

NEZ PERCE TRIBE
RADON MEASUREMENT
QUALITY ASSURANCE PROJECT PLAN



Nez Perce Tribe
Environmental Restoration & Waste Management Division
Air Quality Program
P.O. Box 365|109 Lolo St.
Lapwai, Idaho 83540

February 2022

I. APPROVAL SHEET

Organization: Nez Perce Tribe

Effective Date: 10/12/22

Approvals: The following individuals have reviewed and approved the **Radon Measurement Quality Assurance Project Plan** for the Nez Perce Reservation. By signing each person verifies that the document meets the requirements of 40 CFR 30, 31, and 35 for assistance agreements.

Nez Perce Tribe

Name: Aaron Miles, Sr.

Title: Department of Natural Resources Manager

Signature: **Aaron Miles,
Sr.**

Digitally signed by Aaron
Miles, Sr.
Date: 2022.10.06
15:13:51 -07'00'

Date: 10/6/22

Name: Jack Bell

Title: ERWM Division Director

Signature: **JackHBell**

Digitally signed by
JackHBell
Date: 2022.10.03
15:45:45 -07'00'

Date: 10/3/22

Name: Julie Simpson

Title: Air Quality Program Coordinator

Signature: **Julie D
Simpson**

Digitally signed by Julie D
Simpson
Date: 2022.09.29
13:50:07 -07'00'

Date: 9/29/22

Name: Johna Boulafentis

Title: Air Quality Program Environmental Specialist

Signature: **Johna
Boulafentis**

Digitally signed by Johna
Boulafentis
Date: 2022.09.29
13:37:10 -07'00'

Date: 9/29/22

United States Environmental Protection Agency – Region 10

Name: Will Wallace

Title: Quality Assurance Coordinator

Signature: **HENRY
WALLACE**

Digitally signed by
HENRY WALLACE
Date: 2022.10.12
07:34:53 -07'00'

Date: 10/12/22

Name: Vanessa Marshall

Title: State Indoor Radon Grants (SIRG) Program Project Officer

Signature: **VANESSA
MARSHALL**

Digitally signed by
VANESSA MARSHALL
Date: 2022.10.12
09:10:22 -07'00'

Date: 10/12/22

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II. ABBREVIATIONS, INTRODUCTION, AND DISTRIBUTION LIST

1. List of Abbreviations

AARST - American Association of Radon Scientists and Technologists
CoC – Chain of Custody
DQA – Data Quality Assessment
DQO – Data Quality Objectives
EPA – Environmental Protection Agency
ERWM – Environmental Restoration and Waste Management Division
LT – Long Term (radon measuring device)
NPT – Nez Perce Tribe
NPTAQP – Nez Perce Tribe ERWM Air Quality Program
NRPP - National Radon Proficiency Program
pCi - picoCuries
QA - Quality Assurance
QAPP – Quality Assurance Project Plan
SIRG – State Indoor Radon Grants Program
SOP – Standard Operating Procedures
ST – Short term (radon measuring device)

2. Introduction

This Quality Assurance Program Plan (QAPP) is consistent with the guidance issued by the U.S. Environmental Protection Agency (EPA Interim Guidelines for Preparing QA Plans [EPA 1980]; EPA Requirements for QA Project Plans [EPA 1992a]). This Plan is formatted in a way that allows Nez Perce Tribe Air Quality Program (NPTAQP) staff to reference easily pertinent portions of this document. The 16 elements recommended by the EPA (EPA Interim Guidelines for Performing QA Plans [EPA 1980]) are all included although some have been combined. The nomenclature used in this QAPP is appropriate for the operations of Environmental Programs, and every effort has been made to maintain consistency with the latest EPA guidance (QA Guidance for RMP Participants [EPA 1993 draft]).

3. Distribution List

The final version and all subsequent revisions of the Radon Measurement Quality Assurance Project Plan for the Nez Perce Reservation will reside in the NPTAQP office. The NPTAQP Coordinator will distribute copies, either in an electronic or printed format, to anyone who requests a copy and to the following people:

Julie Simpson
Nez Perce Tribe, ERWM Air Quality Program Coordinator
julies@nezperce.org

Vanessa Marshall
EPA R10, SIRG Project Officer
marshall.vanessa@epa.gov

Will Wallace
EPA R10, Quality Assurance Coordinator
wallace.will@epa.gov

III. PROJECT ORGANIZATION | RESPONSIBILITY

The Radon Measurement Program will be managed and implemented by the NPTAQP, with reliance on an independent laboratory for analytical services.

The specific responsibilities and tasks of each organization are shown below.

1. EPA Region 10

Responsible for QAPP review, technical assistance and approval of the QAPP for implementation.

2. Nez Perce Tribe

NPTAQP Coordinator: Responsible for project oversight and coordination, internal approval and submission of QAPP, and approval of monitoring data.

NPTAQP Environmental Specialist: Responsible for identifying tribal housing for testing and re-test determination, test kit deployment, retrieval and shipment to the laboratory; creation and maintenance of a radon database results and compiling results and reporting to Nez Perce Tribe Housing Authority and residences.

3. Independent Laboratory

Air Chek, Inc. and RSSI will provide analysis of radon test kits. Each laboratory has key individuals identified and tasked as the Quality Assurance Officers and Program Managers. These individuals are responsible for insuring that appropriate and consistent methods are followed at each laboratory. EPA does not endorse any products or commercial services used in this QAPP.

A. *Short Term Measurements*

- Test devices and laboratory services will be provided by Air Chek, Inc. of Mills River, North Carolina.

- Air Chek, Inc. is a privately held corporation. The company's organization and employee responsibilities may be reviewed in the *Standard Operating Procedures and Quality Assurance Plan and Appendices*, which is attached to this QAPP, Appendix A.
- This device is approved by the nationally recognized American Association of Radon Scientists and Technologists - National Radon Proficiency Program (AARST-NRPP): Device # 8200, Device Group 20 AC, Air Chek Foil Bag Test Kit.

B. *Long Term Measurements*

- Test devices and laboratory services will be provided by RSSI of Morton Grove, Illinois. The test devices will be ordered through Air Chek, Inc., see above.
- RSSI is a privately held corporation. The company's organization and employee responsibilities may be reviewed in the *Standard Operating Procedures and Quality Assurance Plans*, which is attached to this QAPP, Appendix B.
- The device is approved AARST-NRPP: Device Code # 8207, Device Group 24 AT, RSSI AT-101 Alpha Track Detector

C. *Spike Testing Lab*

- Charcoal tests will be sent to the *Kansas State University Radon Chamber* for spike testing.
- The *Kansas State University Radon Chamber* is a Certified Radon Test Chamber through ARRST-NRPP for testing devices with a known radon quantity. The QA Program document and *Standard Operating Procedures* is attached to this QAPP, Appendix C.

IV. PROBLEM DEFINITION | BACKGROUND

The 1863 Nez Perce Reservation, located in the lower Clearwater River basin of North Central Idaho, is over 770,000 acres/1,200 square miles and crosses five Idaho counties; Clearwater, Idaho, Latah, Lewis, and Nez Perce. Over 18,000 people; **1,200** tribal members live on the Reservation. Landscape is a plateau-valley terrain with the valleys prone to atmospheric inversions and the consequent trapping and concentration of air pollutants. Terrain effects can combine with weather effects (humidity variations, high-pressure stagnation) and/or seasonal source emissions (woodstoves, wildfires) to occasionally cause hazy conditions and elevated levels of particulate matter. In the case of wildfire smoke events, elevated levels of particulate matter can become extreme and prolonged.

Radon is a colorless, odorless radioactive gas that is released from the natural breakdown of uranium in soil, rock and, to some extent, water. It is considered to be the second leading cause of lung cancer in the United States, responsible for approximately 21,000 lung cancer deaths per year. The only way to know if a building has radon is to test.

V. PROJECT | TASK DESCRIPTION

This project involves the measurement of radon within Nez Perce Tribal Housing Authority homes and tribally owned public buildings. This project is designed to assess initial radon levels and identify potential risk to the tribal community. In addition, voluntary residential testing would be for homeowners or residents who are concerned about the radon levels in their living space.

The radon measurements will be performed with either short-term or long-term devices. Initial measurements will be conducted with short-term tests. To provide maximum environmental health protection for the tribal community, the residential and school standard will also be applied to public buildings. The laboratory results will be compared to the EPA's recommended action level of 4 picocuries per liter (pCi/L) of air. Homes or public buildings that possess analytical results of 4 pCi/L or greater will be subject to a follow-up test (if a side-by-side test was not performed).

This follow-up test will be made by either using a short-term device (the same type), or a long-term device at the same location using the following protocols. If the initial short-term test result is greater than 4 pCi/L and less than 8 pCi/L (between 4 and 8 pCi/L), a follow-up long-term test will be conducted. If the long-term radon measurement is greater than 4 pCi/L, radon mitigation recommendations will be provided to the building manager or homeowner. If the initial short-term test result is greater than 8 pCi/L, a follow-up short-term test will be conducted. If the average of the two short-term test results remains higher than 4 pCi/L, radon mitigation recommendations will be provided to the building manager or homeowner (*Protocols for Radon and Radon Decay Product Measurements in Homes*, USEPA. EPA 402-R-92-003. May 1993).

The table below lists the projected type of device quantities and the buildings to be surveyed. The total number of devices is 155, this includes amount needed for QA activities.

Table 1: Projected Locations and Device Quantities by Type

Type of Device	Residences/Buildings	Number of Devices
Short-term	Residence	100
	Buildings	45
Long-term	Residences	5
	Buildings	5
Total		155

VI. PROJECT OBJECTIVES

1. Problem Statement

Radon, a naturally-occurring radioactive gas in the environment, can be trapped in buildings and elevated levels result that pose an increased lung cancer risk to the population living within. Smokers face an increased risk (6.2 per cent at the exposure of 4 pCi/L, and the risk increases with increased radon exposure levels). Smoking rates are nearly ten per cent higher among American Indians/Alaska Natives than among the general population (American Lung Association, June 2007), therefore tribal members who smoke are more susceptible to health risks when living in a house with higher radon levels.

2. Decision

The project is intended to assess the levels of radon and/or radon decay products in homes and public buildings on the Reservation. The results will be used to provide the NPTAQP with the necessary information to make informed recommendations to participating residents and public building managers regarding indoor air quality and potential mitigation procedures.

3. Inputs to Decision

A. *Short-term Device*

Short-term (3 to 7 day exposure duration) activated charcoal devices will be used to measure the radon concentrations in homes and public buildings. Depending on initial laboratory results an additional short-term test or a long-term test will be deployed for follow-up testing, see Section V.

B. *Long-term Devices*

Alpha-track devices will be deployed for long-term (91 to 364 day exposure duration) radon measurements in homes and public buildings as primary testing or follow-up testing, on a case-by-case basis. Long term devices do not require closed-building conditions and therefore radon measurements will occur under normal living conditions. These devices are also considered more reliable than short term devices; a longer time corresponds to more recordable decays from radon and its decay products.

4. Study Boundaries

The project is limited to participating tribal member homes and tribally-owned public buildings on tribal lands. At each measurement location, a device will be placed twenty inches to six (6) feet above the floor in the lowest living area of the home or building.

The device's opening will face toward an open area of the room, and will be placed at least four (4) inches from other objects. The detector will be placed at least 12 inches from the outside walls of the building, and no less than 36 inches from any opening in the outside walls, such as windows or doorways.

5. Decision Rule

If the results of the mitigation measurement exceed the U.S. EPA recommended action level of 4 pCi/L, appropriate mitigation strategies will be suggested to the resident or building manager.

6. Limits on Decision Errors

Homes or buildings that exhibit analytical results that exceed the U.S. EPA recommended action level of 4 pCi/L will be offered a second, follow-up test (*Protocols for Radon and Radon Decay Product Measurements in Homes*, USEPA. EPA 402-R-92-003. May 1993). This follow-up test will either be made using a short-term device (the same type) or a long-term device at the same location following the protocols in this document.

If the initial short-term test result is greater than 4 pCi/L and less than 8 pCi/L (between 4 and 8 pCi/L), a follow-up long-term test will be conducted. If the long-term radon measurement is greater than 4 pCi/L, radon mitigation recommendations will be provided to the building manager or homeowner. If the initial short-term test result is greater than 8 pCi/L, a follow-up short-term test will be conducted. If the average of the two short-term test results remains higher than 4 pCi/L, radon mitigation recommendations will be provided to the building manager or homeowner.

7. Design for Obtaining Data

Tribally-owned public buildings and participating tribal households will be measured for radon and/or radon decay products.

VII. SPECIAL TRAINING REQUIREMENTS | CERTIFICATION

The NPTAQP Environmental Specialist successfully completed the 16-hour Radon Measurement Proficiency Course offered by the Midwest Universities Radon Consortium – Kansas State University in January 2021. Other NPTAQP staff involved in the radon measurement efforts would be under the guidance of the Environmental Specialist.

VIII. DOCUMENTATION AND RECORDS

The NPTAQP Coordinator is responsible for ensuring that the most current copy of the QAPP (draft or approved status) is available to project personnel, the EPA R10 Quality Assurance Coordinator, the EPA R10 SIRG Project Officer, and others identified in Section

III. The current version of the QAPP will be identified in the upper right hand corner of each document page.

The NPTAQP Environmental Specialist will ensure that data is recorded appropriately on the test devices and on field data collection sheets (Appendix D). The NPTAQP Environmental Specialist is responsible for the maintenance of all documents, records and laboratory analytical results. The documentation will be kept in Department files for at least five years.

1. Device Deployment | Retrieval Records

The test device has a unique number that will be recorded onto the data sheets. An in-house field data collection form has been developed for use during the deployment and retrieval of the test devices, and another spreadsheet/form will have the same information and be a single sheet with the unique number of the sampling device. The form will include the name of the homeowner or building, address, location of the device, start date and time, stop date and time, the serial number of the device, temperature and any additional information that is pertinent to the test site (such as evidence of tampering or whether “closed-building” conditions exist in the case of short-term deployment). This documentation will demonstrate that proper sampling protocol was performed in the field.

2. Sample Tracking Records

Chain-of-custody forms from the specific radon measurement device companies will be used for this project. It is important that radon test devices not be exposed to outdoor air without being closed, that radon test devices not be tampered with during exposure, and that devices are sealed properly at the end of the testing period. Devices will be shipped out by the following day to the analytical laboratory with next day or two-day delivery. Using a delivery company’s tracking records, the delivery receipt of the device(s) received by the laboratory will be recorded. A log will be used to record device shipments and shipping labels will be kept in the NPTAQP files (this may be an electronic spreadsheet file).

3. Analytical Data

Air Chek, Inc. and RSSI will provide the analytical data to the NPTAQP Environmental Specialist. These reports will be reviewed, evaluated, and if appropriate, recommendations will be made for re-testing. All data will be kept confidential and shared only with the homeowner or building manager for privacy purposes. The information will be stored in spreadsheet format, which is accessible only to NPTAQP staff members working from this QAPP.

IX. SAMPLING METHODS REQUIREMENTS

The NPTAQP Environmental Specialist and/or building manager will decide whether to implement a short-term or long-term measurement device for the structure(s) for radon measurement. For the short-term testing method closed-house conditions must be practiced: testing occurs with no house ventilation for a period of 3 to 7 days, with an additional 12 hours prior to the device deployment. Radon fluctuates diurnally, seasonally, and with changes in weather patterns, and these details may be over-inflated or under-inflated within a short duration. Measurements less than four days in length should not be made if high winds (greater than 30 mph) or rapidly changing barometric pressure are predicted.

Long-term testing occurs for periods of 91 – 364 days with the radon fluctuations averaged over the testing period. Radon levels in structures can be close to background levels in the environment, and the longer the time period to collect the measurements, resulting in more data (more counting), and the minimum detectable activity level for radon is lowered for that sample. Long term testing is advantageous because radon fluctuations are considered in the measurement, and in the warmer months the residents do not have to have their windows and doors closed for the entire duration of the test.

EPA recommends that radon re-testing occur every five years. Re-testing should also occur in buildings that have been renovated or remodeled even if it has been less than five years.

1. Short-Term Devices (ST Devices)

For short-term testing, an Air Chek, Inc. short-term (3 to 7 day exposure duration) activated charcoal, diffusion barrier device will be used. The device is a foil bag uniquely numbered and filled with a preset amount of charcoal.

All participants will be reminded to make sure all external doors, windows and vents are kept closed beginning 12 hours before the start of the test period (closed-house conditions); written instructions will be left with the resident (Appendix D). Placement of the packets will follow the protocols provided by Air Chek, Inc. and the 1992 EPA document entitled *Indoor Radon and Radon Decay Products Measurement Device Protocols*.

2. Long-Term Devices (LT Devices)

The Alpha Track AT-101 Radon Detector from RSSI will be deployed for all long-term tests. These devices contain a detector element called a foil. When radon atoms decay inside the detector, they release alpha particles. If the alpha particles strike the foil, they make microscopic tracks in the surface of the foil. Placement of the devices will follow the protocols provided by manufacturer and the 1992 EPA document entitled *Indoor Radon and Radon Decay Products Measurement Device Protocols*.

X. PROCEDURES

These procedures will be followed for the short-term (ST) and the long-term (LT) devices. NPTAQP staff will ensure that the kits are in good working order. Prior to sampling event, all test kits will be inspected in accordance with manufacturers' specifications. All radon test kits will be inspected to ensure that expiration dates have not been exceeded.

1. Location Selection for ST and LT Devices

- Each test device will be placed within the lowest level that contains a room that is used regularly (no closets or storage rooms).
- A position should be selected where the detector will not be disturbed during the measurement period and where there is adequate room for the device.
- The device should not be placed in areas near drafts caused by heating, ventilation and air conditioning vents, doors, fans and windows. Additionally, areas near excessive heat, such as fireplaces and direct sunlight, and areas of high humidity (kitchens, bathrooms, laundry rooms) should be avoided.
- The device locations should not be less than three (3) feet from windows or other openings in an exterior wall. If there are no openings along the exterior wall, the test device should be placed at least 12 inches from the exterior wall.
- The device must be placed 20 inches from the floor, and 4 inches from other objects. It will be suspended from the ceiling or an interior non-masonry wall.

2. Preparation of ST and LT Devices

- Record the test device serial number on the field data form, along with the resident's name and address or building and room name.
- Remove all packaging.
- Copy the number of the device onto the field data form.
- Record the necessary information onto the test kit, or corresponding data form.
- Record: test begin time, test end time, day, month, and year onto the field data form.
- Record the selected location for the test device deployment on the field data form and mark placement on diagram of building or home section of the field data form.
- Deploy device per manufacturer's instructions.

3. Placement of ST and LT Devices

- Do not place the test devices within three feet of another device. (Exception: Two devices may be placed within four inches of one another for quality control purposes.)
- Open device.
- Verify that the open end of the device is not obstructed from the ambient room air.

4. Retrieval of Devices

A. *Retrieval of ST Devices*

- Each test device will be retrieved no earlier than three (3) days, and no later than seven (7) days, after its deployment.
- **Do not remove the test device from the area until it has been sealed.**
- Inspect the area for deviations of conditions that had been noted on the field data form at the time of deployment.
- Record the test end time hour, day of the month, and average room temperature on the field data form and device package.
- Verify that the device is sealed **air-tight**. Repair any tears or unsealed flaps with a small piece of plastic tape or cellophane tape.
- Mail each test device to Air Chek, Inc. within 24 hours of its retrieval from the test location, following the manufacturer's direction, using the Chain of Custody Form (Appendix A).
- Record the delivery location, date, and time the test device was mailed on the field data form (these data may all be on the same form or single entry if the dates are identical).

B. *Retrieval of LT Devices*

- Each test device will be retrieved no earlier than 91 days, and no later than 364 days, after its deployment.
- **Do not remove the test device from the area until it has been sealed.**
- Inspect the area for deviations of conditions that had been noted on the field data form at the time of deployment.
- Record the test end time hour, day of the month and year, on the field data form and associated RSSI form.
- Mail each test device to RSSI after its retrieval from the test location, following the manufacturer's directions (Appendix B).
- Record the delivery location, date, and time the test device was mailed on the field data form (these data may all be on the same form).

Any issues or problems encountered with the device installment, collection, or retrieval will be noted. Decisions on whether data will be valid will be made by the NPTAQP Environmental Specialist with professional documented justification (this may include discussion with analytical laboratory). Retesting is another option and easily can be performed.

XI. SAMPLE HANDLING AND CUSTODY REQUIREMENTS

All participant homes and tribal-owned facilities will be tested using a dedicated testing device with a unique, pre-printed serial number for proper identification. NPTAQP staff is responsible for documentation and for the care and custody of the test device samples,

including transport of the exposed devices to the delivery or post office for mailing to Air Chek, Inc. or RSSI for analyses. Each test device will be delivered to Air Chek, Inc. or RSSI with next day or two-day delivery requirements. (Chain-of-custody documentation is not required for this part of the project because Air Chek, Inc. and RSSI will be responsible for logging and storage of the exposed test devices according to their standard procedures.)

XII. ANALYTICAL METHODS REQUIREMENTS

Air Chek, Inc. will analyze all devices at their analytical laboratory in Mills River, North Carolina, and RSSI will have their devices analyzed at their laboratory in Morton Grove, Illinois. All devices will be analyzed in accordance with the procedures outlined in the respective laboratories' QAPP and/or Standard Operation Procedure (SOP) documents attached to this QAPP as Appendix A and B.

XIII. BACKGROUND METHODS REQUIREMENTS

Field blanks are devices, which are not exposed in the field, but sent to be analyzed with field exposed devices, to ensure no false positives. Field control detectors (field blanks) deployed should be a minimum of five percent (1 in 20 deployed). These devices should be set aside and kept sealed in a low radon environment, then labeled in the same manner as the field detectors to ensure equal processing during the manufacturer's analysis. These control devices measure the background exposure that may accumulate during shipment or storage and results should be recorded. If the field control detector have concentrations significantly greater than the LLD established by the supplier, it may indicate defective devices or poor procedures. For controls being significantly greater than the LLD, the average value of the field controls should be subtracted from the reported field detector concentrations and the supplier notified of a possible problem. The packets should result in background radon levels, or at least less than 1.0 pCi/L.

XIV. QUALITY CONTROL REQUIREMENTS

The quality assurance objectives for this project are to develop and implement procedures for field sampling, laboratory analyses, and reporting that will provide high quality, reliable results. Specific procedures regarding these items are presented in other sections of the QAPP.

1. Precision

Precision is a measure of the degree to which two or more measurements are in agreement. Field precision is assessed through the collection and measurement of field duplicates or replicates, which will be deployed for 10 per cent of total locations per year. Total precision is a measurement of the variability associated with the entire sampling and analytical process. It is evaluated through the analyses of duplicate or replicate field samples and measures the variability introduced by both the laboratory and field

operations. One field duplicate device will be exposed for every ten primary device exposures.

Duplicate results will be assessed using the relative percent difference (RPD) between duplicate device measurement concentrations. For duplicate measurements, the RPD will be calculated per *Equation 1*.

$$\text{Equation 1: } \text{RPD} = \frac{(D1 - D2) \times 100\%}{(D1 + D2) / 2}$$

Where RPD = relative percent difference

D1 = sample1 value

D2 = sample2 value

The objective for the precision of radon concentrations using Air Chek, Inc. devices at or above 4 pCi/L is at least 25 percent relative difference. The results will be graphed.

Duplicate pairs with an average less than 4 pCi/L are not considered because of the inherent limitations of measurement devices at radon concentrations below 4 pCi/L of air. If the average of each duplicate pair is below 4 pCi/L, assume that the precision of the duplicate measurements is acceptable given the measurement device's limitations.

2. Accuracy

Accuracy is the degree of agreement between an observed value and an accepted reference value. Accuracy in the field is assessed through the adherence to all sample collection, handling, preservation, and holding times. Laboratory accuracy is assessed through the analysis of matrix spikes or standard reference materials, and the determination of percent recoveries. This procedure will be performed by the Air Chek, Inc. and RSSI laboratory, according to their QA procedures.

A. Spike Testing for School Measurements

If the short-term devices are used for radon measurements in schools, then another accuracy quality assurance procedure is required. This is exposure of the devices to a known quantity of radon or a spike test. The procedure entails sending detectors to a laboratory where they are exposed to radon gas which is in a known concentration. The detectors are then resealed just as they would be in the field. The detectors are returned to NPTAQP and repackaged and sent to the Air Chek, Inc. for radon concentration analysis. This test should be performed on three devices for every 100 devices deployed each year. The results of the spike tests should be within 25% of the known exposure, using the Per Cent Difference calculation, Equation 2 below. The spike test difference will be presented as an absolute value.

Equation 2:

$$\% D = \frac{MV - RV}{RV} \times 100$$

Where : %D (absolute value of) per cent difference

MV = Measured value

RV = Reference value

The charcoal devices will be sent to the Kansas State University *Radon Chamber*. The ARRST-NRPP has approved this lab for spike testing devices with a known radon quantity. The *Standard Operating Procedures (SOP)* is attached to this QAPP (Appendix C). (This same analysis may also be used for the ST/LT testing devices for the residences or tribal buildings should funding allow.)

3. Representativeness

Representativeness expresses the degree to which data accurately and precisely represents a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition. It is dependent on the proper design of the sampling program and will be satisfied by ensuring that the field sampling plan is followed and that proper sampling techniques are used. The NPTAQ Environmental Specialist will ensure that all EPA radon testing protocols for deployment and retrieval of activated charcoal radon detection devices, as listed in Section X are followed.

Representativeness in the laboratory is ensured through the use of proper analytical procedures, analyses of samples within holding times, and analyses and assessment of field duplicate samples when they are used.

4. Comparability

Comparability is an expression of the confidence with which one data set can be compared with another. It is dependent on the proper design of the sampling program and will be satisfied by ensuring that the field sampling plan is followed and that proper sampling techniques are used. Planned data is comparable when similar sample collection and analytical methods are used and documented in the QAPP. This QAPP addresses comparability by specifying appropriate field methods and presenting the Air Chek, Inc. laboratory protocols in their QA documents.

5. Completeness

Completeness is the amount of valid data obtained compared to the amount that was expected to be obtained under normal conditions. The number of valid results divided by the number of planned data points, expressed as a percentage, determine the

completeness of the data set. Completeness for this project is not specified since the number of data points is contingent upon voluntary participation.

6. Corrective Action and Report

The NPTAQP will investigate and establish a corrective action if any of the following occurs:

- duplicates fail to meet the coefficient of variations criteria,
- it is reported that EPA protocols were not followed,
- results for spikes are not evaluated within the accuracy and precision limits,
- blanks are below instrument detection limits,
- detectors are lost,
- information reported for the exposures is incomplete, or
- if someone in the group finds other issues.

A corrective action report will document the tracking and progress of the corrective action, including the following:

- Description and date of the problem
- Person who identified problem
- Person doing corrective action
- Target date of solution
- Reporting of status
- Nature and date of solution

XV. INSTRUMENTATION/EQUIPMENT TESTING, INSPECTION AND MAINTENANCE RECORDS

There is no specialized field equipment necessary to implement the device deployment/retrieval phase of this project. Each device will be evaluated for suitable use prior to deployment as specified in Section X. The Air Chek, Inc., and RSSI technical staff will be responsible for all laboratory instrument and equipment tests, inspections and maintenance.

XVI. INSTRUMENT CALIBRATION AND FREQUENCY

Air Chek, Inc., RSSI, and KSU Radon Chamber will be responsible for the calibration of all analytical instruments. The calibration procedures are described in their SOPs and/or QA documents.

XVII. INSPECTION/ACCEPTANCE REQUIREMENTS FOR SUPPLIES

Each device will be evaluated for suitable use prior to deployment as specified in Section X by the NPTAQP staff. Air Chek, Inc., RSSI, KSU Radon Chamber will be responsible for inspection and acceptance determination of any supplies used in their laboratory.

XVIII. DATA MANAGEMENT

An in-house field data form that includes the name of the homeowner or renter, address, location of the device, start date and time, stop date and time, device ID number, temperature (short-term only) and any additional information that is pertinent to the test site will be the initial documentation for all test devices deployed. The information will be transferred to an Excel spreadsheet by the NPTAQP Environmental Specialist as the tests are completed. The forms will be kept on file at the NPTAQP office, either physically or electronically (Air Quality Shared Drive) for at least three years. Backup files will be managed on an external drive, staff computers, or USB. This drive is accessible only to NPTAQP personnel.

Analytical data will be submitted to the NPTAQP Environmental Specialist by Air Chek, Inc. or RSSI, for evaluation and/or recommendation for re-testing, as appropriate. The information will be added to the Excel spreadsheet database and the accuracy of previously transferred data will be verified at that time. All residential data will be kept confidential and will be shared only with the homeowner or building manager for privacy purposes. Data will be handled and controlled by the NPTAQP staff. Any mapping or correlation with i.e., geological data will be strictly internal. Tribal office data will be released to building manager/ Division Director.

Any Personnel Identifiable Information (PII) will not be shared. The PII collected will be protected and securely stored. (This information includes name, phone number, and address). Any radon levels for public display will be aggregated to the zip code level prior to public release.

XIX. ASSESSMENTS AND RESPONSE ACTIONS

No external audits are planned for this program. The NPTAQP Environmental Specialist will ensure that the elements of the QAPP are implemented as prescribed. Assessment of testing device deployment, retrieval, and scheduling and data management will be periodically performed via discussions between the NPTAQP Coordinator and the Environmental Specialist. Any need for corrective action will be identified during these reviews and implemented immediately.

All laboratory assessments and corrective actions will be performed by Air Chek, Inc. or RSSI according to their SOPs and QAPP documents.

XX. REPORTS TO MANAGEMENT

Programmatic and financial status reports will be submitted to the SIRG Project Officer in accordance with the terms and conditions of the grant.

XXI. DATA VALIDATION AND USABILITY

AQ staff will use protocol outlined in Sections IX and X of this document that outline the details necessary for the consistent deployment, retrieval and sample shipment methods. Adherence to the stated protocols will ensure the data's usability from a field collection standpoint.

Laboratory data validation procedures at Air Chek, Inc. or RSSI, outlined in their SOPs and/or QAPP documents. The laboratory will provide notice with, or in lieu of, the analytical results with respect the data's accuracy or validity. These notices are related to the following conditions noted by the laboratory on receipt of the testing devices:

- Time elapsed since close of the test and receipt at the laboratory.
- Exposure to excessive moisture.
- Exposure to extreme temperatures.
- Insufficient information supplied with the device.
- Improperly sealed devices.
- Device expiration date.

These notices will be reviewed to assess the usability of an individual analytical result by the NPTAQP staff.

XXII. RECONCILIATION WITH DATA QUALITY OBJECTIVES

Data quality assessment (DQA) follows the data validation and verification steps. As such, DQA determines how well the validated data can support their intended use. The NPTAQP Environmental Specialist will evaluate the data to determine if it will meet the data quality objectives outlined in Sections IX and XIV.

XXIII. REFERENCES

EPA, 1992. Indoor Radon and Radon Decay Products Measurement Device Protocols.
https://archive.epa.gov/epa/sites/production/files/2019-07/documents/indoor_radon_and_radon_decay_product_measurement_device_protocol.pdf

EPA, 1993. Protocols for Radon and Radon Decay Product Measurement in Homes.
<https://archive.epa.gov/epa/protocols-radon-and-radon-decay-product-measurements-homes.html>

EPA, 1993. Radon Measurements in Schools. <https://archive.epa.gov/epa/iaq-schools/radon-measurement-schools-revised-edition.html>

EPA, 2016. A Citizen's Guide to Radon: The Guide to Protect Yourself and Your Family from Radon. https://www.epa.gov/sites/default/files/2016-12/documents/2016_a_citizens_guide_to_radon.pdf

EPA, 2018. Home Buyer's and Seller's Guide to Radon.
<https://www.epa.gov/sites/default/files/2015-05/documents/hmbuygud.pdf>

Knapp, Sam, Jennifer Athey, and Art Nash Jr (State of Alaska), 2020. Understanding Your Radon Test Results. <https://dggs.alaska.gov/webpubs/dggs/ic/text/ic089.pdf>

Midwest Universities Radon Consortium, 2016. Radon Measurement Proficiency Course - Appendices

XXIV. APPENDICES

- A. Air Chek, Inc., QA Documents and Device Instructions for Short-Term Charcoal Device**
- B. RSSI, QA Program Documents and Device Instructions for the Alpha Track Long-Term Detector**
- C. Radon Chamber at Kansas State University QA Program and Standard Operating Procedures**
- D. NPTAQP Radon Device Forms for Houses or Buildings:**
 - **Field Data Sheet**
 - **Radon Test Information/Agreement & Door Hanger**
 - **Radon Measurement Data and Analysis Spreadsheet**