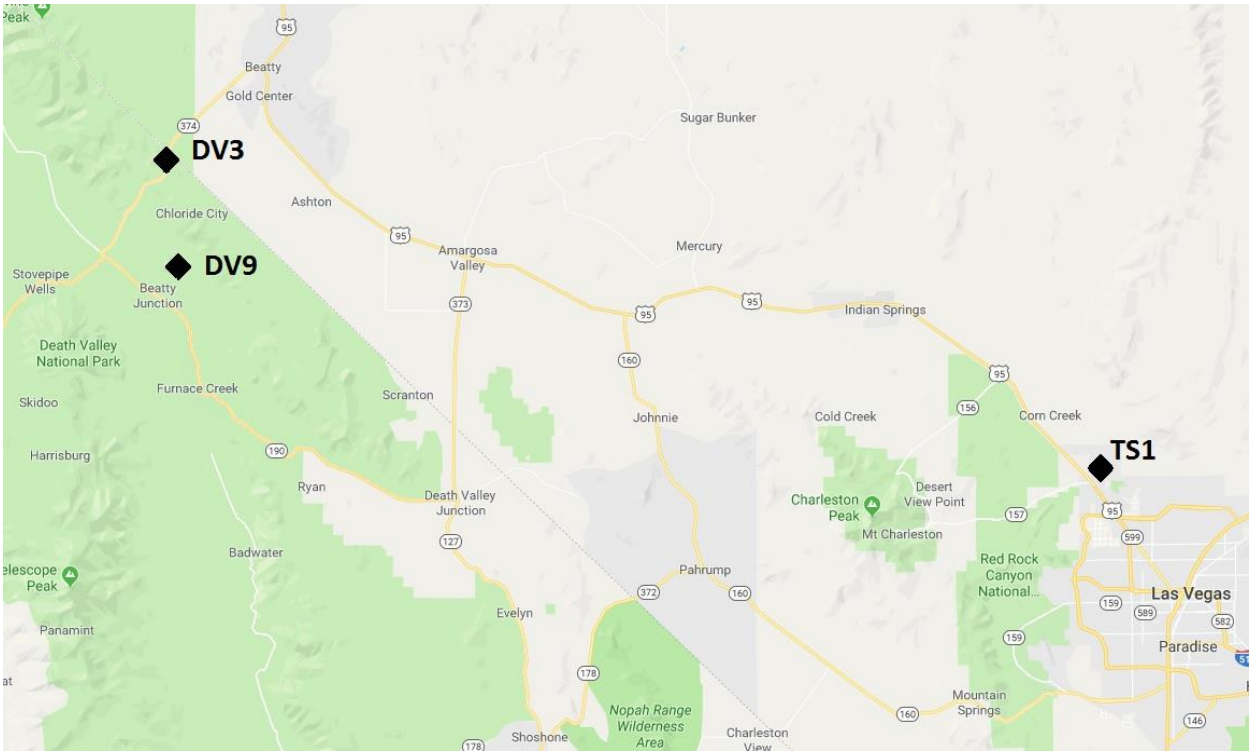

Figure 1. Death Valley and Tule Springs Sampling Locations

Table 1. Sampling Summary

Location Name	Abbr. Name	Latitude	Longitude	Elevation (m)	# of Samples collected
Death Valley 3	DV3	36.7510	-116.9358	1042	5
Death Valley 9	DV9	36.6554	-116.9556	205	5
Tule Springs 1	TS1	36.3405	-115.2845	800	4

2.0 Installation

Installation of the sampling points was done using direct push installation techniques. First, a shallow hole was dug to provide a starting point for installation. A hollow drive rod (Geoprobe®) was then driven to the target depth using an electric jackhammer (Figure 2). After driving to the target depth, a sampling screen attached to tubing was inserted into the drive rod. The rod was then removed (using a hi-lift jack), and sand was poured down the hole, covering the screen. The remainder of the hole was filled with a bentonite slurry. This approach has previously proven successful for installation of sampling points that result in the collection of representative soil gas samples (Fritz et al 2016; . After sample collection, the tubing was removed and the shallow hole was filled back in, leaving no evidence of disturbance at the surface.

Figure 2. Installation and extraction using Geoprobe® rod and jack

3.0 Location Notes

Death Valley 3 (DV3)

The first location visited was along Daylight Pass Road, close to the California-Nevada state line (Figure 3). The sample was collected approximately 30 feet away from the edge of the road. This location was very rocky; the coring tool would only penetrate about 1 meter, limiting the depths of soil sample collection. Soil gas samples were collected from this location at 100 cm, 180 cm, 300 cm and 380 cm below ground surface. An atmospheric gas sample was also collected from this location.

Figure 3. Sampling Location

Death Valley 9 (DV9)

The second location visited was along Beatty Road, roughly half-way between Beatty Junction and Daylight Pass Road (Figure 4). The sample was collected approximately 50 feet away from the edge of the road. This location was moderately rocky; the coring tool penetrated about 2 meters. Soil gas samples were collected from this location at 150 cm, 250 cm, 325 cm and 400 cm deep. An atmospheric gas sample was also collected from this location.

Figure 4. DV9 Sampling Location

Tule Springs 1 (TS1)

The third sampling location was within Tule Springs National Monument, approximately ¼ mile north of Moccasin Road along a gravel access road (Figure 5). This location consisted of finer grained sediment with some rocks; the coring tool penetrated about 2 meters. Soil gas samples were collected from this location at 250 cm and 350 cm depth. An atmospheric gas sample was also collected from this location.

Figure 5. TS1 Sampling Location

Overall, 14 samples were collected; three atmospheric air samples and 11 soil gas samples. The target volume for samples was 400L. Some samples were close to, or even below, the target collection volume. When the radon concentration indicated potential breakthrough of atmospheric air the sample volume was minimized to reduce dilution of the sample.

Table 2. Summary of Sample Locations, Collection Dates and Sample Volumes

Sample Name	Date collected	Sample Depth (cm)[a]	Sample Volume (L)	Location Elevation (m)
DV3-180cm	9/7/18 9:00	180	490	1042
DV3-380cm	9/7/18 10:00	380	300	1042
DV3-100cm	9/7/18 12:00	100	380	1042
DV3-300cm	9/7/18 13:00	300	380	1042
DV3-AtmAir	9/7/18 11:00	NA	380	1042
DV9-150cm	9/8/18 9:00	150	415	205
DV9-400cm	9/8/18 11:00	400	900	205
DV9-325cm	9/8/18 13:00	325	415	205
DV9-250cm	9/8/18 14:00	250	380	205
DV9-AtmAir	9/8/18 15:00	NA	560	205
TS1-350cm	9/9/18 11:00	350	1200	800
TS1-250cm	9/9/18 10:00	250	490	800
TS1-250cm repeat	9/9/18 13:00	250	340	800
TS1-AtmAir	9/9/18 14:00	NA	380	800
a- Depth to bottom of screened interval				

4.0 Sample Collection

Samples were collected using small battery powered sample pumps (10D, Gast Mfg., Benton Harbor, MI). The sample stream was passed through a desiccant column (Silica Gel) to remove moisture, and then split. Most of the sample stream (4 L/min) was directed to a compressor (Microboost, Rix Industries, Benicia, CA) and compressed into a SCUBA tank for transport and storage. A portion of the sample stream (nominally 1 L/min) was passed through a radon detector (Rad7, Durridge, Billerica, MA).

5.0 Sample Characterization

Samples were characterized for several key parameters. The measured radon concentration of the sample is used to determine sample representativeness. This is done in two ways; first, the change in radon concentration over the course of sample collection is an indicator of sample point integrity. If the radon concentration drops significantly during sample collection, it is an indication that atmospheric air is breaking through and diluting the sample. Additionally, the expected radon concentration in the soil can

be predicted using the uranium concentration measured in the soil (Silker et al 1979; Ishimori et al 2013.). The measured radon concentration can be compared to the predicted radon concentration; if there is a large difference between the two, it is an indication that there may be a problem with the sampling point installation and the sample may not be representative.

For each sampling point installed, gas diffusion tests were done to measure the effective diffusion coefficient. This measurement is a modified version of a test developed for studies of soil gas intrusion to indoor air (Johnson et al 1998), and provides data used in the argon-37 prediction model.

In addition to the diffusion tests, soil samples were collected. The dry rocky conditions made it difficult to collect soil below 2 meters deep. Soil samples were analyzed for moisture content with a hand held insertion probe and for metals concentration with a hand held X-ray fluorescence (XRF) analyzer. All samples were very dry (less than the 2% minimum detectable moisture content of the probe), and assumed to be 1%. The calcium and potassium concentrations for samples below 2 meters was assumed to be the same as at the 2 meter depth. There were no obvious lithologic changes observed during installation (noted as changes in the difficulty of driving the sample point). Additionally, the depositional nature of the sediments indicates that the assumption of similar calcium concentrations vertically through the soil column is adequate.

Table 3. Results of Sample Location Characterization Testing and Measured Radon Concentration

Sample Location	Effective Diffusion Coefficient (Cm^2/day)	Calcium Concentration (mg/kg)	Potassium Concentration (mg/kg)	Average Radon Concentration (Bq/m^3)	Predicted Radon (Bq/m^3)
DV3-100	3032	25,000	11,000	4600	5510
DV3-180	2379	25,000	11,000	4660	9100
DV3-300	2579	25,000	11,000	9600	11,500
DV3-380	3317	25,000	11,000	10,900	11,900
DV9-150	3725	40,000	9000	11,000	11,200
DV9-250	4382	30,000	9000	13,100	14,900
DV9-325	3481	30,000	9000	13,500	17,900
DV9-400	4515	30,000	9000	10,300	18,400
TS1-250	3259	90,000	6000	23,000*	32,700
TS1-350	3165	90,000	6000	39,300	38,200
*Average of 2 samples					

6.0 Results and Conclusions

The 14 gas samples were analyzed for argon-37. Of the 14 samples collected, only 12 provided viable results. One sample would not calibrate within the detector, making it unanalyzable. Another sample was noted to be questionable during sample collection; the result was similarly unusual, and was excluded as an outlier. The results were consistent with previously published background concentrations

of argon-37, where atmospheric air concentrations are on the order of 1 mBq/m^3, and soil gas concentrations range between 1 and 200 mBq/m^3 (Table 1; Fritz et al 2018, Riedmann et al 2011). Further, the concentrations of argon-37 measured in the soil gas samples was reasonably consistent with the concentration predicted using a solution developed by PNNL (Fritz et al 2018). Given the uncertainty associated with all of the physical parameters that influence argon-37 production and transport, agreement between measured and modeled concentrations within a factor of 2 is considered acceptable agreement.

Table 4. Modeled and Measured Argon-37 Concentrations

Location Name	Sample Depth (cm)	Modeled Ar-37 (mBq/m^3)	Measured Ar-37 (mBq/m^3)	Analytical Error (mBq/m^3)
DV3-100	93	7.6	9.9	0.77
DV3-180	173	11.6	7.7	0.76
DV3-300	293	10.9	*Sample not Representative*	
DV3-380	373	8.6	9.9	0.80
DV9-150	143	6.3	1.0	0.49
DV9-250	243	4.9	*Sample not Analyzable*	
DV9-325	318	5.4	5.5	0.64
DV9-400*	393	4.3	2.6	0.56
DV9-400*	393	4.3	2.1	0.40
TS1-250	243	24.7	16.9	1.45
TS1-250 Repeat	243	24.7	15.4	2.11
TS1-350	343	23.6	16.6	1.76
DV3-AtAir	NA	NA	2.2	0.56
DV9-AtAir	NA	NA	1.3	0.56
TS-AtAir	NA	NA	0.5	0.70
*Sample split for analysis on separate instruments				

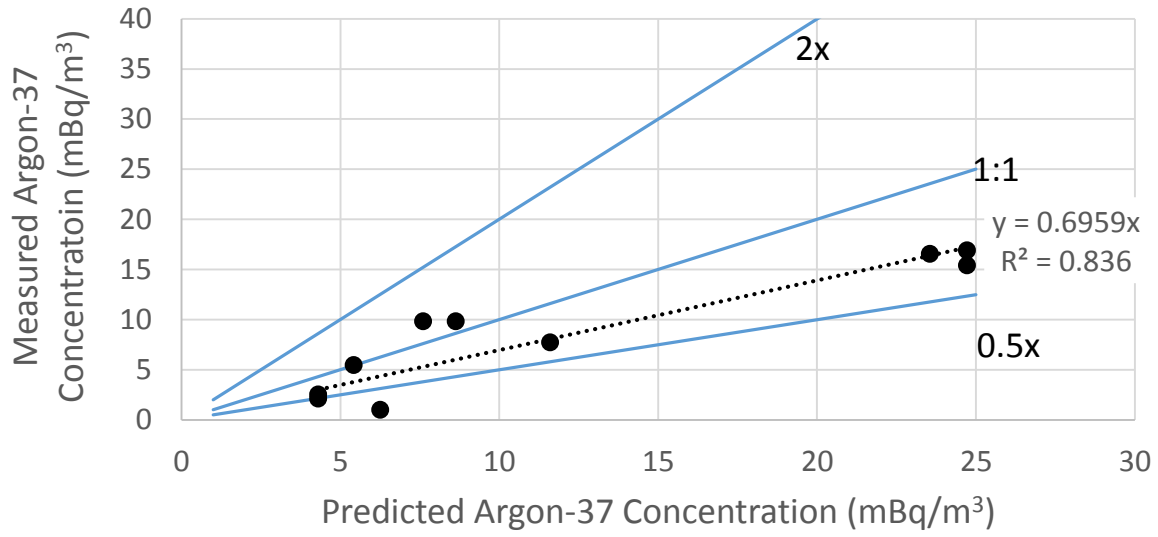

Figure 6. Comparison of Measured and Modeled Argon-37 Concentrations

7.0 References

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8.0 Appendix A- Collection Permits

SCIENTIFIC RESEARCH AND COLLECTING PERMIT Grants permission in accordance with the attached general and special conditions United States Department of the Interior National Park Service Death Valley	Study#: DEVA-00507 Permit#: DEVA-2018-SCI-0030 Start Date: Aug 08, 2018 Expiration Date: Sep 16, 2018 Coop Agreement#: Optional Park Code:

Name of principal investigator:
Name: Brad Fritz **Phone:**5093717119 **Email:**bradley.fritz@pnnl.gov

Name of institution represented:
Pacific Northwest National Laboratory

Additional investigators or key field assistants:
Name: James Hayes **Phone:** (509) 375-1793 **Email:** jc.hayes@pnnl.gov

Study Title:
Background Soil Gas Sample Collection

Purpose of study:
The purpose of this study is to collect soil gas samples from locations relatively undisturbed by human activities. These soil gas samples will be analyzed for trace levels of background concentrations of several naturally occurring radio-isotopes.

Subject/Discipline:
Soils

Locations authorized:
Locations are all within a dozen feet of roads (paved and unpaved). A table of GPS coordinates is included in the documentation.

Transportation method to research site(s):
Pickup Truck.

Collection of the following specimens or materials, quantities, and any limitations on collecting:
Up to 15 soil samples are allowed under this permit. Individual sample size will not exceed 250g. All reasonable efforts will be made to minimize the visibility of any scarring resulting from soil sampling. Samples will be taken from locations that are not visible from established roads, trails, routes or camping areas. Surface disturbance is limited to only what is necessary for sample collection.

Prior to visiting Death Valley National Park, the employee below will be notified of the locations and the dates of the field activities. Notification must be received at least two weeks before arrival in the park. Please include a vehicle description with the notification:

Richard Friese: richard_friese@nps.gov (760) 786-3255

A copy of the project report, publications, and/or data generated as a result of permitted activities will be made available to the Death Valley NP Curator (jane_lakeman@nps.gov) for inclusion in the park's archival collections.

Any samples left after analysis, which the researcher believes to be viable samples that should be retained, would need to be cataloged and labeled with NPS labels and would be considered federal property. Contact Death Valley NP Curator (jane_lakeman@nps.gov) for inclusion in the park's museum collections.

Name of repository for specimens or sample materials if applicable:

NPS General Conditions for Scientific Research and Collecting Permit (available at the RPRS HELP page) apply to this permit. The following specific conditions or restrictions, and any attached conditions, also apply to this permit:
If any objects of cultural value (e.g. historic or prehistoric ruins, graves, fossils, or artifacts) are found during the implementation of the project, all necessary steps will be taken to protect them, and the Park Archeologist notified immediately. Operations at the site will be suspended until the appropriate mitigation action has been determined. Objects of cultural value will not be moved or collected.

All data, reports and publications resulting from this study shall be provided to Death Valley National Park, attention Research Permit Coordinator. The Museum Curator will need archival quality copies of all field notes, databases, maps, photos, reports, publications, and any other associated project records at the completion of the project.

Prior to visiting Death Valley National Park, one of the employees listed below will be advised of the locations and the times of the field research. Permit may be revoked if there is no attempt made to contact these personnel.

A COPY OF YOUR RESEARCH PERMIT MUST BE PLACED ON THE DASHBOARD OF EACH RESEARCH VEHICLE WHILE IN THE PARK.

Richard Friese: Richard_friese@nps.gov (760) 786-3255

PARK-SPECIFIC CONDITIONS for SCIENTIFIC RESEARCH AND COLLECTING PERMIT

United States Department of the Interior
National Park Service
DEATH VALLEY NATIONAL PARK

1. Notification - Send notification a week before your visit to the NPS personnel identified on your permit. Please include: (1) principal investigator's name, (2) fieldwork activities, (3) locations, (4) dates, (5) vehicle description including year, color, make, model, state, and license number.

2. Interpretive Programs - Scientific information is important to park management and is interesting to park visitors. Therefore, we strongly encourage you to contact Chief of Interpretation Linda Slater at 760 786-3279 to arrange for appropriate transfer of information about your research project to park visitors, interpretive park rangers, and other park staff -- perhaps an evening program at the Visitor Center auditorium, a short article in the park newspaper, or a ten-minute briefing at a staff meeting.

3. Exotics - To avoid the accidental introduction of exotic organisms, if wetlands or muddy sites are visited, shoes and equipment must be cleaned (disinfected with full strength Clorox and air-dried) prior to entering the park and between sites within the park. Heavy equipment must be pressure washed prior to entering the park. Animal feeds must be weed seed free.

4. Hardware - No hardware (field markers, pin flags, stakes, rock cairns, recorders, signs, caches, traps, nets, cameras, weather stations, data loggers, radar reflectors, equipment, etc.) may be left in the park unless specified on the permit. If the site is located in a designated Wilderness area, then a separate documentation and waiver is required. Any such permitted items must be identified with a minimum of (1) the principal investigator's last name, (2) the date of establishment, and (3) the name of the study, e.g., "Darwin, 04 July 2003, Finch Genetics." Unmarked hardware will be removed as abandoned or unknown.

5. Entrance Fee - The researcher named on this permit, and those in the research party, are eligible for a complimentary entrance permit from an entrance station or visitor contact center, upon presentation of this permit, provided that the visit is solely non-recreational. Camping fees are not waived.

6. Report Unusual Circumstances - Help the park rangers by reporting observed violations, off-road driving, destruction of park resources, locations of exotic plants, burros, rare wildlife, rare plants, and archeological sites.

7. Wilderness - No off-road driving, no wheeled vehicles beyond road, no motorized equipment beyond road, no rock drilling, and no excavation, unless specified on the permit.

8. Leave No Trace - When traveling in wilderness (95% of the park), practice "Leave No Trace" (LNT) outdoor skills and ethics, and teach these to your students. See the LNT web page at www.lnt.org.
a)Plan ahead and prepare.
b)Concentrate use in resistant areas.
c)Avoid places where impact is just beginning.
d)Protect and conserve water resources (don t camp near water).
e)Pack it in, pack it out.
f)Properly dispose of what you can t pack out (dig a shallow hole and bury both feces and toilet paper).
g)Leave what you find.
h)Use only camp stoves (no campfire rock rings).

9. Collection of specimens or materials - 36 CFR 2.5(g) outlines specific conditions that govern specimens and related data. If the permittee or researcher collects specimens that are to be permanently retained - regardless of where they are kept - those specimens must be accessioned and cataloged into the National Park Service (NPS) National Catalog, and must bear official NPS museum labels. Information on specimens must be included in the Investigator's Annual Report (IAR), discussed below under Reports. If specimens are destroyed in analysis, the data resulting from the analyses will be curated permanently in the park museum collection in lieu of the

actual specimen.

10. Long-term curation of specimens - If the permittee proposes to curate collections outside Death Valley National Park, the permittee must secure park approval of the designated non-NPS repository in writing, and the designated repository must certify in writing that it will care for the collections in accordance with 36 CFR Part 79. Both approvals must be obtained before specimen collecting begins and must be referenced in the Permit. A repository agreement between the park and the repository must be signed and all loan documents prepared before collections are deposited in the repository. No park collections will be placed in a non-NPS repository without a signed NPS Outgoing Loan agreement. The permittee must contact the Park's curator (see below) for instructions on preparing the proper agreements. Transfers of specimens between repositories must be done under a NPS loan agreement. Trading of Death Valley National Park collections between repositories is prohibited. All specimens, as well as their derivatives and byproducts, shall remain Government property.

11. Cataloging specimens - Unless otherwise noted on the Research Permit, the permittee will catalog each object or specimen collected.

a)Before specimen collecting begins, a Park accession number will be assigned by the Park's Curator and must be referenced in the permit. The accession number must be used on all reports, field records, correspondence, and permit(s) relating to the collection, and, on the label of each specimen or material that will be permanently retained.

b)When specimen collecting is finished, the permittee must contact the Curator to obtain a block of Park catalog numbers for the specimens that will be permanently retained. Specimens that are consumed in the course of analysis or research need not be cataloged. The Curator will have a copy of the permit to which to refer. The permittee will initially provide the Curator with the following information:

I.Park accession number
II.Collection date(s)
III.Number of specimens collected (estimates are acceptable for large collections)

c)The Curator will either provide NPS specimen labels to the permittee, or, will approve the electronic scanning or writing of NPS specimen labels. The Curator will provide instructions for label completion. The labels must be completed in permanent, archival ink and appropriately affixed to specimens or their containers, even if the researcher applied their own or their institution's labels. If the size of the specimen or the container preclude completion of another label, the permittee's label must at minimum include the Park accession and catalog number, in permanent ink, in the following format:

DEVA-1234 (for the accession number, must include a hyphen)
DEVA 99999(for the catalog number, do not include a hyphen)

Catalog numbers must be referenced in the final report or publication when individual specimens are referred to.

d)The catalog record for each specimen can be either paper or electronic. The Curator will provide catalog instructions and/or worksheets to the permittee or cataloger. If the collection is large, the Curator may send the permittee or cataloger a copy of the NPS National Catalog software (ANCS+), to allow direct data entry. The permittee or cataloger may also submit data in either Microsoft Excel or Access format, but the catalog fields must have the same field attributes as the ANCS+ record (numeric and text format and size). Specimen catalog data must include:

I.Accession number
II.Catalog number
III.Classification
IV.Specimen Name (scientific and common name)
V.Quantity or item count
VI.Collection Site
VII.Township/Range/Section or UTM Coordinates or Latitude/Longitude (if GPS is used, include the datum)
VIII.Collector
IX.Collection Number
X.Collection Date
XI.Collection Method (chisel, shovel, net, hand, etc.)
XII.Identified By and Date
XIII.Formation (for geology)
XIV.Period/System (for geology and paleontology)
XV.Condition
XVI.Type (if designated)
XVII.Specimen description

XVIII.Preservative and/or preparation method

e)Within one (1) year of the final date of collecting, the permittee must submit to the Park Curator:

I.All specimens that are to be permanently retained in the Park museum collection, their associated labels, and catalog documentation (catalog worksheets and/or electronic data)
II.Associated catalog documentation (catalog worksheets and/or electronic data) for all specimens that are to be permanently retained in
III.Copies of all field records (notes, maps, recordings, reports, etc.), printed or copied onto archival or acid-free quality paper
IV.Copies of final reports or publications

f)If the permittee cannot meet the one-year submission deadline (i.e. specimens are required by the permittee for long-term analyses), please call or write the Curator to make other arrangements. The permittee is responsible for annually reporting the status of their collection analysis and/or cataloging in the IAR. Research and collecting projects are considered complete when most, if not all, of the above conditions are fully met.

g)Researchers are encouraged to contact the Curator s office at any time during this process with any questions that may arise. Curatorial staff is available to help the permittee comply with the terms of their permit and make compliance as easy as possible under current regulations. The Curator's office is located in the Curatorial and Research Facility, Cow Creek, Death Valley National Park. Please contact:

Jane Lakeman
Death Valley National Park
P.O. Box 579
Death Valley, CA 92328
Tel:760 786-3282
Fax:760 786-2169
Email:jane_lakeman@nps.gov

12. Historic Cultural and Archaeological sites. Care shall be taken not to disturb any historic cultural or archaeologic sites during the course of the field investigations. When any site is encountered in the field its location shall be noted and that information shall be provided to the park resources management division.

13. Reports. The principal investigator shall complete an IAR by the end of each calendar year in which research, collecting, specimen analysis and/or cataloging activity occurs. When the IAR is submitted, the permittee will include copies of all field notes, databases, maps, photos, and any other material noted on the research permit. Three copies of all scientific and other publications resulting entirely or in part from research and/or collecting through the issuance of this permit will be furnished to the Park Superintendent.

Recommended by park staff(name and title):
KEVIN WILSON Digitally signed by KEVIN WILSON Date: 2018.05.14 11:08:48 -07'00'

Approved by park official: RICHARD FRIESE

Title: Hydrologist

Resource Specialist

Reviewed by Collections Manager:

Yes ____ No ____

Date Approved:
05/14/18

I Agree To All Conditions And Restrictions Of this Permit As Specified
(Not valid unless signed and dated by the principal investigator)

Brad Fritz
(Principal investigator's signature)

5-7-18
(Date)

THIS PERMIT AND ATTACHED CONDITIONS AND RESTRICTIONS MUST BE CARRIED AT ALL TIMES WHILE CONDUCTING RESEARCH ACTIVITIES IN THE DESIGNATED PARK(S)

SCIENTIFIC RESEARCH AND COLLECTING PERMIT Grants permission in accordance with the attached general and special conditions United States Department of the Interior National Park Service Tule Springs Fossil Beds	Study#: TUSK-00004 Permit#: TUSK-2018-SCI-0001 Start Date: Aug 01, 2018 Expiration Date: Dec 31, 2018 Coop Agreement#: Optional Park Code: TUSK-0009

Name of principal investigator:
Name: Brad Fritz **Phone:**5093717119 **Email:**bradley.fritz@pnnl.gov

Name of institution represented:
Pacific Northwest National Laboratory

Additional investigators or key field assistants:
Name: James Hayes **Phone:** (509) 375-1793 **Email:** jc.hayes@pnnl.gov

Study Title:
Background Soil Gas Sample Collection

Purpose of study:
The purpose of this study is to collect soil gas samples from locations relatively undisturbed by human activities. These soil gas samples will be analyzed for trace levels of background concentrations of several naturally occurring radio-isotopes.

Subject/Discipline:
Soils

Locations authorized:
Locations are all within a dozen feet of roads (paved and unpaved). A table of GPS coordinates is included in the documentation.

Transportation method to research site(s):
Pickup Truck.

Collection of the following specimens or materials, quantities, and any limitations on collecting:

Name of repository for specimens or sample materials if applicable:
Repository type: Will be destroyed through analysis or discarded after analysis
Objects collected:
Small soil samples will be collected for characterization and laboratory analysis. They will be destroyed as part of the analysis process. Samples will be around 50g each, with 1 to 5 soil samples being collected from each location. Gas samples will be collected and disposed of as part of the analytical process.

NPS General Conditions for Scientific Research and Collecting Permit (available at the RPRS HELP page) apply to this permit. The following specific conditions or restrictions, and any attached conditions, also apply to this permit:
Contact Integrated Resources Program Manager Erin Eichenberg (702-279-3009, erin_eichenberg@nps.gov) at least one week in advance to discuss access issues within Tule Springs Fossil Beds NM.

Avoid all cultural and paleontological resources in the sampling areas. If any resources are unearthed during sampling, work must stop and the Erin Eichenberg must be contacted immediately.

Use of "Geoprobe" machine will require an inspection by an NPS resource manager to ensure that the equipment is clean and free of any dirt or vegetation material, in order to prevent the introduction and spread of invasive species into the park. Contact Erin Eichenberg to schedule the inspection.

Recommended by park staff(name and title):

Reviewed by Collections Manager:

Yes____ No____

Approved by park official:

Date Approved:

Michael J. Boyko 6-19-18

Title:

Lands, Planning, and Compliance Specialist

I Agree To All Conditions And Restrictions Of this Permit As Specified
(Not valid unless signed and dated by the principal investigator)

(Principal Investigator's signature) 6-29-18 (Date)

THIS PERMIT AND ATTACHED CONDITIONS AND RESTRICTIONS MUST BE CARRIED AT ALL TIMES WHILE CONDUCTING RESEARCH ACTIVITIES IN THE DESIGNATED PARK(S)

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