TECHNICAL MEMORANDUM
RADIOLOGICAL TRIGGER LEVELS
SANTA SUSANA FIELD LABORATORY SITE
AREA IV RADIOLOGICAL STUDY

TO:	Andrew Bain, USEPA Region 9 RPM
FROM:	Shannon Thompson, PhD., HGL Principal Radiological Scientist
THROUGH:	L. Steven Vaughn, HGL Project Manager
CC:	Mary Aycock, USEPA Region 9 RPM S. J. Chern, USEPA Region 9 RPM Gregg Dempsey, USEPA Senior Science Advisor
DATE:	December 16, 2011
SUBJECT:	Proposed radiological trigger levels strategy for use in evaluating soil sample results and recommending Lookup Table values to DTSC for remediation of soil
CONTRACT NO:	EP-S7-05-05
TASK ORDER NO:	0038

1.0 INTRODUCTION

HydroGeoLogic, Inc. (HGL) is performing a radiological characterization study at Area IV and the Northern Buffer Zone of the Santa Susana Field Laboratory (SSFL) site located in Ventura County, California. This work is being executed under U.S. Environmental Protection Agency (USEPA) Region 7 Architect and Engineering Services Contract EP-S7-05-05, Task Order 0038. The technical lead on the project is EPA Region 9.

This technical memorandum describes the conceptual framework for, approach to, and implementation of radiological trigger levels (RTLs). These are reference concentrations for the radionuclides of concern for the SSFL Area IV Radiological Study. They are designed for screening analytical results of site soil and sediment collected during Round 1 sampling and analysis efforts to inform decisions for Round 2 sampling (also called step-out sampling). Individual Round 1 analytical results will be compared to RTLs, and, if results exceed an RTL, then step-out sampling or other actions are warranted. Thus, RTLs guide Round 2 sampling to support the determination of the nature and extent of radiological contamination in Area IV.

RTLs have two purposes:

- First, they inform step-out sampling. “Step-out” denotes sampling and analysis in the vicinity of a positive contamination result to bound the extent of contamination (sample locations added are generally proximate to the original sample location(s)). To determine step-out sample locations, the RTL approach must be resolved expeditiously to meet the Radiological Study schedule. The Radiological Study commenced field activities and soil sampling in Subarea 5C; hence, analytical results from Subarea 5C are the first Round 1 data available. Subarea 5C Round 2 sampling must have actionable soil concentration limits established by December 2011 to conclude the USEPA Round 2 investigation in a timely manner.

- Second, RTLs will be ultimately be submitted to the California Department of Toxic Substances Control (DTSC) as USEPA's recommended radiological Lookup Table concentrations. The RTL values discussed herein and used for screening Subarea 5C Round 1 results could potentially be modified based on outcomes of screening Subarea 6 results. If accepted by DTSC, RTLs will serve as clean up values during the remedial phase of the project. The promulgation of final radiological and chemical Lookup Table values has been scheduled for the spring of 2012.

Screening site data using RTLs is an objective assessment process. Considering the importance of RTLs to remedial actions and the very low analytical detection limits of the Radiological Study, part of the development process is to use RTLs to screen soil results from Subareas 5C and 6. These Subareas are expected to represent lower and higher contamination areas, respectively. This expectation is based on operational history and multiple lines of evidence used to select Round 1 sample locations. As an example, 30 gamma radiation anomalies were observed (out of a total of 59 potential gamma radiation anomalies[1]) from the field gamma survey data collected in Subarea 6 whereas none were observed in Subarea 5C. Subarea 6 was the site of the Sodium Reactor Experiment which contained and generated much greater quantities of radioactive materials than the facilities located in Subarea 5C.

The intention of this exercise is to examine the usefulness of RTLs and evaluate challenges which may arise through data screening using RTLs to form a rigorous and reliable screening process. As the USEPA gains experience through the application of RTLs to Radiological Study analytical results, modifications to either the RTLs or to proposed RTL exceedance response criteria may be necessary to meet project requirements.

2.0 OBJECTIVE

The ultimate goal of the RTLs is to provide concentration limits for the radionuclides of concern that define the nature and extent of radiological contamination on site and effectively guide the remediation process with respect to radiological contaminants. This Technical Memorandum is not applicable to chemical contamination which is being addressed separately by DTSC.

The RTLs are being developed as an approach that balances the benefits of removal of contaminated soils versus removal of soils containing only naturally occurring radionuclides which may not be indicative of site activities. Importantly, naturally occurring radionuclides are present in all soil and sediment samples; the key factor is to confidently identify locations

[1] The terms potential gamma anomaly and gamma anomaly are used to describe gamma radiation survey findings. A *potential* gamma anomaly denotes an area of elevated total gamma measurement data; a *gamma anomaly* is an area containing elevated gamma measurements which have been verified to contain man-made radionuclides.

which were deemed to be contaminated as a result of Area IV site operations. As described in the Administrative Order on Consent (AOC), individual analytical results that exceed a Lookup Table value may be cause for step-out sampling and subsequent remedial action.

3.0 DEVELOPMENT OF RADIOLOGICAL TRIGGER LEVELS

The RTLs are based on information and guidance from the Radiological Background Study, the AOC, and the technical capabilities of Radiological Study laboratories for each radionuclide of concern. Each of these has some influence in shaping the development of RTLs.

3.1 RADIOLOGICAL BACKGROUND STUDY

USEPA's Radiological Background Study was conducted to determine local background concentrations as a part of the development of SSFL Lookup Tables (HGL, 2011). During the Radiological Background Study, 149 surface and subsurface soil samples were collected and analyzed to determine concentrations of the Radionuclides of Concern from unimpacted areas representative of the Radiological Study area native soil in terms of geology, soil type, vegetation, and topography. The results of 68 Radionuclides of Concern for up to 149 samples[2] were compiled and statistically evaluated. These pools of data were used to compute Background Threshold Values (BTV) for 64 radionuclides using the 95 % Upper Simultaneous Limit (USL) and to develop the criteria defined in the Radiological Background Study Report (HGL, 2011). The 95 % USL was employed to address variability in concentration distributions of radionuclides of concern and to reduce the number of false positives that may be expected in comparisons between site data and background data.

3.2 PURPOSE OF RADIOLOGICAL TRIGGER LEVELS

USEPA initially included the 10^{-6} agricultural Preliminary Remediation Goals (PRGs) in RTLs criteria development and discussed the criteria in a September 2011 public meeting. On October 20, 2011, USEPA sought guidance from DTSC on the issue of using PRGs for the 10^{-6} agricultural risk scenario, as recommended in the USEPA Radiological Background Study Report. DTSC's response (Attachment 3) citing the AOC states "there is no provision for using risk based factors in the development of our lookup tables." Using BTVs and MDCs alone would result in remediating to levels below the agricultural 10^{-6} PRG for approximately 25 percent of the radionuclides of concern. USEPA understands that excluding PRGs (which are risk-based) from the RTL table will result in more sample results exceeding an RTL, which would result in additional characterization and, potentially, additional remedial efforts. The full impact of this point is unknown at this time. USEPA will consult the PRG combined with method uncertainty as an screening result evaluation tool, particularly for cases of slight exceedances of NORM.

The purpose of EPA's SSFL Area IV Radiological Study is to determine radiologically contaminated areas in Area IV and the NBZ; however, there are inherent limitations in determining RTLs. For example, BTVs were defined using as many as 149 sample data and are a function of the statistical cohesiveness of the background study data for each

[2] Not all radionuclides have 149 results due to various reasons, such as logistical and quality concerns.

radionuclide. For many radionuclides, an analytical laboratory cannot reasonably measure concentrations below its respective BTV in an individual soil sample. In lieu of the capability to detect below the BTV concentration, the Minimum Detectable Concentration (MDC) shall be used as an alternative.

There are circumstances which may require exceptions to Lookup Table values. Native American artifacts which may be recognized as cultural resources can be exempt from the cleanup requirements. Another is the use of professional judgment to interpret data wherein Naturally Occurring Radioactive Materials (NORM) radionuclides may be found in drainages. NORMs are discussed in Section 3.7.

3.3 MINIMUM DETECTABLE CONCENTRATION

The Radiological Background Study used 95 % USL to derive BTVs. Similarly, MDC values were derived using an upper confidence limit and computed using the mean MDC plus two standard deviations above the mean which approximate the 95 % Upper Confidence Limit (UCL) for each MDC. Representative analytical results from each radiochemistry laboratory (40 samples for Laboratory A, and 48 samples for Laboratory B) were assembled and the arithmetic means and standard deviations of each MDC were calculated for each laboratory. Use of a UCL is necessary for comparisons of individual result MDCs to RTLs. For example, if the mean MDC value was selected as an RTL instead of the 95 % UCL, then analytical results from uncontaminated samples would exceed that value approximately 50 percent of the time. Hence, RTL development using the 95 % UCL of MDCs adds confidence that a result exceeding the RTL is meaningful.

The RTL is based on the higher of two Radiological Study laboratory MDCs. Neither laboratory alone has the analytical production capacity required to support the project schedule, so sample analysis must be conducted by both laboratories. USEPA recognizes that USDOE will need support from radiological laboratories during the remedial phase of the project, and those laboratories will also be required to achieve the sensitive radiological MDCs used in this study.

3.4 PROCESS TO DEVELOP RADIOLOGICAL TRIGGER LEVELS

Development of RTLs must consider and account for several factors, such as the variability in distributions of both man-made and naturally occurring Radionuclides of Concern, technical limitations, and inclusion of the measurement uncertainty of individual sample data for comparison against RTLs.

Figure 1 illustrates the two step process for development of RTLs. The first step illustrates the formation of an individual RTL. Individual RTLs are formulated from the higher of BTV and MDC data plus the overall method uncertainty for each radionuclide of concern.

RTLs are reference concentrations computed from pools of data. To optimize RTLs and minimize decision errors, overall method uncertainties must be factored into RTL development. Consideration of overall method uncertainty in RTLs is not the same as adding or subtracting the individual sample-specific uncertainty from a result before comparing to the RTL. In the former case, the method uncertainty (not the sample-specific uncertainty) is recognized as a legitimate constraint to minimizing decision errors. In the latter case, laboratory error or poor quality results might be used to assert that the BTVs have not been exceeded. The magnitudes of radiochemistry method uncertainties range from approximately 1 to 16 percent of the RTL. While an increase of 16 percent is not insignificant, these are relatively small. In fact, DTSC discussed chemical Lookup Table development challenges including chemical Method Detection Limits and Reporting Limits (analogous to radiological MDCs and RTLs). For chemical contaminants, the Reporting Limits are typically 3 to 5 times Method Detection Limits or 300 to 500 percent.

The second step of the RTL development process is to apply RTLs to screen onsite results from Subareas 5C and 6. To do this, validated radiological soil results will be evaluated against each RTL, for up to approximately 56 radionuclides based on the total number of analyses requested for each sample location. Individual RTL values may require adjustment or additional logic to be effective. In essence, step 2 is a process quality check. Final RTLs will be applied to all Round 1 analytical results to inform Round 2 sampling.

Table 1 (see Attachment 1) lists the radionuclide, analytical method, suite, and concentration values for RTLs composed of BTVs and MDCs. The key illustrates certain analytes which are NORM radionuclides (highlighted in green) and those radionuclides for which the Background Study recommended use of the MDC (highlighted in blue).

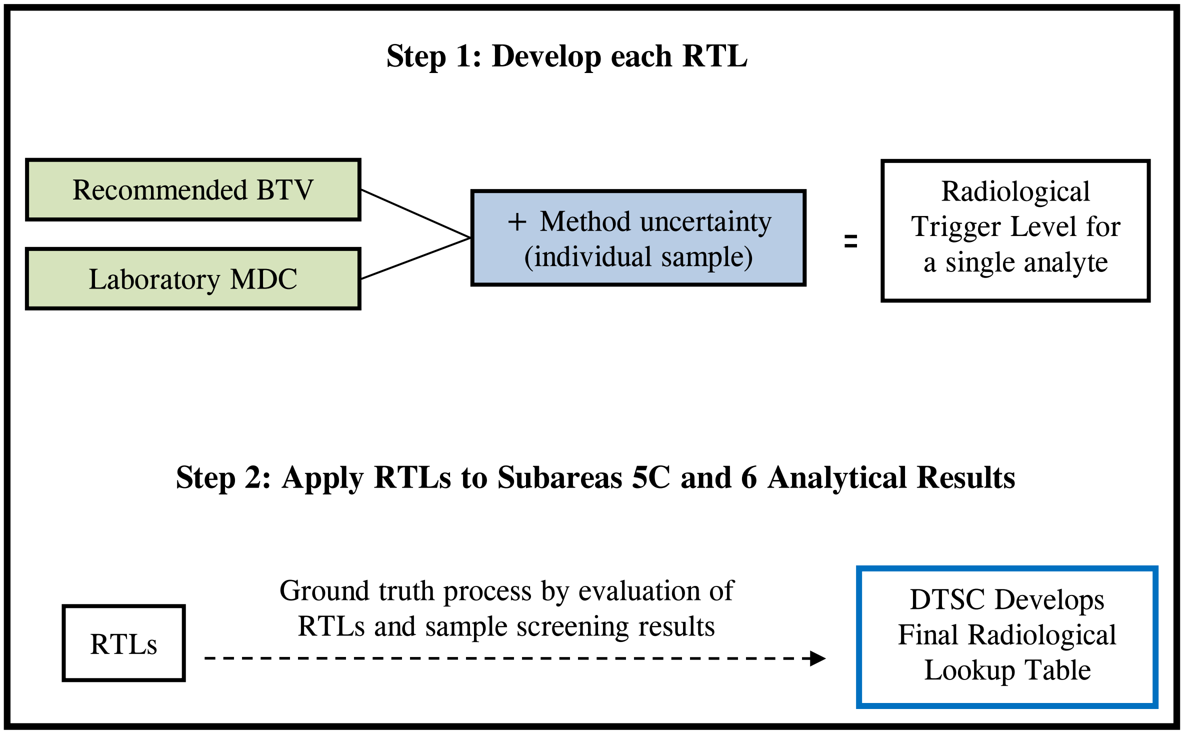


Figure 1
Strategy for the development of Radiological Trigger Levels

3.5 USE OF RADIOLOGICAL TRIGGER LEVEL CONCENTRATIONS TO SCREEN ANALYTICAL RESULTS

Radiochemistry data consist of a large amount of information including sample identifiers (sample number, location, sample depth, time of collection, etc.), internal tracking information, and results parameters. The key analytical results are concentration, reporting units (e.g., picocuries per gram), MDCs, uncertainty, and data qualifiers. Together, these provide information regarding data quality and quantify the analytical result. Screening of analytical data is a relatively straightforward process. The initial step is to determine whether a radionuclide of concern has been detected. This is based on a positive activity result being greater than its associated MDC. If a positive analytical result occurs, then it is compared to the RTL.

Figure 2 is a decision tree logic diagram showing actions to be taken or considered based on analytical data screening results. The questions posed in this diagram are incorporated in the screening process to inform Round 2 targeted sampling, with one exception. Exceedances of man-made radionuclides will require step out sampling; however stepping out for NORM radionuclides is less clear. Considerations for NORM radionuclides are discussed in Section 3.7. Figure 2 illustrates cases in which detected results exceed or do not exceed an RTL. It also shows the nuanced case in which the initial criterion is not detected yet the sample-specific MDC exceeds the RTL. This is a special case where the laboratory analytical protocol fails; in the figure, the resulting action shown is reanalysis. It is possible that reanalysis would not resolve the issue, due to spectral interference or other similar challenges. Those findings will be dealt with on a case-by-case basis.

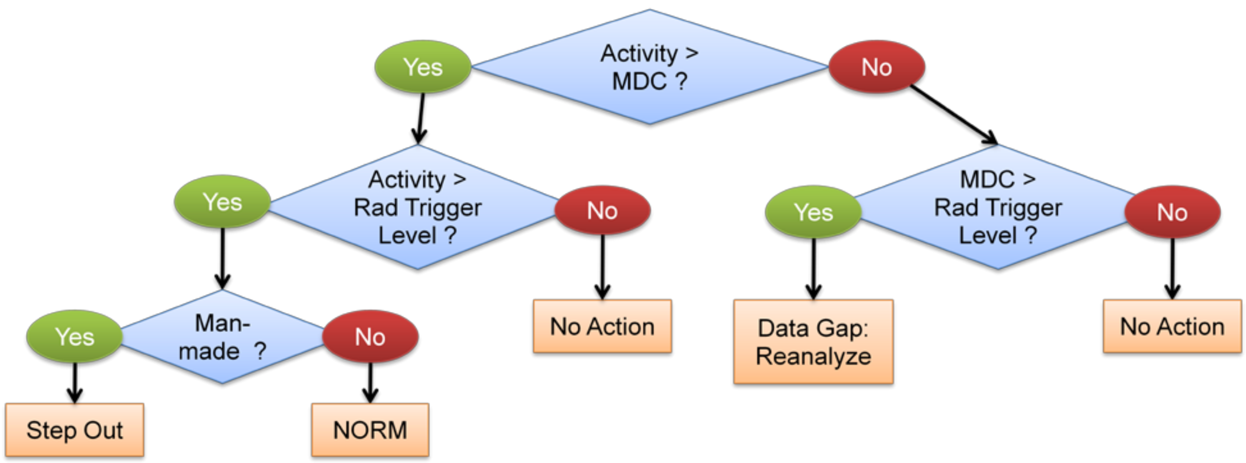


Figure 2
Analytical Result Decision Tree

Table 2 shows key analytical data with RTL screening criteria. There are multiple analytes for each sample; in this example, excerpted laboratory results for six radionuclides are listed alphabetically from protactinium-231 (Pa-231) to plutonium-239 and 240 (Pu-239/Pu-240) to demonstrate radioanalytical data screening. The four columns at left contain sample identity, radionuclide of concern, reported activity and associated MDC. The columns are right address the questions illustrated in Figure 2. The first criterion condition answers the question, was a radionuclide of concern detected? Detected results are then compared to their respective RTL concentrations. If an analyte is detected at a concentration which exceeds the RTL, then it is noted and the magnitude of exceedance or ratio is calculated. As shown in Table 2, lead-212 (Pb-212) and lead-214 (Pb-214) were detected at concentrations below their respective RTLs. This is expected because these are NORM radionuclides present in soil. At the bottom of the table, Pu-239/Pu-240 was detected above the RTL. The next criterion refers to a data gap which is the condition of a sample for which activity was not detected, but the MDC exceeded the RTL. In this example, no data gaps were observed.

Table 2
Analytical Data Screening Example

Field Sample ID	Analyte Name	Activity	MDC	Detected? (Activity > MDC)	Radiological Trigger Level (RTL)	Detected Above RTL	Detected Activity /RTL	Data Gap MDC > RTL	Data Gap MDC /RTL
10242	Pa-231	0.009	0.61		9.36E-01				
10242	Pb-212	1.74	0.025	Yes	2.69E+00				
10242	Pb-214	1.1	0.027	Yes	1.70E+00				
10242	Pu-236	-0.0015	0.0064		7.79E+00				
10242	Pu-238	0.0044	0.0036	Yes	4.15E-02				
10242	Pu-239/Pu-240	0.0486	0.0013	Yes	4.04E-02	Yes	1.203		

Notes:
ID – identification
Pu-236 – plutonium-236
Pu-238 – plutonium-238

3.6 SUBAREA 5C RADIOLOGICAL TRIGGER LEVELS SCREENING RESULTS

Validated data sets for Subarea 5C are nearly complete at present and those for Subarea 6 are in progress, so screening results are limited to *preliminary data from Subarea 5C*. However, based on discussions with project data validators, both the RTL values and the key analytical results discussed in this report are not expected to change. Table 3 shows the summary results from RTL screening of Subarea 5C. For convenience, NORM radionuclide analytes are highlighted in green and anthropogenic (man-made) analytes are in red. The findings indicate three samples with five radionuclides exceed the RTLs. No data gaps are observed.

Table 3
Preliminary Subarea 5C Screening Summary using RTLs

Field Sample ID	Analyte Name	Activity	MDC	Detected? (Activity > MDC)	Radiological Trigger Level (RTL)	Detected Above RTL	Detected Activity /RTL	Data Gap MDC > RTL	Data Gap MDC /RTL
10045	Bi-214	1.72	0.031	Yes	1.59E+00	Yes	1.08		
10045	Pb-214	1.95	0.031	Yes	1.70E+00	Yes	1.15		
10045	Th-230	2.24	0.008	Yes	2.20E+00	Yes	1.02		
10081	Cs-137	0.818	0.015	Yes	2.07E-01	Yes	3.95		
10242	Pu-239/Pu-240	0.0486	0.0013	Yes	4.04E-02	Yes	1.20		
3		**Count**		**4967**		**5**		**0**	

Notes:
Bi-214 – bismuth-214
Cs-137 – cesium-137
Th-230 – thorium-230

3.7 IMPLEMENTING RADIOLOGICAL TRIGGER LEVELS DURING ROUND 2 SAMPLING

Figures 3 through 6 (Attachment 2) are maps illustrating the spatial distribution and concentrations of elevated Subarea 5C preliminary results. Figure 3 shows all Subarea 5C sample locations and analytical results relative to the RTLs. Three samples exceed RTL concentrations; on Figure 3, two locations having man-made RTL exceedances are symbolized as red circles and the location with a NORM exceedance is depicted as a green circle (consistent with the color highlights in Table 3). These are shown individually in proximal views in Figure 4 – 6 along with site investigation data from gamma scanning results, geophysical results, and HSA features. Figure 4 shows the result of sample 10081 which has Cs-137 present at four times the RTL. Figure 5 shows the result of sample 10242 which has Pu-239/Pu-240 present at 1.2 times the RTL. In Figure 6, sample 10045 indicates three NORM radionuclides exceed their RTLs. It is critically important to understand that all three of these particular NORM radionuclides are members of the same decay series and are relatively close to their respective RTL values.

Based on screening against the RTLs, results from sample locations 10081 and 10242 will require step out sampling to adequately characterize the extent of contamination. Although the activities observed for sample 10045 (for all three radionuclides) are above the RTLs, this sample may not require step out sampling. The logic and professional judgment underlying this position are described in the following passages. Each of these NORM radionuclides is members of the same decay series (U-238), and there is evidence they may reflect site conditions.

NORM radionuclides are of interest because they are present in soils, sediment, and rock in the earth's crust (Faw and Shultis, 1999). They are primordial - they were present in the geological materials when the rocks first formed. There are two types of naturally occurring radionuclides in soil, those occurring singly and those occurring as a part of a decay series. The only significant singly occurring NORM radionuclide is potassium-40. Three primordial decay series ubiquitous in rocks and minerals originate from thorium-232, uranium-235, or uranium-238. Thus, these radionuclides and their decay progeny are present in rocks and soil on site. The main purpose of the Radiological Background Study was to determine concentration ranges of both naturally occurring and fallout (anthropogenic) radionuclides and establish BTVs to represent reasonable upper bounds for concentrations of each radionuclide in unimpacted areas.

The background study demonstrated that radionuclides are present in unimpacted areas at ranges of concentrations with some degree of variability. It is possible that a radionuclide or several radionuclides could be observed above RTLs and not be due to Area IV radiological operations. To bound this discussion, if a NORM radionuclide exceeded its RTL by a factor of say 3 or 10, then it is logical to assume this would indicate an impacted area. On the other hand, an RTL exceedance for NORM of 1 - 15 % may not.

There are several radionuclides in decay series which should be compared to neighboring radionuclides (within a series) to assess whether analytical results are logical. Checking and comparing results from individual members of a decay series allows flexibility to make professional judgments based on the data as a whole rather than a singular exceedance. Data quality assessments are frequently performed to assess the data quality from a particular laboratory, to examine differences between specific methods, or to inter-compare results between different laboratories. For example, the fact that all three NORM radionuclides observed in sample 10045 are members of the same decay series supports the idea that this result may reflect site conditions. For two of these, Bi-214 and Pb-214, they exceed their respective RTLs by 8 and 12 %; however they are orders of magnitude below their 10^{-6} Agricultural PRGs.

Professional judgments are supported by the investigation of site related activities and other lines of evidence. Importantly, sample 10045 was located coincident to the site of potential gamma radiation anomaly 5C-3, which was a vernal pool area near sandstone rock outcrops and not particularly near former site facilities or HSA features. Gamma scanning results indicates the area to the immediate south and west of sample 10045 has high gamma measurements of NORM radionuclides. In fact, the potential gamma anomaly shown as red in Figure 6 covers virtually the entire extent of the vernal pool area; hence the soil sample was collected adjacent to the biological exclusion zone. Historical Site Assessment data indicate that the storage yard for Building 4626 was in the general vicinity, but indicated storage of primarily europium-152 and cobalt-60 bearing sands and USDOEs not indicate storage of thorium bearing wastes nor chemical separation operations.

USEPA will exercise the type of professional judgments described above and similar evaluation tools to justify decisions for selecting and locating step-out samples. The slight exceedances of naturally occurring Th-230, Bi-214, and Pb-214 would not merit further investigation by USEPA.

It is possible that an RTL employed during the Radiological Study may differ from its final Lookup Table value. Under this scenario, an information gap may exist for individual sample locations or for a radionuclide should the concentration used to determine step out sample locations for the Radiological Study be greater than the corresponding final Lookup Table value.

4.0 CONCLUSIONS

RTLs are composed of BTV and MDC concentration values per DTSC direction. The RTLs will be tested by application to selected Subarea 5C and 6 soil samples. Subarea 5C represents lower levels of radionuclide contamination and Subarea 6 represents higher levels of radionuclide contamination; therefore, these are believed to be suitable datasets for testing the RTLs. Exceedances of man-made radionuclides will, in general, prompt the need for additional sampling. Observations of slight RTL exceedances of naturally occurring radionuclides may require professional judgments and further data review to determine whether step-out sampling is warranted. Specific sampling locations will be discussed in forthcoming Subarea FSP Round 2 Addenda.

5.0 REFERENCES

Faw, R. E. and J. K. Shultis, 1999. Radiological Assessment: Sources and Doses. American Nuclear Society, Inc., La Grange Park, IL.

HydroGeoLogic, Inc., 2011. Final Radiological Background Study Report, Santa Susana Field Laboratory, Ventura County, California. October 31.

State of California Environmental Protection Agency, Department of Toxic Substances Control, 2010, Administrative Order on Consent for Remedial Action, Ventura County, California. December 6.

ATTACHMENTS

Attachment 1	Draft Radiological Trigger Levels Table	
Attachment 2	Figure 3	Preliminary 5C RTL Screening Findings
	Figure 4	Preliminary 5C RTL Screening Result With Associated Data for Sample 10081
	Figure 5	Preliminary 5C RTL Screening Result With Associated Data for Sample 10242
	Figure 6	Preliminary 5C RTL Screening Result With Associated Data for Sample 10045
Attachment 3	DTSC position response to use of PRGs in development of RTLs	

ATTACHMENT 1

TABLES

Table 1 DRAFT Radiological Trigger Levels Table

Table 1
Radiological Trigger Levels Table

Radionuclide	Method	Suite	Source (BTV-MDC)	RTL [1] (BTV-MDC)
actinium-227+D	Gamma	Default	MDC	2.17E-01
actinium-228			BTV	2.40E+00
antimony-125+D			BTV	3.54E-01
bismuth-212			BTV	2.15E+00
bismuth-214			BTV	1.59E+00
cadmium-113m			BTV	3.03E+03
lead-212			BTV	2.69E+00
lead-214			BTV	1.70E+00
cesium-134			MDC	8.64E-02
cesium-137+D			BTV	2.07E-01
cobalt-60			MDC	2.80E-02
europium-152			MDC	5.66E-02
europium-154			MDC	1.50E-01
europium-155			BTV	2.31E-01
holmium-166m			BTV	4.32E-02
neptunium-236			MDC	4.70E-02
neptunium-239			MDC	1.39E-01
niobium-94			MDC	2.14E-02
potassium-40			BTV	3.24E+01
protactinium-231			BTV	9.36E-01
sodium-22			MDC	3.70E-02
tellurium-125m			BTV	8.38E-02
thallium-208			BTV	9.37E-01
thulium-171			BTV	7.24E+01
tin-126			MDC	2.37E-02
strontium-90+D (Y-90)	Sr-Y	Default	MDC	4.85E-01
thorium-228+D	Th-isotopic	Default	BTV	3.98E+00
thorium-230			BTV	2.20E+00
thorium-232			BTV	3.10E+00
thorium-234			BTV	3.19E+00
thorium-229+D	Th-229	Site Specific	MDC	1.45E-01
uranium-233/234	U-isotopic	Default	BTV	2.02E+00
uranium-235+D/236			BTV	1.51E-01
uranium-238+D			BTV	1.80E+00
uranium-232	U-232	Site Specific	MDC	1.17E-01
plutonium-238	Pu-isotopic	Default	MDC	4.15E-02
plutonium-239/240			MDC	4.04E-02
plutonium-242			MDC	4.06E-02
plutonium-236	Pu-236	Site Specific	MDC	7.79E+00
plutonium-244+D	Pu-244		MDC	3.13E-02
plutonium-241	Pu-241	Site Specific	MDC	1.04E+01
americium-241	Am-241-Cm Isotopic	Default	MDC	4.54E-02
curium-243/244			MDC	4.43E-02
americium-243+D	Am-243-Cm Isotopic	Site Specific	MDC	4.01E-02
curium-245/246			MDC	3.06E-02
curium-248			MDC	3.33E-02
neptunium-237+D	Np-237	Site Specific	MDC	4.01E-02
radium-226+D	Gamma Ra	Site Specific	BTV	2.03E+00
radium-228+D			BTV	2.40E+00
tritium (H-3) organic	H-3	Site Specific	MDC	1.19E+01
carbon-14	C-14	Site Specific	MDC	2.96E+00
iron-55	Fe-55	Site Specific	MDC	5.94E+00
nickel-59	Ni-59	Site Specific	MDC	5.96E+00
nickel-63	Ni-63	Site Specific	MDC	4.92E+00
technetium-99	Tc-99	Site Specific	MDC	1.63E+00
promethium-147	Pm-147	Site Specific	MDC	1.75E+01

Key 1 - RTL values in pCi/g

Naturally Occurring Radionuclides (green shading)

Maximum Non-Detect BTV - Use MDC (blue shading)

ATTACHMENT 2

FIGURES

Figure 3
Preliminary 5C RTL Screening Findings

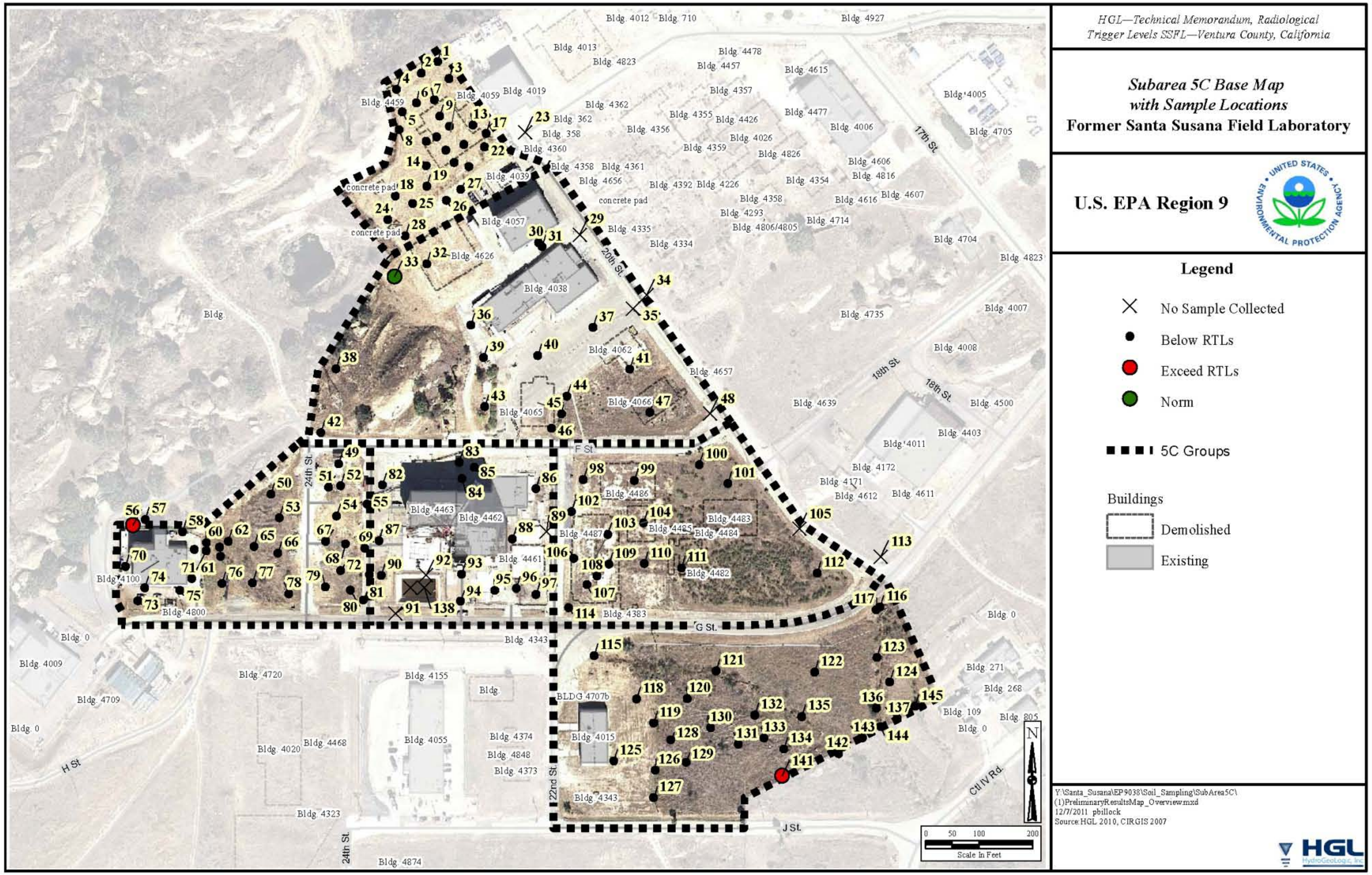


Figure 4
Preliminary 5C RTL Screening Result With Associated Data for Sample 10081, Location 56

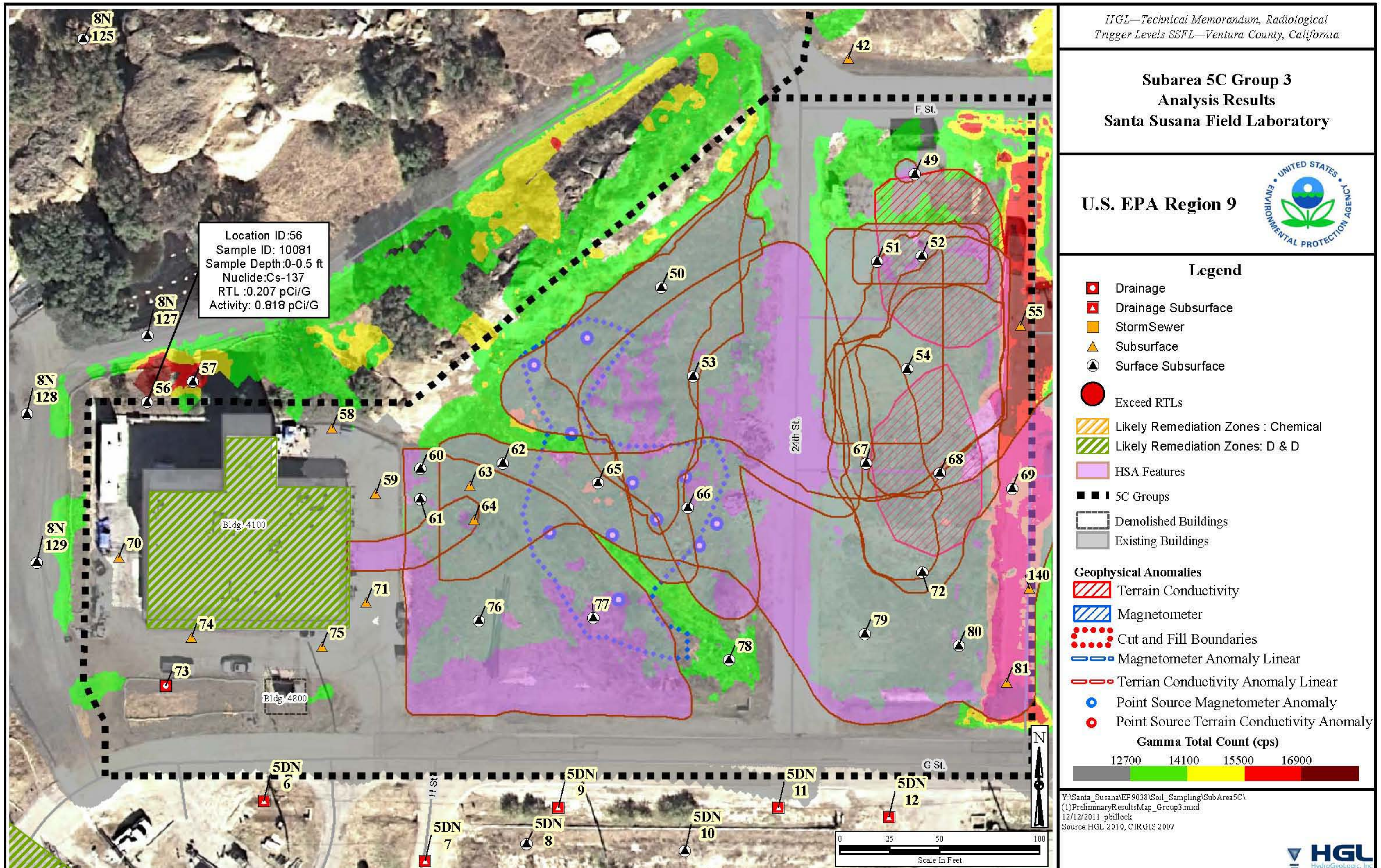


Figure 5
Preliminary 5C RTL Screening Result With Associated Data for Sample 10242, Location 141

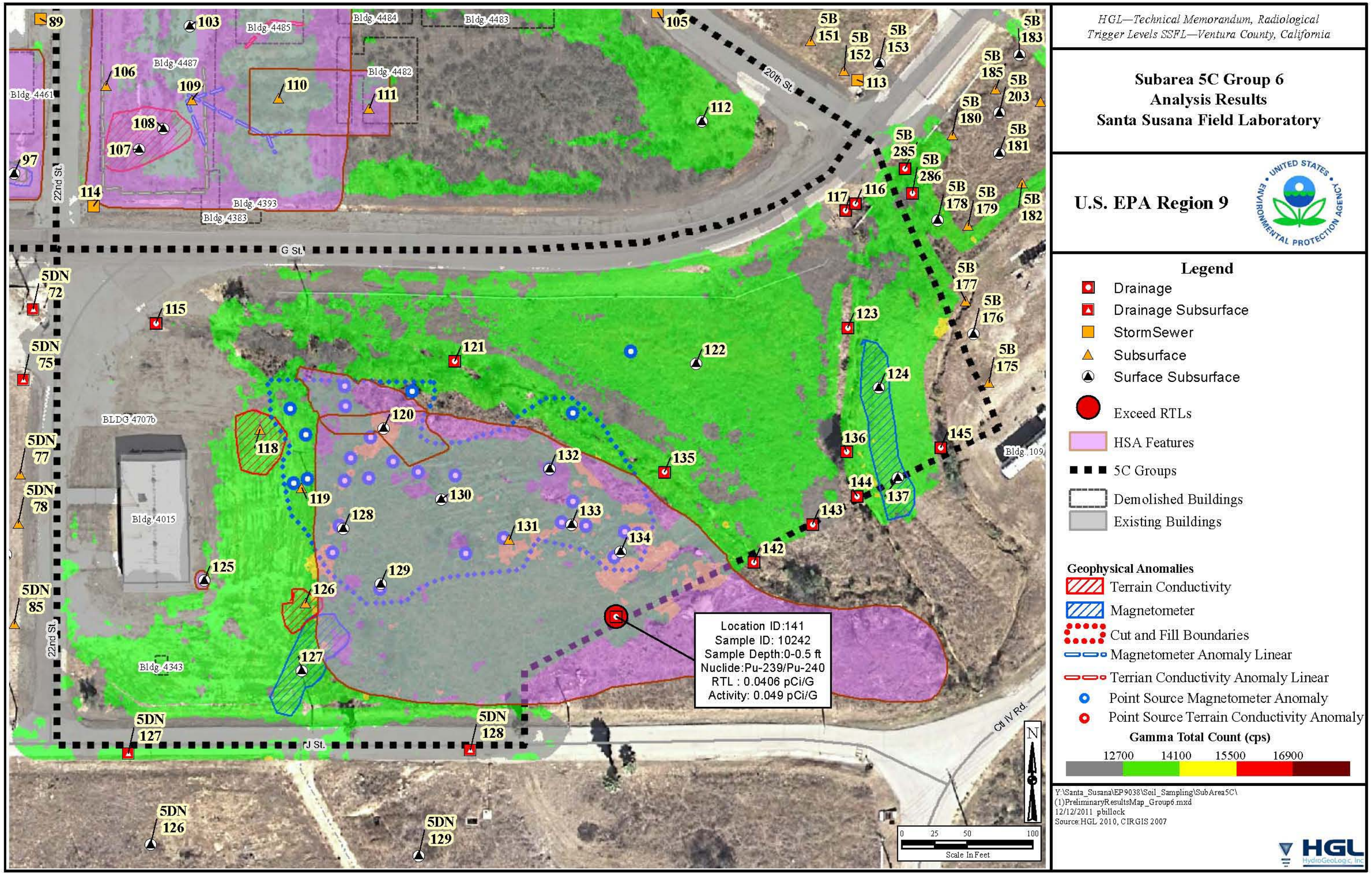
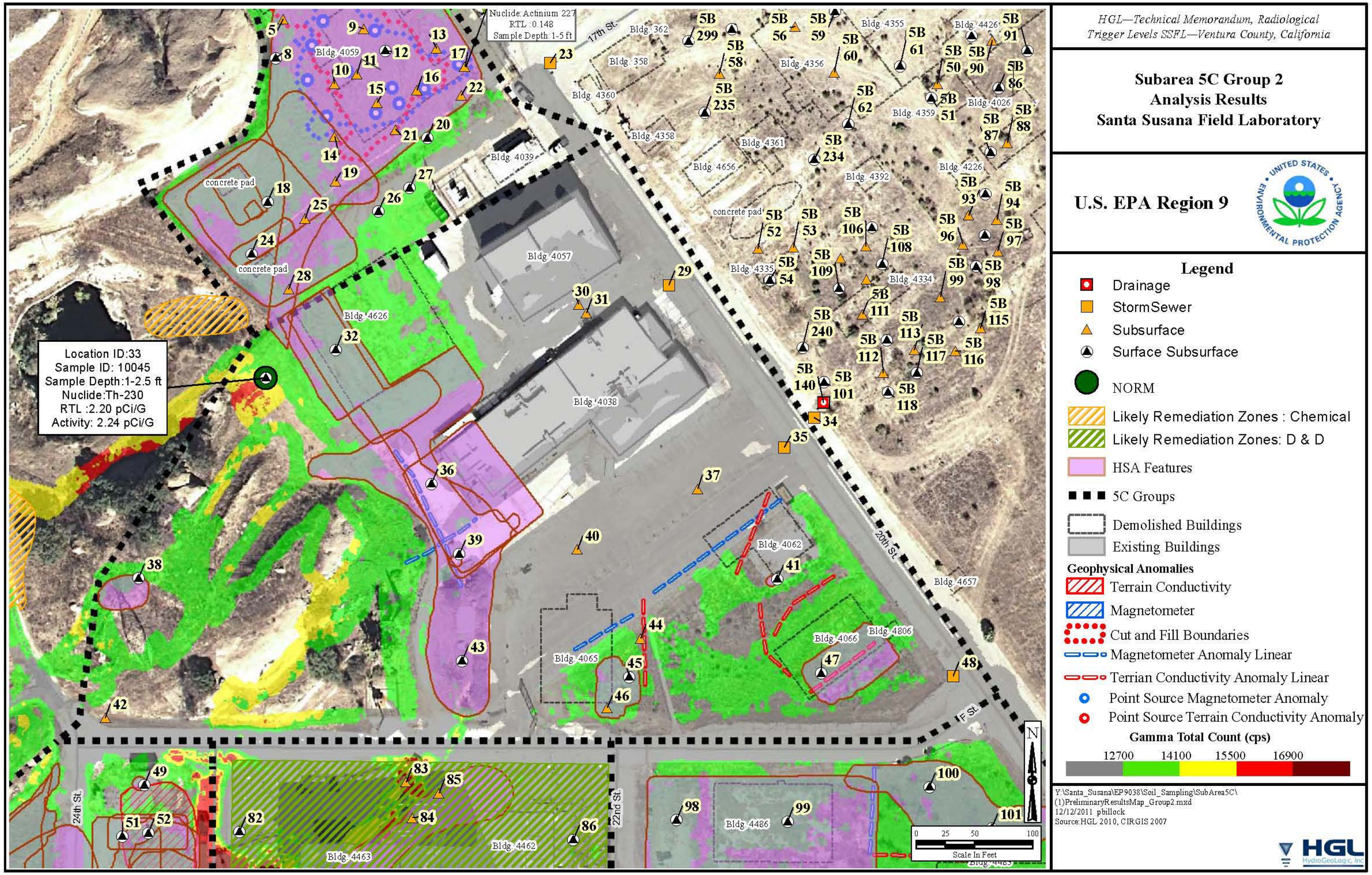


Figure 6
Preliminary 5C RTL Screening Result With Associated Data for Sample 10045, Location 33



ATTACHMENT 3

DTSC Position Response to use of PRGs in Development of RTLs

Re: DTSC position requested Stewart Black

To: Rick Brausch, Stewart Black, Michael Montgomery 11/01/2011 05:00 PM

Cc: Mark Malinowski, John Jones, Mary Aycock, Andrew Bain, Jane Diamond, Loren Henning

From: Stewart Black <sblack@dtsc.ca.gov>

Mike,

Thank you for your note and request for DTSC's decision on the use of the radiological preliminary remediation goals in your development of "trigger levels" for EPA's use in its next round of sampling for the Radiological Survey work in Area IV of the Santa Susana Field Laboratory. As we understand it, the trigger levels you are developing are to aid in identifying where additional "step out" sampling will be required, and are necessary because the "lookup table" values have not yet been developed by DTSC as required under the Administrative Order on Consent that was negotiated between DTSC and USUSDOE.

While we understand the rationale you presented for using the radiological preliminary remediation goals as a trigger level for your phase 2 study, as we read and interpret the language of the AOC, there is no provision for using risk based factors in the development our lookup tables. As we discussed with your staff in September, and discussed in a recent meeting with the community, there are a number of factors that DTSC will be considering as we develop the lookup tables in which adjustments to the numbers presented in EPA's background study report. Because the AOC is explicit in the cleanup goal for the site, risk based values such as PRGs or Risk Based Screening Values would not be consistent with the specific terms of the AOC. While their use as "trigger levels" at this point in the investigative process would not be prevented, to use PRGs in the way EPA proposed could create a significant inconsistency between the levels being measured in this round of sampling and the values to be included in the Lookup Tables, an inconsistency that could require additional sampling in the future to reconcile.

Because the Lookup Tables for both radiological and chemical constituents have not yet been developed, we recognize that EPA must use some methodology to develop "trigger" or action levels to guide its sampling strategy, to define where additional sampling must be conducted. Ideally the Lookup Tables would provide the specific criteria to guide that decision. In their absence, DTSC would suggest that EPA only use background threshold values (BTVs) and minimum detectable concentrations (MDCs) to determine the need for step out samples. As you suggested, as additional data becomes available, and as the development of the radiological lookup table progresses, we may be in a position to revisit this discussion for later phases of EPA's sampling activities.

Let me know if you have any questions.
Thanks -SB

Stewart W. Black, P.G. Acting Deputy Director Department of Toxic Substances Control Brownfields and Environmental Restoration Program P.O.Box 806, 11-44 Sacramento, CA 95812-0806 (916) 324-3148
>>> <Montgomery.Michael@epamail.epa.gov> 10/20/2011 4:11 PM >>>

TO: Stewart Black and Rick Brausch, DTSC

FROM: Michael Montgomery,
Assistant Director, Superfund Federal Facilities Branch, EPA Region 9

RE: Santa Susana Field Laboratory Site EPA's Proposed Soil Radiological Trigger Level Criteria

We are approaching a critical decision point in our characterization efforts and need DTSC's input at or before the end of October. As you know, we are preparing to conduct Round Two step out samples. For the most significant radionuclides of concern (ROCs) EPA is proposing the use of background threshold values (BTVs) and minimum detectable concentrations (MDCs) to determine the need for step out samples. Based on the Radiological Background Study findings, EPA has identified 14 ROCs out of 55, roughly 25%, which are not risk drivers and which present significant characterization challenges to differentiate from Naturally Occurring Radioactive Materials (NORM). For these 14 ROCs, EPA proposes to use the radiological preliminary remediation goals (strictly 10^{-6} Agricultural), as criterion for the need for step out samples. We had discussed this approach with your staff and the community and received positive feedback.

EPA believes the use of the Ag PRGs for this subset of ROCs is a technically justifiable, effective and protective approach which greatly reduces the risk of conducting additional sampling based on NORM results. However, if DTSC prefers that EPA should not use this approach and instead exclusively utilize the BTVs and MDCs as screening criteria, please advise us by October 31 in order for us to complete development of our RTL Technical Memorandum. If DTSC prefers the BTV/MDC approach we may have to revisit it as additional data is delivered.

Thanks for your attention to this. Mike