Appendix A-7

Response to NDEP Comments on SOP-16 Flux Chamber Source Testing dated January 25, 2008

GENERAL COMMENTS

1. The NDEP understands and appreciates that BRC is in the process of obtaining and testing the PTG-7RN (real time) radon detector and associated interface methods with the surface flux chamber. As the current SOP-16 is written, there are a number of radon methods that may be used, including static versus dynamic charcoal-based methods and dynamic PTG-7RN methods (and combinations thereof), and it is difficult for the NDEP to separate out the methods in the various discussions, as written. We recommend that the charcoal and PTG-7RN methods be briefly described (citing the associated guidance) up front in the current SOP (e.g., p. 3), with a statement that the final method will be identified following field verification studies. We recommend that the more detailed discussions regarding radon flux methods (e.g., bottom of p. 5 to top of p. 6 and Sections 2.2, 2.4, 5.1, 5.3 [radon components], and 9.4) be deleted until the final method is identified. It is simply too confusing to follow the methods, and combinations of methods, that are being proposed as it is currently written.

Response: *The manufacturer of the PTG-7RN has indicated a delivery date of mid-February, at which time (as schedule allows), the analyzer will be evaluated and field tested against the activated charcoal (AC) canister technique for assessing exposure to radon. As background, there are two radon detection techniques (AC canister integrated sampler and PTG-7RN real time analyzer) and two flux chamber technologies (static chamber- AKA 5-gallon bucket and the USEPA dynamic flux chamber.). Both detection techniques can be used in both chamber technologies, and the SOP-16 document reflects that. However, it is BRC's hope that we will be able to dismiss the AC canister (integrated technique) and be able to obtain valid radon flux data from the USEPA flux chamber and real time analyzer (PTG-7RN) combination. So, after successful completion of the demonstration of the real time analyzer, we plan on revising the SOP-16 document to only include the USEPA dynamic flux chamber and real time analyzer for all on and off site applications. Therefore, it would make sense to hold off on the revision of the SOP-16 document until we have evaluated the real time analyzer, which greatly improves the APA and will allow for a streamlined SOP-16.*

BRC suggests a meeting or teleconference between Dr. Schmidt, BRC, NDEP, and NDEP's consultant to discuss the procedure to be used to verify that use of the PTG-7RN detector for radon flux will work for the project. A conceptual approach has been developed that collects side-by-side radon flux from two measurement approaches at the same three locations over a potential radon gas emitting source; dynamic flux with the radon monitor, and static flux with integrated, activated charcoal canister sampling. The test includes identifying three 'near-by' locations at one site, setting out the 5-gallon bucket static chamber equipped with two activated charcoal canisters each and securing the buckets for a 48 hour integration or exposure time-period. During this time period, the dynamic flux chamber will be used to measure the flux at each location three times per day over the two days. The average of the 'within one day' and *'day-to-day' real time flux will be compared to the average of the replicate charcoal canister flux at each location. This will determine the comparability of the measurement methods, which assumes that the close proximity of the test location by each method is not a factor in the analysis. The added benefit of this approach is that the variability of radon flux, both within day and day-to-day variability, can be examined by reviewing the real time flux data collected with the dynamic flux chamber and the radon monitor. It is proposed that the testing take place on the BRC Eastside property.*

2. NDEP requests a discussion regarding the verification testing of the PTG-7RN real time methodology. This discussion should include, reviewing the scope of the work plan and a follow up to discuss the results of the verification testing.

Response: *A work plan for assessing efficacy of using the PTG-7RN radon detector (real time instrument), is attached. It describes the operation of the PTG-7RN and the scope of work intended for the demonstration of the efficacy of the measurement approach. Basically, the verification testing will challenge the analyzer against static chambers placed on a potential radon source onsite. The plan is to place three static chambers on a potential radon source for a 48-hour time period as per the operation of the AC canisters technique, and concurrently perform multiple dynamic flux chamber measurements adjacent to the static chambers at multiple times per day for the two day time period. An evaluation of the techniques will be made by comparing the results of the assessment with the static chamber and AC canisters to the radon count in the dynamic flux chamber averaged over the time interval.*

Note- the PTG-7RN is a simple ion chamber that works like a Geiger Counter. Energy particles emitted from the source are detected as radon gas over an integration period of no more than one-hour. The advantage of the real time instrument is that a sensitive assessment of radon gas can be made over a short time constant, which will allow field testing to occur without having to leave static or dynamic chambers on test locations over the 48-hour time period needed for the AC canisters. Give the sensitivity of the instrument, which counts single energy particles, it is possible that a shorter sampling interval can be used for the field assessment provided that a minimum ion count is achieved per test location.

SPECIFIC COMMENTS

1. Table of Contents, Section 9.3.2 – Please add the term "SIM" in the title of this section (please make the same edit for body of text section title). This is a global edit which needs to be carried through the document and will not be repeated for every instance.

Response: *Agreed. The TO-15 full scan and TO-15 SIM analysis will be properly identified throughout the SOP-16 document.*

2. Section 1.0 Introduction, page 1, second paragraph, 6th line, Please delete the words "static chamber", as this sentence refers to the flux chamber program in general.

Response: *Agreed. The words 'static chamber' have been deleted from this sentence.*

3. Section 2.0, page 3, second full paragraph, 4th line, Following the statement "…based on the soil matrix data", please add "and/or groundwater data".

Response: *Agreed. this text has been added to this sentence.*

4. Table 1, page 10, please note in the table that the "22 target compounds" method is TO-15 SIM.

Response: *Agreed. 'SIM' has been added to this section of the table.*

5. Section 9.3.1, USEPA Method TO-15, Canister Sampling Gas Chromatograph/Mass Spectroscopy (GC/MS) for VOCs, please provide a list of the 16 TO-15 analytes that will not be tested for, as well as rationale for their exclusion.

Response: *The 16 analytes not included have been listed, as well as the rationale for their exclusion. Basically all 16 analytes are not considered site-related chemicals (SRCs) for the project.*

6. Table 6, page 32, please provide rationale for the SIM compounds (e.g., the TO-15 reporting limits without SIM that exceed risk-based levels). Please identify why non-carcinogens such as TEX are included on the SIM list.

Response: *The TO-15 SIM compound list has been revised to include those chemicals which do not reach target reporting limits. See also response to specific comment 6 below.*

7. Section 16.0, References, Please delete the USEPA 1999 reference for TO-14.

Response: *Agreed. Reference to USEPA 1999 has been deleted.*

APPENDIX A-6, Response to NDEP Comments dated December 11, 2007:

Specific Comment 3 (Please identify the TO-15 analytes that will not be reported and provide rationale for excluding them from flux chamber investigations). This comment was not adequately addressed. Please create a table of the 16 TO-15 analytes and list, for each one, the rationale for excluding the analyte from the site testing program.

Response: *See response to specific comment #5 above.*

Specific Comment 6 (Please provide rationale for the analytes listed for SIM analysis, as well as the need for the RLs listed). This comment was not adequately addressed. Please create a table of the 22 target SIM analytes listed in the current Table 6, and document that TO-15 (no SIM) RLs are inadequate for these analytes. The criterion for SIM analysis is that, without the SIM, RLs do not meet risk-based targets.

Response: *Attachment 4 has been added to the SOP to demonstrate which of the analytes need TO-15 SIM analysis in order to meet reporting limit requirements.*

SAMPLING AND ANALYTICAL PROTOCOL (SAP) FOR THE VERIFICATION TESTING OF THE PTG-7RN RADON DETECTION ANALYZER

DRAFT (Version 1)

February 2008

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TABLE OF CONTENTS

1.0- INTRODUCION

2.0- PARCEL NUMBER AND LOCATION

3.0- SAMPLE COUNT

4.0- SAMPLE FREQUENCY

5.0- SAMPLE COLLECTION

6.0- RATIONAL FOR SAMPLE COLLECTION

7.0- LOCATION OF SAMPLE COLLECTION

8.0- SAMPLE ANALYSIS

1.0- INTRODUCTION

The Sampling and Analytical Protocol (SAP) describes the sampling and analysis design for assessing efficacy of using the PTG-7RN radon detector (real time instrument) as part of the on site and off site assessment of radon flux. The measurement of radon gas flux is part of the project Air Pathway Analysis (APA) for the site and surrounding area. The SAP refers to and relies on the Standard Operating Protocol (SOP) Number 16 (SOP-16, August 15, 2007 for technical description of sampling and analytical methodology, quality assurance/quality control protocols, and project procedural description.

The sampling procedures for this method validation effort include the U.S. Environmental Protection Agency (USEPA) surface emission isolation flux chamber[1] (flux chamber) and a static chamber sampling technique to perform an APA[2] on the Western Offsite Residential area and on various parcels on site. This purpose of this effort is to evaluate and verify the most effective field assessment protocol for detecting and quantifying radon flux. This SAP was prepared for Basic Remediation Company (BRC) with the intent to collect data that can be used to assess radon gas flux as related to the potential the transport of radon gas and exposure to radon (related to the groundwater contamination) via the subsurface air pathway. BRC plans to use the results of the verification study to promote the optimum flux chamber assessment approach supporting an exposure assessment for radon gas as it pertains to current (off site) and future land use scenario (residential and commercial neighborhood) of site parcels. A description of the history, background, and operation of the USEPA-recommended flux chamber flux chamber technology and the static chamber technique, along with sampling and analytical potocol, sampling strategy, quality control requirements, and sample management protocol, is provided in SOP-16.

A conceptual approach has been developed that collects side-by-side radon flux from two measurement approaches at the same three locations over a potential radon gas emitting source; dynamic flux with the radon monitor, and static flux with integrated, activated charcoal canister sampling. The test includes identifying three 'near-by' locations at one site, setting out the 5-gallon bucket static chamber equip with two activated charcoal canisters each and securing the buckets for a 48 hour integration or exposure time-period. During this time period, the dynamic flux chamber will be used to measure the flux at each location three times per day over the two days. The average of the 'within one day' and 'day-to-day' real time flux will be compared to the average of the replicate charcoal canister flux at each location. This will determine the comparability of the measurement methods, which assumes that the close proximity of the test location by each method is not a factor in the analysis. The added benefit of this approach is that the variability of radon flux, both within day and day-to-day variability, can be examined by reviewing the real time flux data collected with the dynamic flux chamber and the radon monitor. This test will establish, by method verification, that the dynamic flux chamber and radon monitor method is capable of distinguishing the difference in radon flux in the study area over the groundwater plume as compared to the background surrounding the test area.

Table 1. Summary of Sampling Schedule for the Verification Program.

TEST LOCATION	**RADON FLUX PTG-7RN**	**RADON FLUX CHARCOAL**	**COMMENT**
Three Test Locations	Three tests per location for two days; 18 tests	Replicate static chamber flux per location; 6 samples	Compare average dynamic, real time flux per location over two days to the average, integrated in the static chamber per location
System or Media Blank Samples	2	2	5% Blank Samples
Replicate Samples	N/A	3	5% Replicate Samples
TOTAL	**20**	**11**	

The SAP provides the following information for the verification of radon assessment technology: Section 2- Parcel Number and Location; Section 3- Sample Count; Section 4- Sample Frequency; Section 5- Sample Collection; Section 6- Rational for Sample Collection; Section 7- Location of Sample Collection; and Section 8.0- Sample Analysis.

2.0- PARCEL NUMBER AND LOCATION

There is no parcel number or location designation for this effort. The verification testing will take place in Red Bluff, California (granite gravel/cobble creek bed) provided that radon is detected from the selected test area. If not, the testing may be conducted on one of the onsite parcels. Regardless of test location, the intent of this study is to develop an acceptable field assessment technology (chamber and radon detection technique) for use both on site and off site in the area.

3.0- SAMPLE COUNT

The sample count includes 25 VOC sample locations and QC samples as given in Table 1.

TEST LOCATION	TO-14 SIM TARGET LIST FLUX	TO-15 FULL SCAN FLUX	COMMENT
Transect Array Locations	25	3	Testing on open soil at 200 ‘ spacing on transects that cross the plume on an E/W direction
System or Media Blank Samples	2	N/A	5% Blank Samples
Replicate Samples	2	N/A	5% Replicate Samples
TOTAL	**29**	**3**	

Three test locations will be selected at one location. The 5-gallon bucket, static chamber, equip with two activated charcoal canisters each, will be secured for the time-integrated 48- hour exposure period. During this time period, the dynamic flux chamber will be used to measure the flux at each location three times per day over the two days; morning, noon, and evening dynamic flux with radon detection by the PTG-7RN instrument. The average of the ‘within one day’ and ‘day-to-day’ real time flux (radon detector and the dynamic chamber) will be compared to the average of the replicate charcoal canister flux from the static chambers at each location. This will determine the comparability of the measurement methods, which assumes that the close proximity of the test location by each method is not a factor in the analysis. The added benefit of this approach is that the variability of radon flux, both within day and day-to-day variability, can be examined by reviewing the real time flux data collected with the dynamic flux chamber and the radon monitor. This test will establish, by method verification, that the dynamic flux chamber and radon monitor method is capable of distinguishing the difference in radon flux in the study area over the groundwater plume as compared to the background surrounding the test area.

4.0- SAMPLE FREQUENCY

The sample frequency includes testing at three near-by locations using the static chamber over a 48-hour time period, with control point testing at these same locations using the dynamic flux chamber for two consecutive days (18 measurements). The static chamber will yield three samples, three duplicate samples, and two media blank samples (8 measurements). Note that real time sampling in the static chamber is not possible.

5.0- SAMPLE COLLECTION

Surface flux of radon gas will be measured using the USEPA surface emission isolation flux chamber technology as described in SOP-16 with radon detection by the real time radon analyzer (PTG-7RN). At equilibrium the real time analyzer will be interfaced to the exhaust line of the flux chamber and sample gas will be drawn through the ion chamber for a minimum of 10 minutes an a maximum of 60 minutes. After the ion count is completed, the data will be recorded and the test discontinued.

Surface flux of radon gas will be measured using the static chamber technique as described in SOP-16 with radon detection by the AC canister technique. AC canisters will be opened, installed in the static chamber sampler, and interfaced for the 48-hour time period. After sampling (exposure in the static chamber), the AC canisters will be sealed and shipped back to the laboratory for radon assessment.

6.0- RATIONAL FOR SAMPLE COLLECTION

The rational for the verification testing is to collect a robust data set that will allow for the comparison of radon flux detection by two different approaches. Since there may be different radon flux at the three near-by test locations, and there may be differences in radon flux with the time of day, it was important to design a program to allow for spatial and temporal variability. As such, three near-by test locations were selected for the static chamber method. Since the two methods (static chamber/AC canister versus dynamic chamber/real time detection) vary in sampling interval (48 hour versus 1 hour), it was important to collect data that could be compared. Thus it was necessary to collect time-dependent data from the dynamic flux chamber over the time-integrated static chamber test interval. Assuming that a static chamber flux is somewhat comparable to a diurnal average dynamic flux, the average of the dynamic flux data over the two-day interval should be comparable, at least in theory, to the static chamber flux. Remember that there is a major difference in the flux generated by these two techniques:

1) The static chamber relies on the entire exposure period to establish the 'time constant' of the test which is very different from the dynamic chamber;
2) The static chamber will rely on the adsorption of radon gas to the activated charcoal matrix and assessment of radon gas on charcoal as the representation of radon gas emitted and detected in the chamber where the dynamic chamber utilized the real time detection of radon in an ion chamber; and
3) Although the AC canister is a recommended technique for assessing radon exposure in structures, the EPA considers static chambers to be a screening-level assessment technology and subject to a higher uncertainty.

Given the inherent differences in the chamber methods and the radon detection methods, the number of test locations and samples suggested should provide for an adequate evaluation of the two different approaches. Note that because of the dynamic flux chamber technology plus the advantage of not having to leave static chambers in place, for instance in the neighborhood, over the 48-hour AC canister sample collection time period, the dynamic flux chamber technology with the real time radon detector is the preferred assessment technology.

7.0- LOCATION OF SAMPLE COLLECTION

The sample location for the verification will be a granite gravel/cobble creek bed located in Red Bluff, California. The test area will be prescreened using the dynamic flux chamber and the PTG-7RN detector. If an adequate radon count is detected, the verification testing will be conducted in Red Bluff. If not, an attempt will be made to generate a 'fresh granite' source by crushing granite cobbles which may generate a higher emitting radon source. The fresh granite gravel source will be screened and if found satisfactory, the testing will be conducted in Red Bluff on fresh granite gravel. If neither of these options is acceptable, the verification testing will be conducted on one of the parcels in Henderson, Nevada.

8.0- SAMPLE ANALYSIS

As indicated in Table 1, the AC canisters will be analyzed by the radon laboratory as described in SOP-16. The real time detector will provide the other sample analysis capability. A description of the PTG-7RN analyzer and the instrument specifications are provided in an attachment to this SAP.

REFERENCES

1) US EPA, "Measurement of Gaseous Emission Rates from Land Surfaces Using an Emission Isolation Flux Chamber- User's Guide," EPA 600/8-86-008 (NTIS PB86-223161), February 1986.

2) US EPA, "Procedures for Conducting Air Pathway Analysis for Superfund Activities, Interim Final Documents, Volume 2- Estimation of Baseline Air Emissions at Superfund Sites, EPA-450/1-89-002a (NTIS PB90-270588), August 1990.

3) SOP-16, CE Schmidt, August 15, 2007.