Decommissioning Plan Aptuit Scientific Operations
Revision 1
Aptuit, LLC
Kansas City, Missouri

Prepared for:

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Acronyms and Abbreviations

ACM	asbestos-containing material
ALARA	as low as reasonably achievable
ALI	annual limits on intake
API	Active Pharmaceutical Ingredients
Aptuit	Aptuit, LLC
AU	authorized user
^{133}Barium	Barium-133
^{14}C	carbon-14
^{45}Ca	calcium-45
Ci	curie(s)
CFH	chemical fume hood
CFR	Code of Federal Regulations
CHP	certified health physicist
cm^2	square centimeters
^{51}Cr	chromium-51
^{137}Cs	cesium-137
CTS	clinical trials supplies
D&D	decontamination and decommissioning
DCGL	derived concentration guideline level
DFP	decommissioning funding plan
DP	decommissioning plan
dpm	disintegrations per minute
DQO	data quality objectives
Duratek	GTS Duratek, Inc.
ft^2	square feet
FSS	final status survey
FSSP	final status survey plan
FSSR	final status survey report
HEPA	high-efficiency particulate air
HMRI	Hoechst Marion Roussel, Inc.

HP	health physics
HSA	historical site
^{125}I	iodine-125
^{131}I	iodine-131
IPA	instrument performance assessment
^{42}K	potassium-42
LAR	Lab Animal Resources
LOTO	lockout/tagout
LSC	liquid scintillation counter
m^2	square meter
MARSSIM	Multi-Agency Radiation Survey and Site Investigation Manual
mCi	millicurie
M&E	materials and equipment
mrem	millirem
^{22}Na	sodium-22
NEPA	National Environmental Policy Act
^{63}Ni	nickel-63
NRC	U.S. Nuclear Regulatory Commission
PGM	Pancake Geiger-Mueller
PPE	personal protective equipment
^{32}P	phosphorous-32
pCi/g	picocuries per gram
QA	quality assurance
QC	quality control
Quintiles	Quintiles, Inc.
RCRA	Resource Conservation and Recovery Act
RDW	remediation-derived waste
ROC	Radiation Oversight Committee
RSC	radiation safety committee
RSPM	Radiation Safety Program Manual
RSO	radiation safety officer
Shaw	Shaw Environmental & Infrastructure, Inc.

^{35}S	sulfur-35
SO	scientific operations
SME	Subject matter expert
^{99m}Tc	Technicium-99m
TEDE	total effective dose equivalent
^{3}H	tritium

Definitions

Assessment. The evaluation process used to measure the performance or effectiveness of a system and its elements. Assessment is an all-inclusive term used to denote any of the following: audit, performance evaluation, management systems review, peer review, inspection, or surveillance.

Background Radiation. Radiation from cosmic sources, naturally occurring radioactive material, including radon (except as a decay product of source or special nuclear material), and global fallout as it exists in the environment from the testing of nuclear explosive devices or from nuclear accidents like Chernobyl which contribute to background radiation and are not under the control of the cognizant organization. Background radiation does not include radiation from source, byproduct, or special nuclear materials regulated by the cognizant federal or state agency. Different definitions may exist for this term. The definition provided in regulations or regulatory program being used for a site release should always be used if it differs from the definition provided here.

Beta Radiation. An electron emitted from the nucleus during radioactive decay.

Class 1 Survey Units. Areas where contamination is known or suspected to exist and insufficient evidence exists to classify the areas as Class 2 or Class 3 survey units.

Class 2 Survey Units. Areas where contamination is known or suspected to exist, but where there is no evidence of it exceeding the release criteria.

Class 3 Survey Units. Areas where contamination is either not believed to exist or exists at levels that are insignificant compared to release criteria.

Contamination. The presence of residual radioactivity in excess of levels which are acceptable for release of a site or facility for unrestricted use.

DCGL. A derived, radionuclide-specific activity concentration in a survey unit corresponding to the release criterion. The DCGL is based on the spatial distribution of the contaminant and hence is derived differently for the nonparametric statistical test ($DCGL_W$) and the Elevated Measurement Comparison ($DCGL_{EMC}$). DCGLs are derived from activity/dose relationships through various exposure pathway scenarios.

Decommissioning. The process of removing a facility or site from operation, followed by decontamination, and license termination (or termination of authorization for operation) if appropriate. The objective of decommissioning is to reduce the residual radioactivity in structures, materials, soils, groundwater, and other media at the site so that the concentration of each radionuclide contaminant that contributes to residual radioactivity is indistinguishable from the background radiation concentration for that radionuclide.

Decontamination. The removal of radiological contaminants from a person, object or area to levels that are within established regulatory guidelines. Decontamination is sometimes used interchangeably with remediation, remedial action, and cleanup.

Detection Limit. The net response level that can be expected to be seen with a detector with a fixed level of certainty.

Detection Sensitivity. The minimum level of ability to identify the presence of radiation or radioactivity.

Direct Measurement. Radioactivity measurement obtained by placing the detector near the surface or media being surveyed. An indication of the resulting radioactivity level is read out directly.

DQA (Data Quality Assessment). The scientific and statistical evaluation of data to determine if the data are of the right type, quality, and quantity to support the intended use.

DQOs (Data Quality Objectives). Qualitative and quantitative statements derived from the DQO process that clarify study technical and quality objectives, define the appropriate type of data, and specify tolerable levels of potential decision errors that will be used as the basis for establishing the quality and quantity of data needed to support decisions.

Exposure Pathway. The route by which radioactivity travels through the environment to eventually cause radiation exposure to a person or group.

Final Status Survey. Measurements and sampling to describe the radiological conditions of a site, following completion of decontamination activities (if any) in preparation for release.

Gamma Radiation. Penetrating high-energy, short-wavelength electromagnetic radiation (similar to x-rays) emitted during radioactive decay. Gamma rays are very penetrating and require dense materials (such as lead or steel) for shielding.

Graded Approach. The process of basing the level of application of managerial controls applied to an item or work according to the intended use of the results and degree of confidence needed in the quality of the results.

Grid. A network of parallel horizontal and vertical lines forming squares on a map that may be overlaid on a property parcel for the purpose of identification of exact locations.

Impacted Area. Any area that is not classified as nonimpacted. Areas with a possibility of containing residual radioactivity in excess of natural background or fallout levels.

Investigation. An activity such as measuring, examining, testing, or gauging one or more characteristics of an entity and comparing the results with specified requirements in order to establish whether conformance is achieved for character.

License Termination. Discontinuation of a license, the eventual conclusion to decommissioning.

Liquid Scintillation. Method of measuring beta activity where energy released during decay is converted into photons that can be measured in the form of light energy within a liquid media referred to as a scintillation cocktail. The energy emitted in the form of light is proportional to the rate of decay and can be reported isotopically as ^{3}H or ^{14}C in disintegrations per minute (dpm), or generally as counts per minute (cpm).

Lower Bound of the Grey Region (LBGR). The lower bound of a region in which the consequences of decision errors are relatively minor. (The upper bound of the grey region is the DCGL and the LBGR is a site-specific variable that provides an acceptable value for the relative shift.)

Lower Limit of Detection (L_D). The smallest amount of radiation or radioactivity that statistically yields a net result above the method background. The critical detection level, L_C, is the lower bound of the 95 percent detection interval defined for L_D and is the level at which there is a 5 percent chance of calling a background value "greater than background". This value should be used when actually counting samples or making direct radiation measurements. Any response above this level should be considered as above background; *i.e.*, a net positive result. This will ensure 95 percent detection capability for L_D. A 95 percent confidence interval should be calculated for all responses greater than L_C.

Minimum Detectable Activity (MDA). The MDA is the *a priori* activity level that a specific instrument and technique can be expected to detect 95 percent of the time. When stating the detection capability of an instrument, this value should be used. The MDA is the detection limit multiplied by an appropriate conversion factor to give units of activity.

Measurement. Measurement is used interchangeably to mean 1) the act of using a detector to determine the level or quantity of radioactivity on a surface or in a sample of material removed from a media being evaluated, or 2) the quantity obtained by the act of measuring.

MARSSIM. Multi-Agency Radiation Survey and Site Investigation Manual. A manual established by the U.S. Environmental Protection Agency (EPA), U.S. Nuclear Regulatory Commission (NRC), U.S. Department of Defense (DOD), and U.S. Department of Energy (DOE) that provides a nationally consistent consensus approach to conducting radiation surveys and investigations at potentially contaminated sites. The approach is both scientifically rigorous and flexible enough to be applied to a diversity of site cleanup conditions.

Nonimpacted Area. Areas where there is no reasonable possibility (extremely low probability) of residual radioactivity. Nonimpacted areas are typically located off site and may be used as background *reference area*s.

Professional Judgment. An expression of opinion, based on technical knowledge and professional experience, assumptions, algorithms, and definitions, as stated by an expert in response to technical problems.

Quality Assurance (QA). An integrated system of management activities involving planning, implementation, assessment, reporting, and quality improvement to ensure that a process, item, or service is of the type and quality needed and expected by the customer.

Quality Control (QC). The overall system of technical activities that measure the attributes and performance of a process, item, or service against defined standards to verify that they meet the stated requirements established by the customer, operational techniques and activities that are used to fulfill requirements for quality. For this decommissioning plan, QC measures include precision, accuracy, bias, sensitivity, representativeness, completeness, and comparability.

Radiation Safety Committee. Individuals within the Aptuit organization who develop policies and procedures for the implementation of the Aptuit Radioactive Materials License.

Radiation Safety Officer. The Aptuit staff member responsible, with the support of the Radiation Safety Committee, for the implementation of the facilities Radiation Safety Program.

Radiation Survey. Measurements of radiation levels associated with a site together with appropriate documentation and data evaluation.

Radioactivity. The mean number of nuclear transformations occurring in a given quantity of radioactive material per unit time. The International System (SI) unit of radioactivity is the *Becquerel (Bq*). The customary unit is the *Curie (Ci*).

Radiological Release. The release of materials/equipment/areas from radiological controls pertaining to radioactive materials. These radiological controls refer to either local requirements as established in the RSPM or license requirements as established in the Nuclear Regulatory Commission Radioactive Material License. The release from radiological controls is preceded by an assessment of the radiological conditions and confirmation that these conditions meet the requirements to be released from further controls.

Radionuclide. An unstable atom of any element that undergoes radioactive decay in order to achieve a more stable state.

Regulation. A rule, law, order, or direction from federal or state governments regulating action or conduct. Regulations concerning radioisotopes in the environment in the United States are shared by the EPA, the NRC, the DOE, and many state governments. Federal regulations and certain directives issued by the DOD are enforced in the DOD.

rem (Radiation Equivalent Man). The conventional unit of dose equivalent. The corresponding International System (SI) unit is the *Sievert (Sv*): 1 Sv = 100 rem.

Remedial Action. Those actions that are consistent with a permanent remedy taken instead of, or in addition to, removal action in the event of a release or threatened release of a hazardous substance into the environment, to prevent or minimize the release of hazardous substances so that they do not migrate to cause substantial danger to present or future public health or welfare or the environment.

Remediation. Cleanup or other methods used to remove or contain a toxic spill or hazardous materials from a site.

Removable Radioactivity. Surface activity that is readily removable by wiping the surface with an absorbent medium using moderate pressure and can be assessed with standard radiation detectors. It is usually expressed in units of dpm/100 cm^2.

Residual Radioactivity. Radioactivity in structures, materials, soils, groundwater, and other media at a site resulting from activities under the cognizant organization's control. This includes radioactivity from all sources used by the cognizant organization, but excludes background radioactivity as specified by the applicable regulation or standard.

Sign p. The estimated probability that a random measurement from the survey unit will be less than the DCGL when the survey unit median is actually at the LBGR.

Survey. A systematic evaluation and documentation of radiological measurements with a correctly calibrated instrument or instruments that meet the sensitivity required by the objective of the evaluation.

Type I Error. A decision error that occurs when a survey unit is determined to be acceptable for release when it truly is not. This error is also called a Type A (alpha) error

Type II Error. A decision error that occurs when a survey unit is determined to be unacceptable for release when it truly is acceptable. This error is also called a Type B (beta) error.

Wipe Test. A procedure in which a sampling material is rubbed on a surface and its radioactivity measured to determine if the surface is contaminated with removable radioactive material.

I. EXECUTIVE SUMMARY

- **Name Address of Licensee/Site Owner** -

  The licensee and owner of the Aptuit facility is Aptuit, LLC (Aptuit), 10245 Hickman Mills Drive, Kansas City, Missouri, 64134-0708.

- **Site Location/Address** - The Aptuit facility is located at 10245 Hickman Mills Drive in Kansas City, Missouri, Jackson County, 64134-0708.

- **Site Description** - Aptuit occupies 7 (Buildings A, B, E, N, and P; the pH treatment building; and the security building) of 13 primary buildings in an industrial complex (Figure 1-1) adjacent to and just east of Interstate 435. The surrounding area is also primarily industrial. The site is situated in a campus-type setting which includes offices, warehouse space, manufacturing space, and laboratory space and is located on approximately 45.5 acres of land. The Aptuit buildings total approximately 417,000 square feet (ft^2). In addition, Aptuit leases the North Hill Waste Storage Building from Sanofi-Aventis. This building was used for staging and storage of waste materials and contaminated equipment.

- **Summary of Licensed Site Activities** - Radioactive materials have been used at the Aptuit facility for research purposes since the issuance of the License (License Number 24-15595-01) in the spring of 1973. The License has authorized fourteen radionuclides including: hydrogen-3 (^{3}H), carbon-14 (^{14}C), nickel-63 (^{63}Ni), phosphorus-32 (^{32}P), sulfur-35 (^{35}S), iodine-125 (^{125}I), iodine-131 (^{131}I), calcium-45 (^{45}Ca), chromium-51 (^{51}Cr), Technicium-99m (^{99m}Tc), sodium-22 (^{22}Na), potassium-42 (^{42}K), cesium-137 (^{137}Cs) and barium-133 (^{133}Ba). With the exception of ^{63}Ni, ^{133}Ba, ^{137}Cs sealed sources, the License authorized the radionuclides in any form, and the authorized uses were research and development in the synthesis of labeled pharmaceuticals for nonhuman experimentation and in vivo and/or in vitro animal studies. There was very limited to no use of ^{32}P, ^{35}S, ^{45}Ca, ^{51}Cr, ^{99m}Tc, ^{22}Na, and ^{42}K. With the exception of ^{22}Na, these radionuclides have very short half-lives and would not constitute a contaminant of concern even if they had been used in recent years. ^{22}Na was authorized on Amendment 15 in January 1992. This radionuclide was no longer authorized as of Amendment 17 issued in September 1993. The license limit was 20 mCi. There is no record of use of ^{22}Na at the facility nor was it identified as a contaminant of concern in any previous site investigations. The short half-life (2.6 years), the time since ^{22}Na was authorized on the license (19.5 years), combined with a lack of evidence of any use effectively eliminates ^{22}Na as a contaminant of concern. Until 2008, the primary use was microcurie (µCi) to millicurie (mCi) quantities of ^{3}H and ^{14}C. Amendment 27 issued in 2008 authorized synthesis of radiolabeled compounds and increased the possession limits for ^{3}H and ^{14}C. Currently, the License allows the possession of ^{3}H, ^{14}C, ^{35}S, and ^{125}I in any form for research and development and for radiosynthesis of radiolabeled organic chemicals. The License also authorizes ^{133}Ba and ^{137}Cs sealed sources for use as internal standards in liquid scintillation counters. Table 1-1 provides an overview of the License and amendments.

  The current radioactive material use and storage areas are contained in Appendix C. The types, quantities and forms of radioactive material used in the Aptuit facilities

are discussed in Section II.A. and Section II.B. Figures 1-4 through 1-6 are scale drawings of locations of use and storage of radioactive materials.

- **Nature and Extent of Contamination**- A summary of the nature and extent of contamination in building structures, equipment, systems, surface soil, subsurface soil, surface water and groundwater is contained in this section. A more detailed summary can be found in Section IV, Radiological Status of Facility. The only remaining contaminants of concern at the Aptuit facilities are ^{3}H and ^{14}C. Contamination outside of the Active Pharmaceutical Ingredients (API) (i.e. radiosynthesis) laboratories and systems is limited to legacy ductwork and a spill area in an analytical laboratory (B3-298). Environmental media (soil, surface water, and groundwater) have not been impacted by site operations. Final characterization of the impacted areas and systems has been pending cessation of principal operations, removal of materials and equipment from the areas, and approval from the NRC of characterization activities that may need regulatory approval to proceed. Characterization surveys will be conducted in accordance with Aptuit work instructions WI-001, *Surface Contamination Surveys for Decommissioning Activities*, WI-005, *Control of Radiological Work*, and WI-007, *Radiological Characterization of Systems, Surface, and Equipment for Decommissioning Activities.*

  Summary of the Nature and Extent of Contamination:

  Legacy Ductwork - Some contamination exists in the legacy ductwork that serviced historical use areas. Highest results obtained in any of the legacy systems were 138,000 dpm/100 cm^2 total ^{14}C, 2,350 dpm/100 cm^2 removable ^{14}C, and 130 dpm/100 cm^2 removable ^{3}H. Total ^{14}C activity measured throughout the systems was generally less than 10,000 dpm/100 cm^2, with removable ^{14}C and ^{3}H activity generally less than 1,000 dpm/100 cm^2 and 100 dpm/100 cm^2, respectively.

  API Laboratories (B2-155 through B2-170) - Routine operational surveys reveal that there is removable low-level ^{3}H and ^{14}C surface contamination throughout the laboratories, but it is generally maintained below 2,000 dpm/100 cm^2. Routine survey areas include floors, hood sashes, hood hand wheels, hood ledges, and miscellaneous equipment.

  Scoping surveys performed on December 15, 2011 were used to assess total and removable contamination levels on internal hood surfaces, hood ledges, floors, walls, tables, sinks, and ceiling tiles. The highest average ^{14}C contamination levels (direct measurements) of 7.4E5 dpm/100 cm^2 and 1.2E5 dpm/100 cm^2 were found on internal hood surfaces and in sinks, respectively. The highest average removable levels of ^{3}H and ^{14}C, 7.2E3 dpm/100 cm^2 and 4.8E4 dpm/100 cm^2, respectively, were found on internal hood surfaces. Similar removable contamination levels were found in the sinks.

  A summary of the scoping surveys performed in the API laboratories can be found in Table 1-3.

  Analytical Laboratory (B3-298) - There are two documented incidents in B3-298 that resulted in ^{14}C contamination or the further spread of contamination on a lab bench and a section of the floor. Contamination levels of 100,000 dpm/100 cm^2

were noted from the first spill. The second incident was a release of water into the contaminated area, which resulted in removable contamination levels of up to 8,000 dpm/100 cm^2. These areas are marked as contaminated, and there is no known contamination outside of these areas.

- **Decommissioning Objective** - The objective of the decommissioning action is unrestricted release and termination of the Aptuit NRC license.

  This DP, prepared in accordance with NRC guidance, is intended to provide information needed to support decommissioning of the facility and for license termination in accordance with the NRC License Termination Rule (10 CFR Part 20, Subpart E).

  In preparing to conduct decommissioning activities at the facilities, it was determined that decommissioning of the facility would fall into Decommissioning Group 3 as defined in NUREG-1757, Volume 1, Revision 2, *Consolidated NMSS Decommissioning Guidance: Decommissioning Process for Materials Licensees* (NRC, 2006). Use of the decommissioning roadmap indicates that the facility would fall into Group 2, since residual activity will be less than the screening values and no DP is required by condition of the license. However, 10 CFR Part 30.36 (g)(1) states, in part, that a DP must be submitted if the procedures and activities necessary to carry out decommissioning of the site have not been previously approved by the NRC and these procedures could increase potential health and safety impacts to workers or to the public. It was determined that the procedures involved in decommissioning would involve techniques not applied routinely during cleanup or maintenance operations; therefore, a decommissioning plan is submitted making this a Group 3 decommissioning.

- **Site DCGLs/ Corresponding Doses/ Method Determination** - Preliminary derived concentration guideline levels (DCGL) have been determined for the two radiological contaminants of concern, tritium (^3H) and carbon-14 (^{14}C). These preliminary DCGLs are 3.7E5 disintegrations per minute (dpm)/100 square centimeters (cm^2) for ^{14}C total contamination and 3.7E4 dpm/100 cm^2 for removable contamination for ^3H and ^{14}C combined. These DCGLs equate to a dose of 2.5 mrem per year.

  The screening values presented in Appendix H of NUREG 1757, Volume 2, Rev. 1 *Consolidated NMSS Decommissioning Guidance: Characterization, Survey, and Determination of Radiological Criteria,* (NRC, 2006a) for the radionuclides of concern, ^3H and ^{14}C were selected as the starting point in determining DCGLs. The screening value for ^3H is 1.2E8 dpm/100 cm^2, and for ^{14}C, the screening value is 3.7E6 dpm/100 cm^2. Since ^3H surface contamination cannot be determined accurately and reliably with direct reading instruments, the most conservative screening value for the contaminants of concern, 3.7E+06 dpm/100 cm^2, was considered as the basis for DCGL determination.

  Considering ALARA, Aptuit is selecting a DCGL for total activity that is 10 percent of the ^{14}C screening value, or 3.7E+05 dpm/100 cm^2. Screening levels presented in NUREG 1757 are based on the assumption that the fraction of removable activity is equal to 0.1 (10 percent). Therefore, 10 percent (the removable portion) of the recommended DCGL for fixed activity, or 3.7E+04

dpm/100 cm^2, is the recommended DCGL for removable activity (^3H and ^{14}C combined).

Materials and equipment released from radiological controls will meet Aptuit's acceptable surface contamination levels (Table 1-2).

- **ALARA Evaluations** – Based on a review of 1) the NRC building surface screening values for license termination and 2) characterization data (operational and scoping surveys), it was determined that the 10 percent of the screening DCGLs would be selected to ensure that doses would be ALARA. The DCGLs result in a dose of 2.5 mrem. In addition, potential exposures to decommissioning workers were evaluated to ensure that doses are ALARA. ALARA evaluation and analysis are discussed in detail in Section VII, ALARA ANALYSIS**.**
- **Restricted Conditions/ Limiting Doses/ Public Participation** – Aptuit is seeking unrestricted release and termination of the NRC license therefore no restricted conditions, alternate dose limits, institutional controls or alternate criteria are requested.
- **Proposed initiation and completion –** Initiation of decommissioning activities at Aptuit will begin upon approval of the decommissioning plan by NRC. Completion is estimated to take approximately eight months.
- **Post Remediation Activities -** The process of decommissioning of the facility will end with the result being unrestricted release and termination of the NRC license. No post remediation activities will be required.
- **License Amendment -** Aptuit requests that Radioactive Materials License Number 24-15595-01 be amended to incorporate this DP.

II. FACILITY OPERATING HISTORY

A. *LICENSE NUMBER/STATUS/AUTHORIZED ACTIVITIES*

- **Radionuclides/Maximum Activities Authorized and Used** –. The current License (Appendix A) authorizes ^{3}H and ^{14}C in any form for research and development and radiosynthesis of radiolabeled organic compounds. The authorized use for both ^{35}S and ^{125}I was changed to "in storage incident to disposal" in the last amendment. Authorized possession limits are 100 curies each for ^{3}H and ^{14}C, 1.5 curies for ^{35}S and 70 millicuries for ^{125}I. In recent years only ^{3}H and ^{14}C have been used. Use of radionuclides over the last three years of operation has averaged 1.2 curies for ^{3}H and 18.3 curies for ^{14}C. The current license also authorizes ^{133}Ba and ^{137}Cs as sealed sources. A summary of the license and amendment history is found in Table 1.1.

- **Chemical Form of Radionuclides** - The current license (Appendix A) authorizes ^{3}H and ^{14}C in any form for research and development and radiosynthesis of radiolabeled organic compounds. The authorized use for both ^{35}S and ^{125}I was changed to "in storage incident to disposal" in the last amendment. Only ^{3}H and ^{14}C have been used. Stock solutions of ^{3}H are most often received as borotritide or tritium gas and ^{14}C stock materials are most often received as potassium cyanide or barium carbonate.

- **Description of Current Radionuclide Use** - Radioactive materials were used for synthesis of radiolabeled compounds and for pharmaceutical research, development, and analysis in accordance with NRC Radioactive Materials License Number 24-15595-01 (Appendix A). The most recent use, until operations ceased in January 2012, was synthesis of radiolabeled compounds using millicurie (mCi) to curie (Ci) quantities of ^{3}H and ^{14}C. Radiosynthesis was authorized in 2008 (Amendment 27) and the license limits for tritium (^{3}H) and carbon-14 (^{14}C) were increased to 100 curies each. Prior to this time use was research and development and analysis using mCi quantities of ^{3}H, ^{14}C, and iodine-125 (^{125}I). There has been no use of radioactive materials, other than QA analysis and what is incidental to preparation activities for decommissioning, since radiosynthesis operations ceased in January 2012.

- **Locations of Use and Storage** – The locations of the current radioactive material use and storage areas are listed in Appendix C, *Current Radioactive Materials Use and Storage Areas*.

- **Drawings of Current Radionuclide Use Locations** –Figures 1-4 through 1-6 are scale drawings of locations of use and storage of radioactive materials.

- **List of Amendments to License –** The list of license amendments can be found in Table 1-1, *Overview of Materials License No. 24-15595-01 and Amendments*. The last license renewal was granted on April 8, 2008 via Amendment 27. This amendment authorized radiosynthesis operations and increased license limits for ^{3}H and ^{14}C to 100 curies each. Since that time the license has been amended seven times to add areas of use, change authorized users, and change company ownership from Aptuit, Inc to Aptuit, LLC. Amendment 34 also changed the authorized use of ^{35}S and ^{125}I to "in storage incident to disposal."

B. *LICENSE HISTORY*

- **Authorized Radionuclides and Maximum Activities Under Previous Licenses** - The radioactive material use in these facilities has only been associated with NRC license number No. 24-15595-01. The list of license amendments can be found in Table 1-1, *Overview of Materials License No. 24-15595-01 and Amendments*.

- **Radionuclides/Maximum Activities Authorized and Used/Chemical Forms -** Radioactive material has been used at Aptuit facility for research purposes since the issuance of the License in the spring of 1973. The original License included ^{3}H and nickel-63 (^{63}Ni) detector cells for use in chromatographs. By 1980, ^{63}Ni had been eliminated from the License. The License has over the years authorized fourteen radionuclides including: ^{3}H, ^{14}C, ^{63}Ni, ^{32}P, ^{35}S, ^{125}I, ^{131}I, calcium-45 (^{45}Ca), chromium-51 (^{51}Cr), Technicium-99m (^{99m}Tc), sodium-22 (^{22}Na), potassium-42 (^{42}K), ^{137}Cs and barium-133 (^{133}Ba). With the exception of ^{63}Ni, ^{137}Cs and ^{133}Ba, the License authorized the radionuclides in any form, and the authorized uses were research and development in the synthesis of labeled pharmaceuticals for nonhuman experimentation and in vivo and/or in vitro animal studies. Radioisotopes were generally received as labeled organic compounds in an aqueous matrix. Typically, the isotopes were diluted into working solutions, and µCi quantities were used primarily as labels on pharmaceuticals. ^{137}Cs was limited to sealed sources used for calibration. As time passed, ^{137}Cs and ^{32}P were eliminated from the License. Calcium-45 (^{45}Ca) was added and later deleted. Until 2008, the primary use was microcurie to mCi quantities of ^{3}H and ^{14}C. There was very limited to no use of ^{32}P, ^{35}S, ^{45}Ca, ^{51}Cr, ^{99m}Tc, ^{22}Na, and ^{42}K. With the exception of ^{22}Na, these radionuclides have very short half-lives and would not constitute a contaminant of concern even if they had been used in recent years. ^{22}Na was authorized on Amendment 15 in January 1992. This radionuclide was no longer authorized as of Amendment 17 issued in September 1993. The license limit was 20 mCi. There is no record of use of ^{22}Na at the facility nor was it identified as a contaminant of concern in any previous site investigations. The short half-life (2.6 years), the time since ^{22}Na was authorized on the license (19.5 years), combined with a lack of evidence of any use effectively eliminates ^{22}Na as a contaminant of concern.

  The License has been amended 34 times, primarily for address changes, changes in company ownership, and changes in the radiation safety officer (RSO). Other amendments include the addition or deletion of radionuclides (such as ^{63}Ni and ^{45}Ca) or their uses and changes in possession limits. The most significant amendment was Amendment 27 in 2008, which substantially increased License limits for ^{3}H and ^{14}C and authorized synthesis of radiolabeled organic compounds. License limits for ^{3}H and ^{14}C were increased from 1 and 2 Ci, respectively, to 100 Ci for each. The license limit for ^{35}S was also increased from 70 mCi to 1.5 Ci, although ^{35}S has not been used. Amendments 28 through 34 were to change authorized users, to add use and support areas and to change company ownership from Aptuit, Inc to Aptuit, LLC.

- **Locations of Use and Storage** –All previous use and storage locations are listed in Appendix D. All of these locations have been released for unrestricted use as allowed under prior license conditions, have been released from the License, or are currently being reviewed for release by the NRC (Shaw, 2012).
- **Drawings of Historical Radionuclide Use Locations** - Figures 2-1 through 2-8 are scale drawings of historical radioactive material use and storage locations.

C. *PREVIOUS DECOMMISSIONING ACTIVITIES*

- **Areas of Aptuit Remediated in the Past**

The following is a summary of the decommissioning activities previously conducted at the site. All of these activities were performed under the Aptuit license.

L Building and LAR - GTS Duratek, Inc., 1999

Radiological site investigations were conducted by GTS Duratek, Inc. (Duratek) in 1999 in support of License transfer activities (Duratek, 1999a,b). Areas covered by these activities were in L Building and in the LAR section of B Building. Radionuclides of concern were ^{14}C and ^{3}H. Together, these two reports describe a concerted effort to identify and eliminate contamination that exceeded specified limits. The purpose of the surveys associated with the July report (Duratek, 1999a) was to locate and identify any areas of contamination on surfaces/structures (floors, benches, and hoods) within the laboratories to support the license transfer from HMRI to Quintiles. There were no specific guideline values utilized for the surveys since the facility was not being surveyed for release. Instead, flag values were implemented based upon the detection capability of the survey instrumentation and the facility radiological control criteria. For direct surface activity measurements, a flag value of 1,000 disintegrations per minute (dpm)/100 square centimeters (cm^2) was used for ^{14}C while a flag limit for total removable activity was set at 200 dpm/100 cm^2 for ^{3}H and ^{14}C combined.

Initial surveys were performed followed by cleaning activities. Cleaning activities were performed in an attempt to reduce radioactivity levels below the flag values. Follow-up surveys were then performed. Radioactivity levels could not be reduced to below the flag values in some cases. Hence, the activities associated with the November report (Duratek, 1999b) were performed.

For areas where radioactivity levels could not be reduced to below flag values prior to the issuance of the July report (Duratek, 1999a), the November report (Duratek, 1999b) stated that aggressive cleaning activities were performed, some equipment was removed, and areas were resurveyed. The purpose of the surveys associated with the November report (Duratek, 1999b) was “to verify that the areas or components were adequately decontaminated and that no spread of contamination occurred during the decontamination process.”

B2-150A - Shaw, 2005

Shaw performed equipment and facility radiological release surveys in Laboratory B2-150A in April 2005 (Shaw, 2005). The release limit was 2,000 dpm/100 cm^2 for ^3H and ^{14}C. A grid was established on the floor and walls. A static count was performed and a wipe sample collected within each grid. Several areas within the laboratory exhibited activity greater than the release limit. These areas were cleaned to below the release limit. Wipes were collected for ^3H, and all results were below the release limit.

L4-421 and L4-422 - Shaw, 2002

In the L Building (formerly an Aptuit facility), two laboratories were released from radiological controls in 2002 prior to release of the entire building in 2006. Laboratories L4-421 and L4-422 were released under the conditions of the License and following guidance in the *Multi-Agency Radiation Survey and Site Investigation Manual* (MARSSIM) (NRC, 2000). The radionuclides of concern were ^3H and ^{14}C. Both laboratories were considered Class 1 survey units because insufficient information was provided at that time to reduce the classification to Class 2 or Class 3. The DCGLs used during these surveys were 3.7E+06 dpm/100 cm^2 for total contamination and 3.7E+05 dpm/100 cm^2 for removable contamination. All direct measurements and wipe sample results were below the respective DCGLs.

L5-526 - Shaw, 2006

Laboratory L5-526 in the L Building was released in 2006. An FSS was performed following MARSSIM guidance. The radionuclides of concern were ^3H and ^{14}C. Based on a lack of historical information the laboratory was considered a Class 1 survey unit. The DCGLs used during these surveys were 3.7E+06 dpm/100 cm^2 for total contamination and 3.7E+05 dpm/100 cm^2 for removable contamination. All direct measurements and wipe sample results were below the respective DCGLs.

A3-367 - Shaw, 2006

Decommissioning activities including a final status survey (FSS) were conducted in Laboratory A3-367 in 2006 (Shaw, 2006b). The FSS included surface scans, direct measurements, and wipe sampling. The radionuclides of concern were ^3H and ^{14}C. All direct measurements and wipe sample results were below the DCGLs. The data indicated that the laboratory was acceptable for unconditional radiological release.

L Building and Lab Animal Resources (LAR) Decommissioning, Shaw -2006

Shaw performed decommissioning activities in L Building and the Lab Animal Resources (LAR) section of B Building in 2006 in preparation for releasing those areas from radiological controls (Shaw, 2006a). Shaw performed a Historical Site Assessment (HSA) and planned and conducted a final status survey (FSS). A final status survey report (FSSR) was prepared and submitted to the NRC (Shaw,

2007). The DCGLs selected, based on NRC screening values and as low as reasonably achievable (ALARA) considerations, were 3.7E+05 dpm/100 cm^2 for total activity and 3.7E+04 dpm/100 cm^2 for removable activity. Being a separate building, the L Building was released from Aptuit's NRC Radioactive Materials License (Amendment 25), and LAR was released from radiological controls.

Aptuit CTS - Shaw, 2012

A final status survey (FSS) was conducted at Aptuit in 2011. The FSS included the radiologically impacted areas of the Clinical Trials Supplies (CTS) facilities of Aptuit. These areas included specific portions of A, B and E Buildings.

Radionuclides of concern in the CTS facilities were ^{3}H and ^{14}C. The scope of the FSS included specific portions of A, B and E Buildings having potentially impacted areas such as laboratories and support areas in which these radionuclides were used or stored. A total of four survey units were included in the FSS: one was a Class 2 and three were Class 3 survey units. There were no Class 1 survey units.

The completed final status survey included scanning and systematic, random, and biased measurement locations. Biased locations were determined by field personnel using professional judgment.

To ensure that residual radioactivity was reduced to levels that were as low as reasonably achievable, final status release criteria were set at 10 percent of the NRC screening values given in Table H.1 of NRC's *Consolidated Decommissioning Guidance - Characterization, Survey, and Determination of Radiological Criteria,* NUREG-1757, Volume 2.

The FSS data demonstrate that the CTS facilities meet the NRC criteria for radiological release established in the license termination rule (10 Code of Federal Regulations 20, Subpart E). The data are presented in the Aptuit CTS Final Status Survey Report (Shaw, 2012). The FSSR is currently under NRC review.

- **Summary of Types, Forms, Activities and Concentrations of Radionuclides Present in Previously Remediated Areas** – All of the previously decommissioned areas were used for research and development in the synthesis of labeled pharmaceuticals for nonhuman experimentation and in vivo and/or in vitro animal studies. Radioisotopes were generally received as labeled organic compounds in an aqueous matrix. Typically, the isotopes were diluted into working solutions, and µCi quantities were used primarily as labels on pharmaceuticals. None of the previously decommissioned areas were used for radiosynthesis operations authorized by Amendment 27. Up until 2008, the primary use was microcurie to mCi quantities of ^{3}H and ^{14}C.
- **Activities Causing Area Contamination** – Activities causing area contamination with radioactive materials at Aptuit's facilities included synthesis of labeled pharmaceuticals and work involved with pharmaceutical research, development, and analysis.

- **Procedures to Remediate Areas/Disposition of Radioactive Material** – Remediation efforts typically involved wiping contaminated surfaces with a water and detergent mixture. In some cases contaminated items and materials were removed and disposed as radioactive waste when cleaning efforts were unsuccessful. All radioactive materials generated during remediation efforts were managed and disposed as radioactive waste. Decontamination efforts involved in specific spills are described in Section II.D.
- **Results of previously remediated areas** – The results of previously remediated areas are discussed in Section II.C above. All areas that have been remediated and released from radiological controls have met the criteria for unrestricted release.
- **Drawings of Previous Remedial Activity** – Scale drawings showing the areas of previous remedial activities are indicated on Figures 2-1 and 2-5.

D. *SPILLS*

- **Summary of Areas of Site Spills** - Five documented radiological incidents are in areas covered by this DP. Each of those incidents is described separately in the following paragraphs, and the incident reports are provided in Appendix B.

  There are two documented incidents in B3-298.

  – On April 4, 2007, it was discovered that the tubing from a detector on a high-performance liquid chromatograph (HPLC) in B3-298 had become detached and had dripped on the floor. Surveys conducted after the tubing was reconnected indicated some ^{14}C contamination on a corner of the cabinet and on the floor. Attempts to decontaminate the area were unsuccessful. The contaminated areas were taped and labeled as radioactive. No contamination was found outside the immediate area of the spill. Contamination levels exceeded 100,000 dpm/100 cm^2.

  – On July 26, 2010, the deionized water system in B3-298 leaked into the contaminated area under the bench. Water that leached from under the bench was contaminated. Water also leaked under the wall into the adjacent hallway. No contamination was found on the carpet in the hallway.

  There have been two incidents in the Active Pharmaceutical Ingredients (API) area.

  – On November 2, 2008 a spill occurred in the API area, originating in B2-166. The spill was a result of a hose, connecting tap water to a hot water bath, becoming disconnected in a chemical hood. The hot water bath was unattended during this leak and water flowed from the chemical hood and became contaminated with ^{14}C and ^{3}H as it flowed from the hood and into the laboratory. The spill resulted in approximately 300 gallons of water being collected and another approximate 110 gallons being disposed through the sanitary sewer. The spill covered Laboratories B2-165, B2-166, B2-167, and B2-170. This spill migrated outside of Laboratory B2-166 to the adjacent linoleum floor tiles and carpeted cubicle area, resulting in contamination of the floor and furniture in the office area. Decontamination activities included

stripping of the linoleum floors, removal and replacement of carpet tiles, and cleaning of furniture. Decontamination efforts were successful in reducing levels to below Aptuit's surface contamination limits.

- On September 20, 2011, contamination was found in the hallway outside of the API laboratories after filling a radioactive waste disposal box. It is suspected that the contamination resulted from a leaking container that was placed into the box. The area was decontaminated successfully.

The locations of these spills are shown on Figures 1-2 and 1-3.

Surveys performed in the cafeteria (B3-275) on April 24, 2010 revealed elevated direct readings for ^{14}C on the floor (one spot) and table legs (two locations). One carpet tile was removed and disposed and the table legs were decontaminated. This survey was performed to determine if radioactive materials were being tracked from the radiosynthesis operations. After this initial survey, the cafeteria was put on a routine quarterly survey schedule and additional radiological controls were instituted in the radiosynthesis laboratories. During at least one following survey, elevated readings have been found on table legs that were subsequently decontaminated.

Other incidents have been reported during the facility's operating life; however, areas where those incidents occurred were previously surveyed and released from radiological controls. These incident reports are also included in Appendix B, *Incident Reports*.

- **Types, Forms, Activities, Concentrations of Radionuclides Involved in Spill** – The spills in B3-298 involved ^{14}C in an organic solvent HPLC carrier. The total activity involved is not known. The November 2008 spill in the API area involved approximately 300 gallons of water contaminated with ^{14}C. Total activity was estimated to be 1.01 mCi. The contamination events on April 24, 2010 and September 20, 2011 involved very low level ^{14}C contamination.

  The two spills that occurred in the LAR area involved a suspension dose formulation of 618 µCi of ^{14}C-RA738 and 12 µCi of ^{14}C-CO2 in B2-119 and B2-112, respectively.

- **Drawings Showing Locations of Spills** – Scale drawings showing locations of spills of radioactive materials in current use areas are included as Figures 1-2 and 1-3.

E. *PRIOR ONSITE BURIALS*

There are no occurrences of radioactive materials being buried at Aptuit.

III. FACILITY DESCRIPTION

Note: Based on guidance provided in NUREG-1757, Vol. 1, Rev. 2, Section 16.3, *Decommissioning Plan: Facility Description, Site Complexity* (NRC, 2006), the following limited information is provided based on the determination that it falls under the category of a "less complex" site. Table D.1 of Appendix D to NUREG-1757, Vol. 1, Rev 2 indicates that "only a minimal amount of information is normally expected" regarding the Facility Description for Decommissioning Group 3 licensees and that the information is usually in existing documentation. In addition, based on the contamination levels and planned decommissioning activities, there are no anticipated impacts to the populations in the surrounding areas or to the environment.

A. *SITE LOCATION AND DESCRIPTION*

- **The size of the site in acres or square meters** - The site is situated in a campus-type setting which includes offices, warehouse space, manufacturing space, and laboratory space and is located on approximately 45.5 acres of land. The buildings total approximately 417,000 square feet (ft^2) or 38,740 square meters (m^2).
- **The State and county in which the site is located** The Aptuit facility is located at 10245 Hickman Mills Drive in Kansas City, Missouri, Jackson County, 64134-0708.
- **The contours and elevation of the site** - The Aptuit property is approximately 940 feet above sea level, with ranges from approximately 850 to 1,000 feet above sea level, sloping to the west and south.
- **Location of off-site wells -** Based on the search of the federal databases by Environmental Data Resources, Inc., there are no wells within 1 mile of the Property. However, there are two mineral exploratory test holes within 0.25 mile, downgradient to the south of the Property. The test holes were reportedly drilled in 1946 and are assumed to be closed (Shaw, 2011).
- **Location of nearest residences**- The nearest residence is approximately 0.25 miles to the east of Aptuit facilities.
- **A description of the facilities (e.g., buildings, parking lots, and fixed equipment) at the site** – Figure 1-1, an Aptuit Facility Site Drawing, shows buildings and parking lots. Aptuit owns and occupies 7 (Buildings A, B, E, N, and P; the pH treatment building; and the security building) of 13 primary buildings in an industrial complex

B. *POPULATION DISTRIBUTION*

- **A summary of the current and projected population in and around the site, by compass vectors** - The site is located in Kansas City which is one of two county seats of Jackson County, the other being Independence, which is to the city's east. As of 2010, the population census was 459,787 with a metro area of 2.1 million. Planned

decommissioning activities will not result in doses to offsite individuals therefore the population distribution information in not applicable.

C. *CURRENT/FUTURE LAND USE*

- **A description of the current and anticipated land uses in and around the site** – The Aptuit facilities are located in a area that is primarily industrial in use. Commercial development is to the North, South, and West. A residential area is to the East. Land use is not expected to change.

D. *METEOROLOGY AND CLIMATOLOGY*

Based on contamination levels and planned decommissioning activities there are no anticipated impacts to onsite and offsite individuals during decommissioning operations from airborne radioactive materials. Therefore the meteorology and climatology data are considered to be not applicable.

E. *GEOLOGY AND SEISMOLOGY*

- **A detailed description of the geologic characteristics of the site and the region around the site** –Site geological and seismological characteristics do not affect the estimation of doses to onsite and offsite individuals during and at the completion of decommissioning operations therefore limited information is presented.

  The Kansas City area is located in the southern limit of the Pleistocene glaciations. Glacial till and loess cover much of the area to the north of the Missouri River. Areas to the south of the river are generally unaffected. Loess deposits are thickest in areas close to the river, and the deposits become thinner to the south of the river. Based on previous investigations (IT Corporation, 1999), lithology at the site is mainly silty clays and silty clay loams overlying a sequence of shale and limestone of the Kansas City Group. Depth to bedrock is typically less than 5 feet below ground surface.

F. *SURFACE WATER HYDROLOGY*

- **A description of site drainage and surrounding watershed fluvial features** Surface water characteristics do not impact the doses to onsite or offsite individuals during or at the completion of decommissioning therefore limited information is presented.

  Drainage classes of the soils range from somewhat poorly drained to well drained.

  Based on previous investigations (IT Corporation, 1999), regional water supply for the Kansas City area is obtained from the alluvial valleys of the Missouri River and its tributaries. With the exception of perched groundwater in fill material on top of bedrock, groundwater was not encountered at depths of 15 feet below ground surface. Based on topography, groundwater is expected to flow south-southwest.

G. *GROUND WATER HYDROLOGY*

Ground water characteristics do not impact the doses to onsite or offsite individuals during or at the completion of decommissioning therefore limited information is presented.

Based on previous investigations (IT Corporation, 1999), regional water supply for the Kansas City area is obtained from the alluvial valleys of the Missouri River and its tributaries. With the exception of perched groundwater in fill material on top of bedrock, groundwater was not encountered at depths of 15 feet below ground surface. Based on topography, groundwater is expected to flow south-southwest.

Based on the search of the federal databases by Environmental Data Resources, Inc., there are no wells within 1 mile of the Property. However, there are two mineral exploratory test holes within .25 mile, downgradient to the south of the Property. The test holes were reportedly drilled in 1946 and are assumed to be closed (Shaw, 2011).

H. *NATURAL RESOURCES*

A discussion of the natural resources occurring at or near the site is not applicable to the proposed decommissioning action since there are no impacts to the environment and exploitation of these resources would have no impact on dose estimates for the site.

IV. RADIOLOGICAL STATUS OF FACILITY

A. *CONTAMINATED STRUCTURES*

- **A list or description of all structures at the facility where licensed activities occurred that contain residual radioactive material in excess of site background levels** – Impacted structures at the Aptuit facility include the Waste Storage Building and sections of Building B. A list of all areas within these buildings that are impacted by radioactive material use or storage are contained in Appendix C, *Current Radioactive Material Use and Storage Areas.* Surveys have been performed on the B Building roof, around and in the vicinity of the external exhaust components and roof drains. All results were below Aptuit's acceptable surface contamination limits.
- **A summary of the structures and locations at the facility that the licensee has concluded have not been impacted by licensed operations and the rationale for the conclusion** – All locations at Aptuit other than those listed in Appendix C, *Current Radioactive Material Use and Storage Areas*, have been determined to be non- impacted. This determination was based on the historical site assessment which included a site assessment, records review, interviews and surveys.
- **A list or description of each room or work area within each of these structures** – Each impacted room or area within the impacted structures is described in Appendix C.
- **A summary of the background levels used during scoping or characterization surveys** – Material specific backgrounds were collected from non-impacted areas. Material backgrounds are given below.

Material backgrounds (cpm)

Material	Ludlum 43-68 GFPD
Lab bench black	268
Lab bench grey	143
Metal	151
Concrete floor	275
Lab floor - white	161
Lab floor - pink	198
Lab floor - resin	202
Carpet	205
Stairwell rubber tread	241

- **A summary of the locations of contamination in each room or work area/A summary of the radionuclides present at each location /The mode of contamination for each surface** – A summary of the contamination present in each room or work area is presented in Appendix C and is summarized by area below. Contamination exists as fixed and removable surface contamination. There are no consistent ratios of ^{3}H to ^{14}C contamination levels.

  Dock 5. Dock 5 is an active shipping and receiving dock servicing the B2 area. Radioactive materials shipped and received at this dock are packaged for transportation. Based on routine survey data, no contamination above Aptuit's acceptable surface contamination levels is expected.

  Health Physics Support Areas (B2-116, 117, 119). These HP support areas include B2-119 (the RSO office, instrument and record storage), B2-116 liquid scintillation counter (LSC) room and B2-117 (LSC waste storage). These areas are on the routine survey schedule. Results are consistently below Aptuit's acceptable surface contamination levels of 5,000 dpm/100 cm^2 total activity and 1,000 dpm/100 cm^2 removable activity.

  API Filter Room (B2-112). B2-112 contains the high-efficiency particulate air (HEPA) filter system (supply and exhaust) that services the API radiosynthesis area. The exhaust system is active and will remain so during some decontamination and decommissioning (D&D) efforts in the API area. The exhaust system prior to the exhaust HEPAs is contaminated but it has not been characterized. Contamination levels in the ductwork and stack beyond the HEPA filters have not been assessed.

  API Laboratories (B2-155 through B2-170). Laboratories B2-155 through B2-179 comprise the radiosynthesis suite for API. Principal operations ceased in these laboratories at the end of January 2012. Routine operational surveys reveal that there is removable low-level ^{3}H and ^{14}C surface contamination throughout the laboratory, but it is generally maintained below 2,000 dpm/100 cm^2. Routine survey areas include floors, hood sashes, hood hand wheels,hood ledges, and miscellaneous equipment.

  Scoping surveys were performed on December 15, 2011. This survey included assessment of total and removable contamination levels on internal hood surfaces, hood ledges, floors, walls, tables, sinks, and ceiling tiles. Direct measurements were made with a with a Pancake Geiger-Mueller (PGM) detector. The highest average ^{14}C contamination levels (direct measurements) of 7.4E5 dpm/100 cm^2 and 1.2E5 dpm/100 cm^2 were found on internal hood surfaces and in sinks, respectively. The highest average removable levels of ^{3}H and ^{14}C, 7.2E3 dpm/100 cm^2 and 4.8E4 dpm/100 cm^2, respectively, were found on internal hood surfaces. Similar removable contamination levels were found in the sinks.

  Average ^{14}C levels on hood surfaces, sinks, lab benches, floors, and overhead areas above Aptuit's acceptable surface contamination level for total activity. Only the walls had average ^{14}C contamination levels below Aptuit's limits.

Average removable ^{3}H contamination levels on hood surfaces, sinks, and overhead areas exceeded the Aptuit acceptable surface contamination level. Average removable ^{14}C contamination levels on hood surfaces, sinks, lab benches, and overhead areas exceeded Aptuit's limits. A summary of the scoping surveys performed in the API laboratories can be found in Table 1-3.

Analytical Laboratory (B3-298). There are two documented incidents in B3-298 that resulted in ^{14}C contamination or the further spread of contamination on a lab bench and a section of the floor. Contamination levels of 100,000 dpm/100 cm^2 were noted from the first spill. The second incident was a release of water into the contaminated area, which resulted in removable contamination levels of up to 8,000 dpm/100 cm^2. These areas are marked as contaminated, and there is no known contamination outside of these areas. These incidents are discussed in Section II.D.

Routine monthly contamination surveys were performed in B3-298 prior to August of 2008. Since that time, the laboratory has not been used for radioactive material studies and has been moved to a semiannual frequency for contamination surveys. Results of routine surveys are consistently below the action limit of 200 dpm/100 cm^2 for removable ^{3}H and ^{14}C. Routine survey locations include door handles, floor, balance enclosure, and lab tables. The routine surveys do not include the known area of contamination.

Waste Storage Building.The waste storage building was used for staging and storage of contaminated equipment and waste. Radioactive materials were packaged for disposal in this building. Characterization surveys will be performed in this building once waste and equipment have been removed. No contamination above Aptuit's acceptable surface contamination levels is expected.

- **The maximum and average radiation levels in mrem/hr in each room or work area –** These measurements are not applicable for the contaminants of concern at Aptuit.
- **Scale drawing showing the locations of radionuclide material contamination-** The only areas where residual contamination exists above Aptuit release levels is the B2 API laboratory suite (Labs B2-155 to B2-170) and B3-298. Surveys indicate low-level ^{3}H and ^{14}C surface contamination throughout the API laboratory suite therefore a separate drawing is not included. The API laboratory suite can be seen on Figure 1-4. Figure 1-3 (B3 Spill Area) is a scale drawing of the spill area which is also the area of residual contamination in B3-298.

B. *CONTAMINATED SYSTEMS and EQUIPMENT*

- **Description and location of contaminated systems or equipment /Summary of the radionuclides present/ /Maximum and average radionulide activities in dpm/100cm^2 -** A description of contaminated systems and equipment is given below. There are no consistent ratios of ^{3}H to ^{14}C contamination.

B Building Contaminated Equipment, and Systems

Legacy Ductwork. The B2-119 potentially contaminated legacy ductwork originated in B2-119 during the time when it was a general use radiological laboratory. The laboratory was decommissioned and released in 2007 (Shaw, 2007). The ductwork from the laboratory was removed to the adjacent utility chase, where it was capped and labeled as potentially contaminated. An investigation and survey of the legacy ductwork has been performed and is in included as Appendix G. The exhaust ductwork as well as exhaust fans were surveyed. Highest results obtained in any of the systems were 138,000 dpm/100 cm^2 total ^{14}C, 2,350 dpm/100 cm^2 removable ^{14}C, and 130 dpm/100 cm^2 removable ^{3}H. Total ^{14}C activity measured throughout the systems was generally less than 10,000 dpm/100 cm^2, with removable ^{14}C and ^{3}H activity generally less than 1,000 dpm/100 cm^2 and 100 dpm/100 cm^2, respectively. All other legacy ductwork from former radiological use areas was found to be below Aptuit's acceptable surface contamination levels of 5,000 dpm/100 cm^2 total activity and 1,000 dpm/100 cm^2 removable activity (Table 1-2).

Incinerator (B2-103A). Radioactive waste containing ^{3}H and ^{14}C was burned in an on-site incinerator until 2005. The incinerator is located on the B2 level in Room B2-103A. The incinerator was vented through a dedicated stack, which was left in place when the incinerator was removed from service. B2-103A contains the incinerator and is also currently used for accumulation of radioactive waste. Surveys performed indicate elevated readings (up to 5,000 dpm/100 cm^2 total) on the refractory lining of the incinerator attributable to naturally occurring radioactive material in the fire brick. Removable contamination surveys were performed in the incinerator burn chamber, in the stack and blower access ports, and on the concrete pad underneath the stack access port. All results were below 50 dpm/100 cm^2. An ash sample from the burn chamber was collected and analyzed in 2006. Results were below the sample specific minimum detectable concentrations) of 0.078 picocuries per gram (pCi/g) ^{3}H and 18 pCi/g ^{14}C. An ash sample was collected from the bottom of the stack and was analyzed for ^{3}H and ^{14}C. The results were 8.74 pCi/g and 4.35 pCi/g for ^{3}H and ^{14}C, respectively.

API Systems. Potentially impacted systems within or servicing the API laboratory suite include the exhaust system, drains, utility service lines, and vacuum system. Some survey data exists (routine and scoping). Further characterization will be performed in accordance with Aptuit Work Instruction WI-007, *Radiological Characterization of Systems, Surfaces, and Equipment for Decommissioning Activities at Aptuit, LLC* (Aptuit Work Instructions are contained in Appendix E) pending removal on all materials and equipment.

Preliminary surveys indicate that the API exhaust system that provides exhaust ventilation for the rooms, hoods and instrument drops is contaminated as described Section IV.A. The exhaust system includes instrument drops, ventilation duct work, the HEPA housing and exhaust stack. It is assumed that the exhaust system prior to the HEPA housing is contaminated.

Water from sink drains and floor drains in the API laboratories goes to an on-site pH treatment building, where it is adjusted if necessary prior to disposal to the

city sewage system. There are no holding tanks between the drains and the pH treatment building. Drain disposal of radioactive materials was not allowed. The first rinse of glassware was collected and disposed as radioactive waste. Water from soaking baths is assayed with disposal dependent on analytical results. Starting in 2011, effluent water samples have been collected for ^{3}H and ^{14}C analysis from the on-site pH lift station twice monthly. No activity above the analytical detection limit has been detected in these samples. However, contamination in the API laboratory sinks is found during the weekly routine surveys, and some of the highest results from the scoping survey conducted on December 15, 2011 were in the sinks, indicating the potential for contamination in the drains. An investigation of the drains will be conducted in accordance with Aptuit WI-007.

The API laboratories are equipped with a central vacuum system; however, it was not routinely used. Vacuum for experiments was typically provided by portable vacuum pumps. However, due to the possibility that the central vacuum system was used for radiosynthesis procedures, it will be investigated. Surveys conducted to date verify that the vacuum system is not internally contaminated.

- **The maximum and average radiation levels in mrem/hr at the surface of each piece of equipment-** These measurements are not applicable for the contaminants of concern at Aptuit.
- **A summary of the background levels used during scoping or characterization surveys -** Background levels are given in Section IV.A. above.
- **A scale drawing or map of the rooms or work areas showing the locations of the contaminated systems or equipment** – Drawings showing contaminated systems are included as Figures 1-7 through 1-10.

C. *SURFACE SOIL CONTAMINATION*

The potential for surface soil contamination was evaluated based on a review of the annual evaluation of effluent releases, material inventories, radiological control practices, and the absence of spills or releases of radioactive materials outside the confines of the buildings. Based on this review it was determined that contamination of surface soils was highly unlikely. However, to validate this assumption, surface soil sampling (0 to 6 inches) was conducted on September 24, 2010 from a total of five locations within the property boundaries of the Aptuit site. The purpose of the sampling was to verify that that were no impacts to the surface soils attributable to air effluents from the API B2 area stack. The samples were analyzed for ^{3}H and ^{14}C. In addition, two background samples were collected from the southeastern portion of the site. Two of the samples were collected from the prominent wind direction (north) and the remaining three samples were collected from the other compass directions (south, east, and west). One of the north samples was collected in an area adjacent to the B2 stack. Sample locations are shown in Figure 3-1.

All ^{14}C results were below the sample detection limits of 0.99 – 1.1 pCi/g. ^{3}H was detected above the sample detection limits (0.20 – 0.21 pCi/g) in two sampling

locations, including one of the background locations. Background sample results were 0.3 and 0.04 pCi/g for ^{3}H and 0.22 and 0.16 for ^{14}C.

The results of the soil investigation verify that there were no impacts to the surface soils (at the stated detection limits) that could be attributable to emissions from the API B2 stack (Shaw, 2010a).

Additional confirmation surface soil sampling will be conducted in accordance with WI-007.

D. *SUBSURFACE SOIL CONTAMINATION*

There are no impacts of site radiological operations to the subsurface soil. Based on guidance provided in NUREG-1757, Vol. 1, Rev. 2, Table D.1 (NRC, 2006), information on subsurface soil contamination is not applicable to Decommissioning Group 3 licensees.

E. *SURFACE WATER*

Based on the types and locations of radioactive material use, the operating history, the absence of outside spills, environmental releases, or contamination of external building surfaces, it was determined that there would be no radiological impacts to surface water from operations at the facility.

F. *GROUNDWATER*

Based on the types and locations of radioactive material use, the operating history, the absence of outside spills or environmental releases, it was determined that there would be no radiological impacts to ground water from operations at the facility.

V. DOSE MODELING

A. UNRESTRICTED RELEASE USING SCREENING CRITERIA

1. Unrestricted Release Using Screening Criteria for Building Surface Residual Radioactivity

Aptuit intends to obtain unrestricted release of the site in accordance with 10 CFR 20, Subpart E. In order to determine residual activity levels for building surface contamination that meet the dose criterion of 10 CFR 20.1402, it is appropriate to begin with the screening values presented in Appendix H of NUREG 1757, Volume 2, *Consolidated NMSS Decommissioning Guidance: Characterization, Survey, and Determination of Radiological Criteria*, (NRC, 2006a) for the radionuclides of concern, ^{3}H and ^{14}C. Only ^{14}C, ^{3}H, and ^{125}I have been used in recent years at the site and only ^{3}H and ^{14}C have been used in the areas covered by this DP.

The screening value for ^{3}H is 1.2E8 dpm/100 cm^2, and for ^{14}C, the screening value is 3.7E6 dpm/100 cm^2. These screening values are the residual surface contamination levels that would meet the NRC's 25 millirem (mrem) per year dose criterion. The screening values are intended for single radionuclides. For radionuclides in mixtures, the "sum of fractions" rule should be used. ^{3}H surface contamination cannot be determined accurately and reliably with direct reading instruments. Therefore, the most conservative screening value for the contaminants of concern, 3.7E+06 dpm/100 cm^2, will be considered as the basis for DCGL determination.

In addition to the dose criterion in the License Termination Rule, there is a requirement that the residual radioactivity be reduced to levels that are ALARA. Considering ALARA, Aptuit is selecting a DCGL for total activity that is 10 percent of the ^{14}C screening value, or 3.7E+05 dpm/100 cm^2. Screening levels presented in NUREG 1757 are based on the assumption that the fraction of removable activity is equal to 0.1 (10 percent). Therefore, 10 percent (the removable portion) of the recommended DCGL for fixed activity, or 3.7E+04 dpm/100 cm^2, is the recommended DCGL for removable activity (^{3}H and ^{14}C combined).

These DCGLs, 3.7E+05 dpm/100 cm^2 for total activity and 3.7E+04 dpm/100 cm^2 for removable activity ^{3}H and ^{14}C combined, would equate to a dose of 2.5 mrem per year.

Materials and equipment released from radiological controls will meet Aptuit's acceptable surface contamination levels (Table 1-2).

2. Unrestricted Release Using Screening Criteria for Surface Soil Residual Radioactivity

Surface soil is not impacted therefore the screening criteria do not apply.

B. ***UNRESTRICTED RELEASE USING SITE-SPECIFIC INFORMATION***

DCGLs selected for the site are based on the NRC Screening DCGLs. These DCGLs use default parameters. Site specific information was not used.

C. ***RESTRICTED RELEASE USING SITE-SPECIFIC INFORMATION***

Not applicable. Aptuit is seeking unrestricted release and termination of the NRC license.

D. ***RELEASE INVOLVING ALTERNATE CRITERIA***

Not applicable. Aptuit is not seeking to use alternate dose criteria for release of the facility.

VI. ENVIRONMENTAL INFORMATION

Aptuit is using DCGLs that are based on the NRC screening values for unrestricted release therefore the *Generic Environmental Impact Statement in Support of Rulemaking on Radiological Criteria for License Termination of NRC–Licensed Nuclear Facilities* (GEIS, NUREG–1496) (NRC, 1997) can be used to satisfy National Environmental Policy Act (NEPA) obligations. The environmental information described in NUREG-1748, *Environmental Review Guidance for Licensing Actions Associated with NMSS Programs* (NRC, 2003a) is not required.

VII. ALARA ANALYSIS

- **Decommissioning Goal/Cost Benefit Analysis**

  Aptuit will achieve a decommissioning goal below the dose limit through the selection of conservative DCGLs that are less than 10 percent of the screening values and through the implementation of a radiological control program during decommissioning activities that ensure that doses to workers and the public are ALARA. A discussion of DCGL selection is presented in Section 5.A.1.

  The DCGLs, 3.7E+05 dpm/100 cm^2 for total activity and 3.7E+04 dpm/100 cm^2 for removable activity ^{3}H and ^{14}C combined, would equate to a dose of 2.5 mrem per year, therefore the doses to the average member of the critical group are ALARA.

VIII. PLANNED DECOMMISSIONING ACTIVITIES

A. *CONTAMINATED STRUCTURES*

- **A summary of the remediation tasks planned/Remediation techniques/Radiation protection and control for each room or area in the contaminated structure, in the order in which they will occur**

  Remediation tasks are planned for the B3-298, B2-103A, API (B2-155 through B2-170), and B2-112. These tasks include decontamination or removal of contaminated attached furniture and decontamination or removal of floor and wall surfaces. These tasks will proceed after removal of materials and equipment. In the API area, removal of the contaminated systems will precede remediation of building surfaces. Remediation activities for each area are described below. Remediation activities will be performed in accordance with Aptuit WI-004, *General Decontamination and Decommissioning Activities*. Radiation protection and control procedures are described in Section X. A preliminary, rough schedule of the decommissioning field activities is provided as Figure 8-1. Impacted areas where no remediation is expected include the API common area, B2-Dock 5, B2-116, B2-117, B2-119, and the Rad Waste Storage Building. A summary of the survey units and proposed decommissioning activities are contained in Table 8-1.

  General D&D Approach

  - Prior to decommissioning activities, the contents of the laboratories, including materials, equipment and chemicals, will be removed and the areas will be made available to perform decommissioning work.
  - Lab benches and other work surfaces will be wiped down with an appropriate cleaner prior to initiating demolition activities.
  - The HP Support Area, which includes rooms B2-116, 117, and 119, will be designated to house D&D base operations, tools, instrumentation, and equipment. Ladders and other large D&D equipment may be kept in other rooms designated as D&D support areas.
  - Utility disconnections will be performed, as necessary, and all energized sources will be properly locked out/tagged out (LOTO) in accordance with 29 CFR 1910.147. Utility disconnects to be conducted prior to the commencement of decommissioning fieldwork may include, but are not limited to, water, gas, air, and electrical power. All utilities will be verified to have been physically disconnected and/or properly LOTO prior to commencement of decommissioning activities.
  - Prior to initiating any component disassembly or removal activities, physical barriers will be established to limit access to work areas. In addition, signage and/or yellow caution tape will be placed around the work sites to provide a warning of the activities taking place.
  - Verification that all project staff are trained/qualified commensurate with assignments in accordance with this DP will be obtained.

- Appropriate safety precautions and necessary personal protective equipment (PPE) will be addressed.

A vehicle and equipment laydown area to support the D&D activities will be established and demarcated in part of the parking area south of B Building. Fencing will be placed around the perimeter of the laydown area.

Roll-offs for waste transportation and disposal will be placed to the west side of B Building in the vicinity of Dock 5. Waste from the D&D activities may be transported by hand carrying, hand truck, or cart to the outside waste staging area through the room 101 hallway.

Materials and Equipment

The following specific tools and/or special materials may be utilized to perform the work.

- HEPA vacuum cleaner
- Jerome mercury vapor analyzer
- Radiation detection instruments (see Section 4.2.4)
- Record/log sheets (e.g., survey forms, checklists, sample collection logs, field activity daily logs)
- Hand tools
- Plastic sheeting
- Power tools
- Waste packaging
- Ladders
- PPE.

Additional equipment/materials may be used as appropriate.

Briefing Requirements

Prior to being assigned to perform work under this plan for the first time, D&D worker will receive project and site-specific radiation awareness training to include radiation safety requirements of the license. This training will be documented.

A daily briefing will be conducted prior to start of work to review specific work steps/tasks, to update any work requirements/conditions as applicable, and to review safety hazards and control methods. This meeting will be documented. Documentation may be on the Job Safety Analysis/Tailgate Safety Meeting form.

Laboratory B3-298

After all of the equipment and materials have been removed from B3-298, the surfaces in the room, including bench tops, cabinets, floor, and walls, will be surveyed for radiological contamination. If any removable radiological contamination is detected, it will be removed using a cleaning agent and water-wetted rags. Any surfaces with fixed radiological contamination above the release criteria will be removed, packaged, and placed in the radiological waste container for disposal.

API Laboratory Suite

After the rooms have been cleared of equipment, hoods, bench tops, tables, and cabinets, a visual inspection and radiological survey will be performed on building surfaces including walls, floors, and drain openings. The visual inspection will be conducted to identify any visible contamination (e.g., oily smears, etc.). If debris or residues are observed, a HEPA vacuum may be used to remove any remaining debris. In addition, rags wetted with water or a cleaning agent may be used to remove any residues until visibly clean. Brushes may be used if more vigorous cleaning is required to remove the residue.

Radiological surveys will consist of scanning and bias measurements of gross beta activity and wipe sampling to determine removable contamination levels. The survey locations, methods, and findings will be documented. Survey results will be used to determine if remedial actions are needed to meet release criteria (i.e. activity below DCGL and reduced to ALARA). Surfaces that are found to meet the radiological release criteria (i.e. activity below DCGL and reduced to ALARA) will be left in place. Surface areas that exceed the release criteria will be removed by cutting out the contaminated areas with the appropriate saw or tool. The removed surfaces will be properly packaged and placed in the radiological waste container for disposal.

HP Support Areas (B2-116, B2-117, B2-119)

The final spaces to be decommissioned are the HP support areas, which include rooms B2-116, 117, and 119. After the HP support areas have been cleared of equipment, bench tops, tables, and cabinets, a visual inspection and radiological survey will be performed on building surfaces including walls, floors, and drain openings. The visual inspection will be conducted to identify any visible contamination (e.g., oily smears, etc.). If debris or residues are observed, a HEPA vacuum may be used to remove any remaining debris. In addition, rags wetted with water or a cleaning agent may be used to remove any residues until visibly clean. Brushes may be used if more vigorous cleaning is required to remove the residue.

Radiological surveys will consist of scanning and bias measurements of gross beta activity and wipe sampling to determine removable contamination

levels. The survey locations, methods, and findings will be documented. Survey results will be used to determine if remedial actions are needed to meet release criteria (i.e. activity below DCGL and ALARA). Surfaces that are found to meet the radiological release criteria will be left in place. Surface areas that exceed the release criteria will be removed by cutting out the contaminated areas with the appropriate saw or tool. The removed surfaces will be properly packaged and placed in the radiological waste container for disposal.

Waste Storage Building

After all of the equipment and materials have been removed from the waste storage building, the surfaces in the room, including shelves, floor, and walls, will be surveyed for radiological contamination. If any removable radiological contamination above the release criteria is detected, it will be removed using a cleaning agent and water-wetted rags. Brushes may be used if more vigorous cleaning is required to remove the contamination. The cleaning items will be placed in a closed-top bucket or drum suitable for radiological waste, which will then be placed in the 30-yard radiological waste container for disposal. Any surfaces with fixed radiological contamination above the release criteria will be removed, packaged, and placed in the radiological waste container for disposal.

B2-103A and B2-112

Decommissioning activities for B2-103A (incinerator room) and B2-112 (HEPA filter room) are described in Section VIII.B. below.

- **A summary of the procedures already authorized under the existing license and those for which approval is being requested in the DP**

The following Work Instructions for decommissioning activities are submitted for approval in this DP. These work instructions can be found in Appendix E:

- Aptuit Work Instruction-001 (Aptuit WI-001), Surveys
- Aptuit Work Instruction-002 (Aptuit WI-002), Instruments
- Aptuit Work Instruction-003 (Aptuit WI-003), Liquid Scintillation Counting
- Aptuit Work Instruction-004 (Aptuit WI-004), General D&D
- Aptuit Work Instruction-005(Aptuit WI-005), Control of Radiological Work
- Aptuit Work Instruction-006 (Aptuit WI-006), Management of D&D Waste
- Aptuit Work Instruction-007 (Aptuit WI-007), Radiological Characterization
- Aptuit Work Instruction-008 (Aptuit WI-008), Bioassay
- Aptuit Work Instruction-009 (Aptuit WI-009), Bag-in Bag-out of HEPA

Filters

- **A commitment to conduct decommissioning activities in accordance with written, approved procedures**

  All decommissioning activities will be performed in accordance with this DP including the attached written, approved procedures.

- **A summary of any unique safety or remediation issues associated with remediating the room or area**

  No unique safety or remediation issues are associated with remediating these areas.

- **For Part 70 licensees, a summary of how the licensee will ensure that the risks addressed in the facility's Integrated Safety Analysis will be addressed during decommissioning**

  Not applicable. Aptuit is not a Part 70 licensee.

B. ***CONTAMINATED SYSTEMS AND EQUIPMENT***

- **A summary of the remediation tasks planned for each system in the order in which they will occur, including which activities will be conducted by licensee staff and which will be performed by a contractor/A description of the techniques that will be employed to remediate each system in the facility or site**

  Remediation tasks are planned for the B Building legacy ductwork and stacks, the API exhaust system components [hoods, duct work, HEPA housing (B2-112), stack], API vacuum system, API drains, and the incinerator (B2-103A). Remediation activities for each contaminated system are described below. Radiation protection and control procedures are described in Section X. A preliminary, rough schedule of the decommissioning field activities is provided as Figure 8-1. A summary of the impacted systems and proposed decommissioning activities are contained in Table 8-1.

  The following equipment/systems will be removed by the Demo Subcontractor:

  - Chemical Fume Hoods
  - Exhaust Ductwork
  - Exterior and Rooftop Exhaust Components
  - Incinerator

  The following equipment/systems will be removed by the D&D Subcontractor:

  - Utility Service Lines
  - Storage Cabinets
  - Freezers
  - Wall Cabinets
  - Bench Tops/Tables
  - Sink Traps/Strains

API Utility Service Line Removal

The utility service lines in the API area, including vacuum lines, water lines, and gas lines, as well as a vacuum line remaining in B2-119, will be characterized and removed, as necessary. Most of the lines are made of galvanized steel or copper and range in diameter from ¾" to 2". The first step will include performing a survey of the exterior of the lines. Any detected removable radiological contamination will be removed with a cleaning agent and water-wetted rags.

After confirming that the system has been properly LOTO, the lines from the fume hoods in the API area to the header will be cut and removed. The cut lines will be surveyed for waste characterization. After the feeder lines are removed, wipe samples of the interior of the header line will be collected through the openings. If the header line is found to be radiologically contaminated, it will be removed and disposed of as radioactive waste. If the header line is not found to be contaminated, then the openings will be capped and the header will be left in place and returned to service. The vacuum line in B2-119 will be characterized and either left in place or disposed appropriately. Utility service lines that are removed and meet the release criteria may be recycled.

API Chemical Fume Hood Removal (CFH)

Eighteen CFHs will be removed as part of decommissioning activities. CFHs with known radioactive contamination will be delineated and surveyed before and after any decontamination attempts. A visual inspection of the CFHs will be conducted. If debris or visual contamination is observed, including pooled liquids, oily smears, etc., it is left to the discretion of the worker to decontaminate the area. A HEPA vacuum may be used to remove debris. In addition, exterior and accessible interior surfaces of the CFH may be wiped with rags with a detergent-water mixture. If residues remain after the initial cleaning, the affected surfaces may be cleaned again using more vigorous techniques or cleaning agents until visibly clean (as is practicable).

Upon completion of the initial inspection and any decontamination, the following activities will be conducted for each CFH:

- All utilities will be verified to be LOTO and disconnected.
- Yellow caution tape and signs will be posted outside the doors leading to rooms where work is being performed to warn personnel of the activities being performed.
- Plastic sheeting will be placed on the floor in the vicinity to collect any debris and protect the floor.
- Any ACM components (transite panels, benchtop) of the CFH will be thoroughly examined for breaks, which will be secured by covering exposed edges with duct tape.
- Sink traps associated with the CFH will be removed as described below.

- All asbestos abatement will be completed as described below for any CFHs that contain ACM.
- The CFH may be disassembled, as necessary, so that the pieces are small enough to be transported to the waste container. The CFH will be disassembled using hand tools or power tools to remove the screws or bolts that hold the pieces together.
- The pieces may be transported to the appropriate waste container using a hand truck or cart or hand carried if small and light enough.
- The CFH pieces will be surveyed and sampled for surface contamination as specified in Section XIV to determine if the radiological release criteria are met. CFH pieces with contamination levels in excess of the release criteria will be placed in the radiological waste container and disposed of as radiological waste. It is anticipated that most, if not all, of the CFHs will be disposed of as radiological waste. Further discussion of waste management is provided in Section XII.
- CFH pieces that meet the free release criteria may be disposed of as construction debris.

API and Legacy Exhaust Ductwork Removal

Aptuit will disconnect and remove exhaust ductwork from CFHs and snorkel exhausts. In addition, impacted legacy ductwork will be investigated and removed as necessary. This impacted ductwork is shown in Figures 1-7, 1-8, and 1-9. Disconnection and removal will proceed as follows:

- Yellow caution tape and signs will be posted outside the doors leading to rooms where work is being performed to warn personnel of the activities being performed.
- Plastic sheeting will be placed on the floor below the ductwork to collect any debris and protect the floor.
- The upper side of any adjacent ceiling tiles may be HEPA vacuumed of loose debris and dust as it is removed to allow work on the ducting.
- Personnel will utilize appropriate PPE, including safety-toed shoes, eye protection, Tyvek suits, and nitrile gloves, at a minimum. Task-specific health and safety requirements specified in the job safety analysis will be briefed prior to each shift.
- A fixative to prevent removable radiological contamination from becoming airborne may be sprayed on the interior surfaces of the duct sections prior to removing each section.
- Ductwork will be removed from the closest point of amenable disconnection near the laboratory wall face to the CFH. Snorkel exhaust ductwork will be removed from the point of connection to the laboratory equipment to the joint at the main exhaust duct.

- All removed ductwork will be surveyed and sampled as specified in Section XIV to ensure that radiological release criteria are met. Any ductwork with suspect internal contamination will have the ends wrapped and taped and will be segregated as suspect radioactive waste.
- Sections sized to a manageable length will be disassembled and lowered to the floor one section at a time. Personnel on multiple stepladders, as necessary, will be utilized to safely lower the ductwork sections to the floor in a controlled manner. In addition, temporary supports may be created to support and secure the duct, as necessary, to ensure a safe disassembly.
- Ductwork sections that do not meet the release criteria will be placed in the radiological waste container for disposal. Ductwork that does meet the release criteria may be disposed of as construction debris.

API and Legacy Exterior and Rooftop Exhaust Components

As part of decommissioning activities, the exterior components of the API exhaust system will be removed, surveyed for radiological contamination, and disposed of appropriately. The exterior API exhaust system components include a HEPA filter system, ductwork, two fans, and a 30" diameter metal stack. The API exhaust system components to the west of room 112 are shown on Figure 1-9, as well as in photo number 17 of Appendix F.

In addition, select B Building rooftop fan assemblies and associated exhaust duct and stacks will be surveyed for radiological contamination, removed as necessary, and disposed of appropriately. The B Building rooftop exhaust systems that will be surveyed are shown in yellow highlighting on Figure 1-10.

Disassembly and removal of the exterior and rooftop exhaust components will include the following tasks:

- Prior to beginning decommissioning work on the roof, the structural capacity of the roof will be evaluated by a structural engineer through review of as-built drawings and/or visual inspection. The structural engineer will confirm that the load capacity of the roof where the decommissioning activities are going to be performed is adequate for the weight of the work crew and their equipment.
- All crew members working in proximity of roof edge or roof openings will be trained and equipped in use of mandatory fall protection harness usage and application thereof for all roof operations conducted during the decommissioning.
- Yellow caution tape and warning signs will be posted around all work areas prior to beginning any decommissioning activities. In addition, temporary fencing will be placed around areas where any crane or overhead operations will occur.
- Prior to beginning any crane or overhead work, the work areas will be inspected for any overhead or ground level hazards. All identified

hazards will be discussed by the D&D team responsible for performing the work and a hazard abatement plan will be established and adhered to by the team.

- The HEPA filters for the API exhaust system are assumed to be radiologically contaminated above the release criteria based on previous survey results of the interior of the HEPA housing. The HEPA housing is equipped with a bag-in/bag-out containment system. The HEPA filters will be removed utilizing the bag-in/bag-out system (Aptuit WI-009) and placed in the radiological waste container for disposal.
- The HEPA filter housing is assumed to be radiologically contaminated above the release criteria based on previous survey results and will either be decontaminated or disposed of as radiological waste. The HEPA filter housing will be disassembled with hand tools or power tools, as necessary, so that the pieces are small enough to be transported to the decontamination area or the radiological waste container. Open ends of the housing will be covered with plastic sheeting.
- The duct connecting the HEPA system, fans, and stack will be disassembled, removed, and surveyed for radiological contamination. The duct may be disassembled using hand or power tools. A fixative to prevent removable radiological contamination from becoming airborne may be sprayed on the interior surfaces of the duct sections prior to removing each section.
- All removed ductwork will be surveyed and sampled as specified in Section XIV to ensure that radiological release criteria are met. Any ductwork with suspect internal contamination will have the ends wrapped and taped and will be segregated as suspect radioactive waste.
- Sections sized to a manageable length will be disassembled and lowered to the ground one section at a time. Personnel on multiple stepladders, as necessary, will be utilized to safely lower the ductwork sections to the floor in a controlled manner. In addition, temporary supports may be created to support and secure the duct, as necessary, to ensure a safe disassembly.
- Ductwork sections that do not meet the release criteria will be placed in the radiological waste container for disposal. Ductwork that does meet the release criteria may be disposed of as construction debris.
- The fans and stack associated with the API exhaust system will be removed and surveyed for radiological contamination. The fans may be removed with a crane or may be disassembled into components small enough to be handled by hand using carts or with a forklift. The stack will be removed using a crane. The open ends of the fans and stacks will be covered with plastic sheeting. If the fans and stack sections do not meet the radiological release criteria, they will be placed in the radiological waste container for disposal. If the fans and stack sections meet the release criteria, they may be disposed of as construction debris.

- Five fan assemblies located on the rooftop of B Building will be surveyed for radiological contamination and removed if found to contaminated. The fan assemblies to be surveyed are designated BR-EF 21A, BR-EF 21B, BR-EF 23, BR-EF 24, and BR-EF 26. The fan assemblies may be removed using a crane. All openings on the fan assemblies will be blanked or sealed prior to moving them. Trained and qualified personnel will perform the rigging and crane operation procedures.
- Fan assemblies identified as radiologically contaminated will be placed in the radiological waste container for disposal. Fan assemblies that meet the radiological release criteria may be disposed of as construction debris.
- The rooftop stacks associated with the BR-EF 21A, BR-EF 21B, BR-EF 23, BR-EF 24, or BR-EF 26 exhaust fans that are determined to be radiologically contaminated, as described above, will be removed. The stacks will be lowered to ground level with a crane. Trained and qualified personnel will perform the rigging and crane operation procedures. Once on the ground, the stacks will be cut into smaller sections and surveyed for radiological contamination. The open ends of the stack sections will be covered with plastic sheeting.
- Stack sections that do not meet the radiological release criteria will be placed in the radiological waste container for disposal. Stack sections that meet the release criteria may be disposed of as construction debris.

B2-103A Incinerator Removal

The incinerator in room B2-103A, along with the associated ductwork, filter, and stack, will be removed and disposed of appropriately. The incinerator is shown in photo number 1 of Appendix F. The exterior and interior surfaces of the incinerator will be surveyed for waste characterization purposes. Any removable radiological contamination detected on the exterior will be removed using a cleaning agent and water-wetted rags. Based on previous incinerator investigations, as discussed in Section IV.B, it is anticipated that the incinerator will be characterized as radiologically contaminated waste and disposed of accordingly.

The incinerator exhaust ductwork runs out the top of the incinerator, through the roof of B2-103A, then makes a 90-degree turn, includes a filter housing, and connects to a 20” diameter stack. The stack, as shown in photo number 16 of Appendix F, is secured to the side of B Building. The ductwork, filter, and filter housing will be removed, characterized, and disposed of appropriately. The angle iron securing the stack to the side of B Building will be disconnected or cut and the stack will be lowered to the ground using a crane. Once on the ground, the stack will be cut into smaller sections, characterized, and disposed of appropriately, either as radiological waste or construction debris.

Prior to removal of the incinerator, the incinerator will be prepared by blanking or sealing all openings in the incinerator and the attached pipe, instruments, and equipment. In preparation for removal of the incinerator, a section of the south wall of B2-103A will be removed to provide access to move the incinerator out of the building. The walls of B2-103A are constructed of concrete block with brick veneer. The wall section planned for removal will be surveyed to determine if the wall materials can be disposed of as nonhazardous construction waste or if they require disposal as radiological waste.

The wall section will then be removed using a concrete saw and/or an electric or pneumatic jackhammer. Dust suppression will be implemented, as necessary. The wall waste will be disposed appropriately, as indicated by the prior survey results.

After a hole in the wall has been created, the incinerator will be slid out of B2-103A using a heavy duty forklift or other equipment with a rated capacity to safely handle the load. Once removed, the incinerator will loaded onto a trailer with a crane and prepared for transportation to the appropriate disposal site.

After the incinerator has been removed, the floor area under where it had been located will be cleaned with a HEPA vacuum. The floor area will then be surveyed to determine if there is any residual radiological contamination on the floor. Any detected removable contamination will be removed with a cleaning agent and water-wetted rags. Any detected fixed radiological contamination will be cut out and disposed of as radiological waste.

- **A description of the radiation protection methods and control procedures that will be employed while remediating each system**

  Radiation protection methods and control procedures are found in Section X and in Work Instruction WI-005, *Control of Radiological Work for Decommissioning Activities*.

- **A summary of the procedures already authorized under the existing license and those for which approval is being requested in the DP**

  The following Work Instructions for decommissioning activities are submitted for approval in this DP. These work instructions can be found in Appendix E:

  - Aptuit Work Instruction-001 (Aptuit WI-001), Surveys
  - Aptuit Work Instruction-002 (Aptuit WI-002), Instruments
  - Aptuit Work Instruction-003 (Aptuit WI-003), Liquid Scintillation Counting
  - Aptuit Work Instruction-004 (Aptuit WI-004), General D&D
  - Aptuit Work Instruction-005(Aptuit WI-005), Control of radiological Work
  - Aptuit Work Instruction-006 (Aptuit WI-006), Management of D&D Waste

- Aptuit Work Instruction-007 (Aptuit WI-007), Radiological Characterization
- Aptuit Work Instruction-008 (Aptuit WI-008), Bioassay
- Aptuit Work Instruction-009 (Aptuit WI-009), Bag-in Bag-out of HEPA Filters

o **A summary of the equipment that will be removed or decontaminated and how the decontamination will be accomplished**

Storage Cabinets and Freezers

Storage cabinets and freezers in the API area will be surveyed to characterize for waste disposal. Storage cabinets and freezers that are not radiologically contaminated above Aptuit's acceptable surface contamination levels (i.e. release criteria) will be disposed of as construction debris. Storage cabinets and freezers that do not meet the free release criteria (i.e. >acceptable surface contamination levels) will be loaded into the radiological waste container. Storage cabinets and freezers may be transported to the appropriate waste container using hand trucks or carts.

Wall Cabinetry

All wall cabinetry in the API area will be removed and characterized for waste disposal. Cabinets will be removed from the walls by loosening and removing wall mounting hardware, typically found in the interior of the cabinets, with hand or power tools. The cabinet surfaces will be surveyed for radiological contamination. Cabinets that do not meet the release criteria will be loaded into the radiological waste container for disposal. Cabinets that are not radiologically contaminated above the release criteria may be disposed of as construction debris.

Bench Tops and Tables (B3-298 and API)

Based on the time frame of original laboratory construction (only for lab B3-298), it is possible that some of the bench tops and table tops may be asbestos-containing material (ACM). Due to this potential, representative samples of bench tops and table tops will be collected and sent to an offsite laboratory to be analyzed for asbestos. Any bench tops or table tops that are determined to be ACM will be removed by a Missouri registered asbestos contractor. All required controls and PPE will be utilized during the handling of ACM. The ACM will be managed to prevent nonfriable materials from being damaged and made friable. The ACM and ACM-related materials, including PPE used during the handling of ACM, will be consolidated to the extent possible. Bench tops and tables may be transported to the appropriate waste container using hand trucks or carts.

ACM bench tops and table tops will be surveyed for radiological contamination. ACM bench tops and table tops with radiological contamination above the release criteria will be properly packaged in accordance with federal and state regulations and disposed of as mixed waste. ACM bench tops and table tops that

are not radiologically contaminated above the free release criteria will be packaged and disposed of in a permitted landfill in accordance with Missouri ACM disposal rules.

Non-ACM bench tops and tables will be surveyed for radiological contamination. Non-ACM bench tops and table tops with radiological contamination above the release criteria will be decontaminated or properly packaged and disposed of as radiological waste. Non-ACM bench tops and table tops that are not radiologically contaminated above the free release criteria will be disposed of as construction debris.

API Sink Trap and Strainer Removal

The p-traps associated with the sinks in the chemical fume hoods (CFH) will be removed and characterized for waste disposal. In addition, p-traps and strainers associated with laboratory bench tops will also be removed and characterized. The p-traps and strainers will be dismantled as follows.

- Prior to beginning work, plastic sheeting will be placed on the floor and on the bottom of any cabinets in the area of the traps or any required pipe disconnections. The plastic sheeting is intended to protect the floor from any leaked or spilled liquids or debris.
- Personnel will utilize appropriate PPE, including safety-toed shoes, Tyvek® suits, safety glasses or face shields, and nitrile gloves at a minimum. Any traps/strainers found to have mercury vapor readings greater than 0.01 milligrams per cubic meter, which is 1/10 of the U.S. Occupational Safety and Health Administration ceiling level, will be removed using Level C PPE with the appropriate mercury vapor cartridge.
- The sink trap openings will be monitored for mercury vapor and radiological contamination. This initial reading may be effective at detecting mercury vapor as the trap may be dry from non-use. The mercury vapor measurements will be recorded and the radiological survey measurements will be recorded on radiological survey forms.
- The traps and strainers will be removed at mechanical joints where possible. Where the pipe is welded or rusted together, or otherwise cannot be mechanically disassembled, the traps and strainers may be removed using a pipe cutter or reciprocating saw. Hearing protection will be used while operating power tools.
- Liquid in the traps could prevent elemental mercury from being detected with a mercury vapor analyzer. For this reason, the liquid contents of the traps will be removed from the traps and collected in U.S. Department of Transportation-approved plastic buckets with lids.
- Once removed, the traps/strainers will be monitored a final time for mercury vapor and the value recorded. Traps/strainers that exhibit mercury contamination and any associated solid residues will be segregated as hazardous waste. If only radiological contamination is

detected, the trap/strainer and any associated solid residues will be segregated as radioactive waste. The solids residues will be removed from non-mercury, non-radiologically contaminated sink traps/strainers and placed in appropriate containers. Sink traps/strainers that do not exhibit mercury and meet radiological release criteria will be disposed as construction debris.

- All sink trap and strainer components will be surveyed as specified in Section XIV to ensure that radiological release criteria are met. Wipe samples will be collected from the openings of the traps. Sink traps and strainers that do not meet radiological release criteria will be segregated and managed as radioactive waste.
- After the final determination of mercury and radiologically contaminated and non- contaminated residues described above is made, trap liquid residues will be combined with like liquids as characterized. All liquid wastes from mercury-only contaminated traps will be combined, containerized appropriately, and labeled as pending analysis. All radiological contamination-only liquid waste will be combined and containerized appropriately for disposal. Liquid collected from traps that are not found to be mercury or radiologically contaminated will be combined and containerized for disposal.

o **A commitment to conduct decommissioning activities in accordance with written, approved procedures**

All decommissioning activities will be performed in accordance with this DP including the written, approved procedures.

o **A summary of any unique safety or remediation issues associated with remediating any system or piece of equipment**

No unique safety or remediation issues are associated with remediating these systems.

o **For Part 70 licensees, a summary of how the licensee will ensure that the risks addressed in the facility's Integrated Safety Analysis will be addressed during decommissioning**

Not applicable. Aptuit is not a Part 70 licensee.

C. *SOIL*

o **A summary of the removal/remediation tasks planned for surface and subsurface soil at the site in the order in which they will occur, including which activities will be conducted by licensee staff and which will be performed by a contractor**

No surface or subsurface soil removal/remediation tasks are planned during decommissioning activities.

Surface soil (0 to 6 inches) sampling was conducted on September 24, 2010 from a total of five locations within the property boundaries of the Aptuit site.

All ^{14}C results were below the sample detection limits of 0.99 – 1.1 pCi/g. ^{3}H was detected above the sample detection limits (0.20 – 0.21 pCi/g) in two sampling locations, including one of the background locations.

The results of the soil investigation indicate that there were no impacts to the surface soils (at the stated detection limits) that could be attributable to emissions from the API B2 stack (Shaw, 2010a).

Additional confirmatory surface soil sampling will be conducted.

D. *SURFACE AND GROUND WATER*

No remediation tasks involving surface water or ground water are planned during decommissioning activities.

Based on the types and locations of radioactive material use, the operating history, the absence of outside spills, contamination of exterior building surfaces, or environmental releases, it was determined that there are no radiological impacts to surface water or groundwater from operations at the facility.

E. *SCHEDULES*

- **A Gantt or PERT chart detailing the proposed remediation tasks in the order in which they will occur**

  Figure 8-1, Aptuit SO Decommissioning Fieldwork Schedule details proposed remediation tasks

- **A statement acknowledging that the dates in the schedule are contingent upon NRC approval of the DP**

  Aptuit acknowledges that the dates in the schedule are contingent upon NRC approval of the DP.

- **A statement acknowledging that circumstances can change during decommissioning, and, if the licensee determines that the decommissioning cannot be completed as outlined in the schedule, the licensee will provide an updated schedule to NRC**

  Aptuit acknowledges that circumstances can change during decommissioning, and, if Aptuit determines that the decommissioning cannot be completed as outlined in the schedule, Aptuit will provide an updated schedule to NRC.

  If the decommissioning is not expected to be completed within the timeframes outlined in NRC regulations, a request for alternative schedule for completing the decommissioning

  If the decommissioning is not expected to be completed within the timeframes outlined in NRC regulations, a request for alternative schedule for completing the decommissioning will be submitted to NRC.

IX. PROJECT MANAGEMENT AND ORGANIZATION

The Aptuit decommissioning project organization chart is provided as Figure 9-1.

A. *DECOMMISSIONING MANAGEMENT ORGANIZATION*

- **A description of the decommissioning organization**

The decommissioning management organization consists of:

The Aptuit Decommissioning Project Manager

The Radiation Oversight Committee

The Aptuit RSO

The Aptuit EH&S Manager

The D&D Subcontractor

The Project Quality Assurance Manager

The Site Quality Assurance (QA) Manager

The Waste Disposal Contractor

The Project CHP

The Site Supervisor

The Demo Subcontractor

RCT/Surveys Techs

- **A description of the responsibilities of each of these decommissioning project units**

Aptuit Decommissioning Project Manager

The Aptuit Decommissioning Project Manager is responsible for coordinating all high level aspects of the decommissioning activities as well as the completion, as a whole, of the decommissioning of the facility. These decisions include providing input and approving all major financial decisions, acting as a coordinator between Aptuit's business divisions as well as other companies with a vested interest in the decommissioning process and completion. The Aptuit Decommissioning Project Manager may also be asked to provide input on any other aspect of the decommissioning process.

Radiation Oversight Committee (ROC)

Laboratory staff and management serve with the RSO on the ROC. The Radiation Safety Committee as described in the RSPM transitioned to the ROC as decommissioning activities began. This committee will continue to review radioactive materials activities, procedures, current issues, etc. Members of this committee may audit decommissioning activities.

Aptuit Radiation Safety Officer (RSO)

The RSO is approved by the NRC and is responsible for the overall management of the radiation protection program, including implementation of ALARA principles.

For decommissioning of the Aptuit facilities, the RSO is responsible for ensuring that all decommissioning activities are conducted in strict conformance to the License, the RSPM, and this DP. The RSO is also responsible for ensuring that all radioactive materials and wastes are removed from the facility. The RSO is responsible for on-site waste management.

Aptuit EH&S Manager

The Aptuit EH&S manager will provide the RSO and RSC with any non-radiological programs (e.g. lockout/tagout, hazard communication, fall protection, etc.) required to complete the D&D activities.

The D&D Subcontractor

The D&D subcontractor will be responsible for performing the physical act of decontamination and decommissioning of the facility. In addition to providing labor for performing decommissioning tasks and radiological surveys, the D&D subcontractor will also provide technical expertise to the Aptuit RSO, RSC and Decommissioning Project Manager to facilitate the decision making processes involved in D&D activities.

Quality Assurance Manager

Project Quality Assurance (QA) manager is assigned duties and responsibilities at the project level for enforcing quality plans and procedures, or specific duties and responsibilities for implementing elements of the corporate quality management program. To assure independence, each Project QA manager reports directly to a Corporate QA manager (Aptuit) and indirectly to the project manager. The Project QA manager is delegated the responsibilities and authorities commensurate with their assigned projects or tasks. The Project QA manager will interface with program and project management, engineering, and other applicable functional organizations. At the project level, each Project QA manager will direct the QC staff specialists/inspectors in implementing quality program, project plans, and procedures, and will update the QA program plan as frequently as needed based upon the duration of the project.

Site Quality Control Manager

The site quality control (QC) manager has the responsibility and authority for implementing the QA program at the project level. The site QC manager conducts surveillance and inspections on the work that is being performed. The site QC manager has the authority to identify deficiencies while work is in process. If the deficiency cannot be resolved at that time the QC manager has the authority to advance the issue to the next level of management for resolution.

The Waste Disposal Subcontractor

The waste disposal subcontractor will be responsible for disposing of D&D radiological and mixed waste in accordance with all local, state and federal laws.

Project Certified Health Physicist (CHP)

The project CHP or designee is responsible for review and approval of all radiological plans and reports prior to issue. The designee must be knowledgeable, trained, and experienced in MARSSIM methodology and its application. The project health physicist will also advise the site supervisor in support of sample collection and analysis activities. Any changes to activities described in this DP must be approved by the CHP or designee prior to implementation.

The Site Supervisor (SS)

The D&D Subcontractor site supervisor is responsible for overseeing on-site decommissioning activities. These include performing radiation surveys and sampling. The duties of this position include direction of task activities, management of HP activities, and on-site inspections to ensure work plan compliance. The site supervisor is also responsible for coordinating activities with the Aptuit personnel.

This individual is responsible for reviewing all on-site activities and supervising project survey and sampling technicians. This individual is responsible for the proper performance of survey activities, including collection and transportation of samples.

Demo Subcontractor

The demo subcontractor will be responsible for performing tasks designated by Aptuit and the D&D Subcontractor. All Demo Subcontractor employees will be trained in accordance with this DP and will be monitored by Aptuit and the D&D Subcontractor to ensure all work is performed safely, accurately and in accordance with this DP.

Radiological Control Technicians (RCT)/Survey Technician (ST)

RCT/ST will be responsible for the field execution of the procedures presented within this DP and for addressing any issues or suggested modifications with the SS, RSO or project CHP.

- **A description of the reporting hierarchy within the decommissioning project management organization**

The reporting hierarchy can be viewed on the Aptuit decommissioning project organization chart, provided as Figure 9-1.

- **A description of the responsibility and authority of each unit to ensure that decommissioning activities are conducted in a safe manner and in accordance with approved written procedures**

Responsibilities and authorities are described above.

B. *DECOMMISSIONING TASK MANAGEMENT*

- **A description of the manner in which the decommissioning tasks are managed**

  The task-specific organization for decommissioning activities includes not only the radiological controls organization described in the previous section, but also the operational and support staff necessary to perform decommissioning activities in a safe and cost-effective manner. This organization is a combination of on-site Aptuit management, Aptuit radiation safety personnel, and the D&D Subcontractor personnel. Representatives from Aptuit and the D&D Subcontractor will be present on site during all decommissioning activities. It is important to note that all employees, regardless of their organizational position, have the authority to stop work if quality, safety, or compliance is being compromised.

- **A description of how individual decommissioning tasks are evaluated and how the Radiation Work Permits (RWPs) are developed for each task**

  Individual decommissioning tasks will be evaluated according to the potential radiological and health risks that may be present in performing that task.

  RWPs will be based on evaluation of individual decommissioning tasks and the hazards applicable to those tasks. Prior to implementation, each RWP will be reviewed and approved by the Radiation Safety Officer (RSO) or his designee.

- **A description of how the RWPs are reviewed and approved by the decommissioning project management organization**

  RWPs will be developed by the Project CHP and reviewed and approved by the RSO.

- **A description of how RWPs are managed throughout the decommissioning project**

  RWP's will be managed and evaluated by the RSO throughout the decommissioning project. The RSO or designee will review all procedures in the RWP with individuals performing decommissioning tasks.

  RWPs will be evaluated based on conditions observed during decommissioning activities. If any significant changes occur that would affect personnel or the environment, but not require amendment to this DP, will result in an update to the appropriate RWP and appropriate training for personnel.

- **A description of how individuals performing the decommissioning tasks are informed of the procedures in the RWP**

  The RSO or SS will review all RWP's with all decommissioning activity personnel. Acknowledgement of the understanding of the RWP and agreement to abide with its conditions will be documented on the applicable entry log form.

C. *DECOMMISSIONING MANAGEMENT POSITIONS AND QUALIFICATIONS*

- **A description of the duties and responsibilities of each management position in the decommissioning organization and the reporting responsibility of the position**

  As stated in Section IX.B, the task-specific organization for decommissioning activities includes not only the radiological controls organization described in the previous section, but also the operational and support staff necessary to perform decommissioning activities in a safe and cost-effective manner. This organization is a combination of on-site Aptuit management, Aptuit radiation safety personnel, and D&D Subcontractor personnel. Representatives from Aptuit and the D&D Subcontractor will be present on site during all decommissioning activities. It is important to note that all employees, regardless of their organizational position, have the authority to stop work if quality, safety, or compliance is being compromised.

  The D&D Subcontractor certified health physicist (CHP) will serve as the project health physicist. The project health physicist or designee is responsible for review and approval of all radiological plans and reports prior to issue. The designee must be knowledgeable, trained, and experienced in MARSSIM methodology and its application. The project health physicist will also advise the site supervisor in support of sample collection and analysis activities. Any changes to activities described in this DP must be approved by the CHP or designee prior to implementation.

  The D&D Subcontractor site supervisor is responsible for overseeing on-site decommissioning activities. These include performing radiation surveys and sampling. The duties of this position include direction of task activities, management of HP activities, and on-site inspections to ensure work plan compliance. The site supervisor is also responsible for coordinating activities with the Aptuit personnel. The site supervisor may also serve as the survey coordinator.

  A D&D Subcontractor health physicist or senior HP technician will serve as the survey coordinator. This individual is responsible for reviewing all on-site activities and supervising project survey and sampling technicians. This individual is responsible for the proper performance of survey activities, including collection and transportation of samples. The survey coordinator supports survey activities and documentation efforts of the field team by preparing sample labels, forms, and logs, as needed. The survey coordinator will also work with the field team and the on-site laboratory or the off-site laboratory to ensure that sample collection, documentation, packaging, and transfer are performed using the procedures specified in the work plans. The survey coordinator will coordinate with the Aptuit RSO to ensure consistent compliance with the License and the RSPM.

- **A description of the duties and responsibilities of each chemical, radiological, physical, and occupational safety-related position in the decommissioning organization and the reporting responsibility of each position**

  The duties and responsibilities have been described in Section IX.B.

- **A description of the duties and responsibilities of each engineering, quality assurance, and waste management position in the decommissioning organization and the reporting responsibility of each position**

  The duties and responsibilities of the quality assurance positions are described in Section XIII.A. Waste management duties are the responsibility of the RSO. Duties and responsibilities of the RSO are described in Section IX.B. Waste disposal will be subcontracted to a licensed waste broker.

- **The minimum qualifications for each of the positions described above, and the qualifications of the individuals currently occupying the positions**

  - The Aptuit RSO – The Aptuit RSO shall be the RSO of record for Aptuit's radioactive material license number 24-15595-01. The RSO shall have similar experience with the types and quantities of residual contamination to be encountered on this project. The Aptuit RSO has these qualifications.
  - The Aptuit EH&S Manager – The Aptuit EH&S Manager shall have training and experience in management of environment, health and safety programs. The Aptuit EH&S Manager has the requisite experience.
  - The D&D Subcontractor – The D&D Subcontractor project manager shall have experience with decommissioning sites with similar contaminants. The D&D Subcontractor PM has the requisite experience.
  - The Project Quality Assurance Manager – The Project QA Manager shall have a BS in environmental sciences or business related field plus 10 years experience as a quality professional and 5 years experience as a manager for quality related tasks at a program level.
  - The Site Quality Assurance (QA) Manager – The Site QA Manager shall have an AS or BS in environmental sciences or related field plus 2 years experience in implementing field quality control at a project level.
  - The Waste Disposal Contractor – The Waste Disposal Contractor shall be licensed by the NRC or an Agreement State to perform duties relevant to the packaging, transportation and disposal of radioactive waste. A licensed waste broker will be used.
  - The Project CHP – The Project CHP will have current certification in the comprehensive practice of Health Physics by the American Board of Health Physics. The Project CHP shall have experience with decommissioning sites with similar contaminants.

- The Site Supervisor – The Site Supervisor will have formal education in radiation protection and have experience in performing radiological site investigations. The Site Supervisor has these qualifications.
- The Demo Subcontractor – The Demo Subcontractor will have relevant experience performing decontamination and decommissioning activities on radiological sites. Although not required for this project, the Demo Subcontractor will be licensed by the NRC or an Agreement State to perform decommissioning activities.
- RCT/Surveys Techs – The RCT/Survey Techs shall have formal training in performing radiological site investigations and prior experience in performing radiological surveys at the project level.

o **A description of all decommissioning and safety committees**

The Radiation Oversight Committee (ROC) serves as the oversight group for all decommissioning activities. The ROC consists of facility management, laboratory staff, a D&D contractor representative, and the RSO. This committee will continue to review radioactive materials activities, procedures, current issues, etc. Members of this committee may audit decommissioning activities.

D. *RADIATION SAFETY OFFICER*

o **A description of the health physics and radiation safety education and experience required for individuals acting as the licensee's RSO**

The RSO is approved by the NRC. The RSO has the appropriate education and experience commensurate with decommissioning activities.

o **A description of the responsibilities and duties of the RSO**

The RSO is responsible for the overall management of the radiation protection program, including implementation of ALARA principles.

For decommissioning of the Aptuit facilities, the RSO is responsible for ensuring that all decommissioning activities are conducted in strict conformance to the License, the RSPM, and this DP. The RSO is also responsible for ensuring that all radioactive materials and wastes are removed from the facility.

o **A description of the specific authority of the RSO to implement and manage the licensee's radiation protection program**

The RSO has specific authority from the Decommissioning Task Management to implement the Radiation Protection Program.

E. *TRAINING*

o **A description of the radiation safety training that the licensee will provide to each employee**

All D&D project staff must have training and qualifications commensurate with their assignments. Minimum training for workers performing D&D activities on radiologically contaminated surfaces or systems includes current Radiation Worker Training (RWT). Training topics that must be included in RWT are:

- Radiological Fundamentals
- Biological Effects
- Radiation Detection and Measurement
- Principles of Radiation Protection
- Regulatory Requirements

In addition, all D&D workers will receive project and site-specific radiation awareness training to include radiation safety requirements of the license. This training will be documented.

- **A description of any daily worker "jobside" or "tailgate" training that will be provided at the beginning of each workday or job task to familiarize workers with job-specific procedures or safety requirements**

  A daily briefing will be conducted prior to start of work to review specific work steps/tasks, to update any work requirements/conditions as applicable, and to review safety hazards and control methods. This meeting will be documented. Documentation may be on the Job Safety Analysis/Tailgate Safety Meeting form.

- **A description of the documentation that will be maintained to demonstrate that training commitments are being met**

  All training will be documented to demonstrate that training commitments are being met.

F. ***CONTRACTOR SUPPORT***

- **A summary of decommissioning tasks that will be performed by contractors**

  The D&D Contractor will be responsible for oversight of all radiological activities and will be responsible for removal of contaminated items including vacuum lines, storage cabinets, freezers, wall cabinets, bench tops, tables sink traps and strains.

  The Demo Subcontractor will be responsible for removal of fume hoods, exhaust ductwork, exterior and rooftop exhaust components and the incinerator.

- **A description of the management interfaces that will be in place between the management and onsite supervisors, and contractor management and onsite supervisors**

  The D&D subcontractor will provide a Site Supervisor (SS) that will oversee activities performed by both the D&D Subcontractor and Demo Subcontractor personnel on a day to day basis. The SS will also act as liaison between the D&D Subcontractor, the Demo Subcontractor and the Aptuit RSO.

- **A description of the oversight responsibilities and authority that the licensee will exercise over contractor personnel**

  The licensee will assume responsibility for oversight of contractor personnel.

- **A description of the training that will be provided to contractor personnel by the licensee and the training that will be provided by the contractor**

  Section IX.E. describes training that will be provided for personnel.

- **A commitment that the contractor will comply with all radiation safety and license requirements at the facility**

  The contractors commit to comply with all radiation safety and license requirements at the facility.

X. HEALTH AND SAFETY PROGRAM DURING DECOMMISSIONING: RADIATION SAFETY CONTROLS AND MONITORING FOR WORKERS

In order to determine the radiation safety controls and monitoring necessary to keep D&D worker exposures ALARA, it was first necessary to assess the potential exposures (i.e. assessment of radiation hazards).

Assessment of Radiation Hazards

Based on the radioactive contaminants of concern, a review of facility operational and characterization surveys, facility inventory, and exhaust stack release data, the most significant potential for dose to the worker during decommissioning activities was determined to be through internal exposure during removal of the API exhaust system (hoods, ducts, and HEPA housing). The potential dose from this decommissioning activity is evaluated based on maximum potential inventory in the system and based on estimated maximum surface contamination levels from scoping surveys.

The upper bound of the primary potential internal exposure was evaluated by assuming that the total activity released to the API stack since operations began in 2008 is present in the exhaust system. This total activity is taken from evaluations of emissions from the annual demonstration of compliance to dose-to-public limits and is based on mass balance calculations. The releases to the stack are as follows:

Estimated Releases to Stack (Ci)		
Year	**^{3}H**	**^{14}C**
2008	0	0.1
2009	0.1	0.35
2010	0.3	0.08
2011	0.6	.04
Total	**1.0**	**0.57**

Using the rule of thumb that, when normal precautions are taken, a worker is not likely to have an intake exceeding 1E-6 of the material being handled (NRC, 1993), the maximum potential dose can be calculated based on the annual limits on intake (ALI) for ^{3}H and ^{14}C. ^{14}C has ALIs for the chemical forms of carbon monoxide, carbon dioxide, and carbon compounds. The most conservative ALI for ^{14}C was used (compounds) since it will give the most conservative estimated dose and it is the form most likely to be present in the exhaust system. Calculation of the maximum potential inhalation dose is given below:

Maximum Potential Inhalation Dose		
	^{3}H	**^{14}C**
Inventory (Ci) in exhaust system, Q	1.0	0.57
Potential intake, I_p ($I_p = Q \times 10^{-6}$)	1E-6	5.7 E-07
ALI (Ci)	8E-2	2E-03
Fraction of ALI, f_{ALI} (I_p/ALI)	1.25E-5	2.85E-04
Maximum potential dose, D (mrem) ($D=f_{ALI} \times 5000$ mrem)	**0.06 mrem**	**1.4 mrem**

Based on a conservative estimate of the inventory in the exhaust system, the maximum potential dose would be 1.5 mrem. According to 10 CFR 20.1502(b)(1), worker intakes of radioactive materials must be monitored if intakes are likely to exceed 10 percent of the ALI. The fraction of ALI as shown above is less than 0.1 percent of the ALI.

The maximum potential dose to the worker (1.5 mrem) is estimated to be less than 0.1 percent of the allowable annual limit (5,000 mrem).

In addition to evaluating the potential exposure from removing the API exhaust system, an evaluation of potential exposure was made from the API area characterization surveys. The maximum and average measured loose contamination values for ^{3}H and ^{14}C were used in the evaluation. Default values in DandD were used except the loose fraction was changed from the default value of 0.1 (10 percent) to 1.0 (100 percent) since loose contamination survey data were used as input into the model. The dose results of the DandD runs for maximum and average contamination levels are presented below.

	^{3}H (dpm/100 cm^2)	**^{14}C (dpm/100 cm^2)**	**TEDE (mrem/yr)**
Maximum wipe result	6.1E4	2.6E5	17.9
Average wipe result	1.8E3	1.4E4	0.08

ALARA Program

The radiation protection goal is to limit all radiological exposures to radiation to ALARA, as defined in 10 CFR 20.1003.

Techniques that will be used on this project to minimize radiation exposure (even though exposures are well below the regulatory limits) include the following:

- Project and site-specific radiation awareness training

- Pre-cleaning exposed surfaces that are potentially contaminated
- Use of PPE as appropriate
- Radiological surveys for exposure and contamination control
- Radiological surveys for uncontrolled release of equipment and areas
- Use of HEPA vacuum to control dust
- Use of containment systems to control contamination
- Use of radiation work permits, as needed, to control radiological work.

A. *AIR SAMPLING PROGRAM*

Based on the evaluation of maximum potential exposures (see Assessment of Radiation Hazards above), it is unlikely that an individual could have an intake of radioactive material in excess of 1 percent of the applicable ALIs, or a total effective dose equivalent in excess of 1 percent of the occupational dose limit. Based on this evaluation, there is no requirement for individual monitoring of occupational dose as established in 10 CFR 20.1502(a)(1) and (b)(1). Although the assessment of potential airborne hazards did not identify the need for air sampling; monitoring or sampling for airborne radioactive material hazards may be conducted, as directed by the RSO, when opening contaminated systems or when performing aggressive decontamination or demolition activities when surface contamination exceeds the action levels in WI-005.

B. *RESPIRATORY PROTECTION PROGRAM*

Based on the evaluation of maximum potential exposures (see Assessment of Radiation Hazards above), it is unlikely that an individual could have an intake of radioactive material in excess of 1 percent of the applicable ALIs, or a total effective dose equivalent in excess of 1 percent of the occupational dose limit. Therefore, the use of respiratory protection is not warranted.

C. *INTERNAL EXPOSURE DETERMINATION*

The evaluation of maximum potential exposures demonstrates that monitoring of internal dose is not required. However, the RSO will determine if decommissioning personnel will participate in the bioassay program based on survey results, activities being performed, and control methods used. The general guidelines for internal dose monitoring from the RSPM are found in Table 10-1. Bioassay for ^{3}H and ^{14}C is by urinalysis (Aptuit WI-008, *Bioassay)*. Scheduling of bioassay tests will be coordinated through the RSO. In addition, appropriate bioassay may be performed whenever an internal exposure to radioactive materials is suspected.

Records of all monitored individual exposures are maintained by the RSO.

D. *EXTERNAL EXPOSURE DETERMINATION*

External exposure hazards are not a significant issue for the type and form of contamination expected during decommissioning activities. However, Aptuit will perform surveys prior to and during decommissioning activities to assess exposure hazards and will adjust control measures accordingly to keep potential exposures ALARA.

E. *SUMMATION OF INTERNAL AND EXTERNAL EXPOSURES*

Based on Sections X.C. and X.D., the summation of internal and external exposures is not required.

F. *CONTAMINATION CONTROL PROGRAM*

Contamination is present in CFHs and associated ductwork and on some building surfaces and lab fixtures. Contamination control methods may include pre-cleaning of accessible surfaces, use of a HEPA vacuum to remove visible dust, use of plastic sheeting to protect adjacent surfaces when removing ductwork and/or capping of ductwork sections after removal, use of foam or fixatives to prevent the spread of contamination, establishment of contamination control zones, and use of step-off pads at access/egress areas. Nonaggressive techniques, such as disassembly at mechanical joints, will be used when possible to limit the generation of airborne materials. Minimum PPE for work in contamination areas to prevent skin contamination includes Tyvek coveralls, shoe covers, safety glasses, and gloves. Personnel and equipment frisking for contamination control will be performed with a Ludlum Model 2360 or 2221 Scaler/ratemeter with a Model 43-68 probe. Frisking when leaving contamination zones may also be performed with a Pancake Geiger-Mueller (PGM) detector. Wipe samples will be collected at access/egress points and in uncontrolled areas to verify that contamination control methods are effective. Wipe samples are counted by LSC.

The RSO will perform regular review of radiological conditions encountered during decommissioning activities. If contamination levels exceed those anticipated, the RSO will evaluate the need for additional protective measures. Action levels are defined in WI-005, *Control of Radiological Work* and are presented in Table 10-2.

- **A description of the written procedures to control access to, and stay time in, contaminated areas by workers, if they are needed**

  Aptuit WI-005, *Control of Radiological Work*, describes control of access to contaminated areas. Stay times are not applicable to these decommissioning activities. RWPs will be utilized to control access to restricted areas including Contamination Areas. RWPs will be based on evaluation of individual decommissioning tasks and the hazards applicable to those tasks.

- **A description of surveys to supplement personnel monitoring for workers during routine operations, maintenance, clean-up activities, and special operations**

  Although personnel monitoring is not required, surveys will be performed to assess the nature and extent of contamination (scoping and characterization surveys and media sampling), defining radiological controls and verifying the adequacy of controls, guiding remedial actions, and demonstrating compliance with NRC release criteria (final status surveys). In general, radiation surveys will consist of instrument scans, direct measurement surveys, and wipe sampling. Radiological surveys will consist of measurements of both removable (^{3}H and ^{14}C) and total contamination (^{14}C). Personnel leaving Contamination Areas will be required to frisk. Contamination surveys will be performed daily, when work is in progress, at control points.

- **A description of the surveys which will be performed to determine the baseline of background radiation levels and radioactivity from natural sources for areas where decommissioning activities will take place**

  Material specific backgrounds have been established for the types of materials to be encountered during decommissioning activities. Average material backgrounds were established by taking at least ten measurements on similar materials in a non-impacted area. Material backgrounds are presented in Section IV.A. Facility Radiation surveys are discussed in detail in Section XIV.

- **A description in matrix or tabular form which describes contamination action limits (that is, actions taken to either decontaminate a person, place, or area, restrict access, or modify the type or frequency of radiological monitoring)**

  Action levels are defined in WI-005, *Control of Radiological Work*, and are presented in Table 10-2.

- **A description (included in the matrix or table mentioned above) of proposed radiological contamination guidelines for specifying and modifying the frequency for each type of survey used to assess the reduction of total contamination**

  Action levels are defined in WI-005, *Control of Radiological Work*, and are presented in Table 10-2.

- **A description of the procedures used to test sealed sources, and to insure that sealed sources are leaked tested at appropriate intervals**

  There are no sealed sources that required leak testing.

G. *INSTRUMENTATION PROGRAM*

Instruments will be properly calibrated, charged, and in good general working condition at the beginning of each day of use. Field and laboratory personnel will be responsible for checking the status of their instruments prior to use and for reporting any problems encountered.

- **A description of the instruments to be used to support the health and safety program**

  Instruments to be used to support the health and safety program are listed in Table 10-3, *Instrumentation for D&D Activities*. Instruments include contamination survey instruments (e.g. Ludlum 43-68 and 44-9), exposure rate instruments (Ludlum Model 19) and a liquid scintillation counter for sample analysis (Packard TriCarb 2900).

- **A description of instrumentation storage, calibration, and maintenance facilities for instruments used in field surveys**

  All Instruments will be stored securely onsite. The health physics support area (B2-116, B2-117, and B2-119) will be used for instrument staging and storage. All field instruments will be calibrated at least annually according to the manufacturer's recommendations. Calibration will be performed by the manufacturer or a calibration vendor (such as Shaw, TMA Eberline, or Ludlum) in accordance with American National Standards Institute Standard N323A-1997, *American National Standard, Radiation Protection Instrumentation, Test and Calibration, Portable Survey Instruments*.

- **A description of the method used to estimate the MDC or MDA (at the 95 percent confidence level) for each type of radiation to be detected**

  Calculation of instrument MDCs is described in Aptuit WI-002, *Operation and Use of Portable Radiation Survey Instruments*. MDCs are determined using the methods described in Appendix A of U.S. Nuclear Regulatory Commission, NUREG-1757, Vol. 2, Rev. 1, *Consolidated NMSS Decommissioning Guidance*, (NRC, 2006a)

- **A description of the instrument calibration and quality assurance procedures**

  As stated above, all field instruments will be calibrated at least annually according to the manufacturer's recommendations. Calibration will be performed by the manufacturer or a calibration vendor (such as Shaw, TMA Eberline, or Ludlum) in accordance with American National Standards Institute Standard N323A-1997, *American National Standard, Radiation Protection Instrumentation, Test and Calibration, Portable Survey Instruments.*

  For direct measurement instruments, daily instrument checks will be performed to verify proper instrument operation. The daily check will include counting of a known reference standard and measurement of the background activity. The instrument checks will be repeated after maintenance activities or the observation of anomalous readings. All daily instrument checks will be recorded in the field or laboratory records and shall include results of the instrument check (i.e., if the instrument is satisfactory or unsatisfactory for use).

  An automatic instrument performance assessment (IPA) will be performed each day of LSC operation. IPA monitors the system background, efficiencies for both ^{3}H and ^{14}C, Figure of Merit (E^2/B) and Chi-squared values for both ^{3}H and ^{14}C. IPA is performed using ^{14}C and ^{3}H quenched standards and a background standard. Instrument operation must be within pre-established limits.

  Most instruments will not be repaired in the field. Any nonoperational instrument will be removed from service and returned to its source for a properly functioning replacement. However, some selected spare parts may be kept in the field or laboratory to be inserted as replacements on an as-needed basis.

- **A description of the methods used to estimate uncertainty bounds for each type of instrumental measurement**

  The uncertainty bounds for static measurements are determined during instrument setup. At project setup the check source is counted at least 10 times and the average and standard deviation are calculated.

  For LSC measurements, the uncertainty is calculated and printed on the sample report for each sample counted.

- **A description of air sampling calibration procedures or a statement that the instruments will be calibrated by an accredited laboratory**

  As stated in Section X.A, air sampling is not required during decommissioning activities.

H. *NUCLEAR CRITICALITY SAFETY*

Nuclear Criticality is not applicable for decommissioning activities at Aptuit.

I. *HEALTH PHYSICS AUDITS, INSPECTIONS, AND RECORDKEEPING PROGRAM*

- **A general description of the annual program review conducted by executive management**

  At the direction of the ROC, periodic assessments will be performed as necessary to evaluate compliance with NRC regulations, license conditions, the RSPM, and this DP. These assessments may be performed by the RSO, the ROC, or the project CHP as directed by the License RSO. A report listing findings and recommendations for program improvements will be issued promptly. At a minimum, a review of the content and implementation of the radiation protection program will be performed annually. An interim review may be initiated at RSO discretion or the request of Aptuit or D&D Subcontractor management.

- **A description of the records to be maintained of the annual program review and executive audits**

  Aptuit will maintain records of the radiation protection program, including any audits or other reviews performed to evaluate program content and implementation.

- **A description of the types and frequencies of surveys and audits to be performed by the RSO and RSO staff**

  The RSO or his designee will perform surveillances or audits of the implementation of the DP at least monthly when decommissioning tasks are active. At a minimum, a review of the content and implementation of the radiation protection program will be performed annually.

- **A description of the process used in evaluating and dealing with violations of NRC requirements or license commitments identified during audits**

  Corrective actions will be identified and taken in a timely manner. If serious deficiencies are noted, immediate action will be required. The RSO or his designee will develop and implement a corrective action plan with specifically assigned tasks and a schedule for completion. The corrective action plan is subject to review by the ROC.

- **A description of the records maintained of RSO audits**

  Aptuit will maintain records of the radiation protection program, including any audits or other reviews performed to evaluate program content and implementation.

XI. ENVIRONMENTAL MONITORING AND CONTROL PROGRAM

Based on the nature and extent of radiological contamination at the site and the planned decommissioning activities, releases to the environment are not likely. Radiological contamination exists as both fixed and removable surface contamination on equipment and building surfaces in the API area and on interior surfaces of the ventilation exhaust system. The methods to minimize any potential releases, no matter how small, are described below.

A. *ENVIRONMENTAL ALARA EVALUATION PROGRAM*

- **ALARA Goals -** The ALARA goal for effluent control is to prevent any releases to the environment during decommissioning activities
- **Procedures, engineering controls, and processes to maintain doses ALARA –** Although releases to the environment are not likely, the following control measures will be used to further decrease the likelihood of environmental impacts:
  - Pre-cleaning exposed surfaces (e.g. with dampened rags) that are potentially contaminated
  - Radiological surveys for exposure and contamination control
  - Radiological surveys for uncontrolled release of equipment and areas
  - Use of HEPA vacuum to control dust
  - Use of containment systems (e.g. wrapping open ends of exhaust ducts with plastic) to control contamination
- **ALARA reviews and reports to management** – Review of effectiveness of controls to limit environmental releases will be part of the RSO's surveillance program. Surveillance reports will be reviewed by the ROC.

B. *EFFLUENT MONITORING PROGRAM*

Based on the nature and extent of radiological contamination at the site and the planned decommissioning activities, releases to the environment are not likely and will not be monitored.

C. *EFFLUENT CONTROL PROGRAM*

- **A description of the controls that will be used to minimize releases of radioactive material to the environment** - Although releases to the environment are not likely, the following control measures will be used to further decrease the likelihood of environmental impacts:
  - Pre-cleaning exposed surfaces (e.g. with dampened rags) that are potentially contaminated
  - Radiological surveys for exposure and contamination control
  - Radiological surveys for uncontrolled release of equipment and areas
  - Use of HEPA vacuum to control dust

- Use of containment systems (e.g. wrapping open ends of exhaust ducts with plastic) to control contamination

- **A summary of the action levels and a description of the actions to be taken should a limit be exceeded** – Effluent monitoring will not be conducted.

- **A description of the leak detection systems for ponds, lagoons, and tanks** – There are no radiologically impacted ponds, lagoons, or tanks.

- **A description of the procedures to ensure that releases to sewer systems are controlled and maintained to meet the requirements of 10 CFR 20.2003** – Releases to the sewer system are not allowed for routine operations. Releases to the sewer during decommissioning activities will be controlled by limiting water sources in areas undergoing remediation and/or by plugging drains in the vicinity of decontamination efforts should water be needed.

- **A summary of the estimates of doses to the public from effluents and a description of the method used to estimate public dose** - Prior to 2008 Aptuit demonstrated compliance with the public dose limit using the possession tables in the EPA Comply code. Since the increase in license limits in 2008 (License Amendment 27), the dose to the public from emissions from the facility have been below 0.1 mrem. The public dose was calculated using the EPA Comply code and conservative estimates of emissions. Aptuit's source term has since been reduced to radioactive materials in packaged waste and residual contamination on building and equipment surfaces. Based on nature and extent of contamination, historical data and the reduced source term, emissions from the facility are not likely, therefore there is no dose expected for members of the public.

XII. RADIOACTIVE WASTE MANAGEMENT PROGRAM

A. *SOLID RADWASTE*

- **A summary of the types of solid radioactive waste (radwaste) that are expected to be generated during decommissioning operations**

  Types of solid radwatse expected to be generated during decommissioning operations include:

  - Chemical Fume Hoods
  - Exhaust Ductwork
  - Exterior and Rooftop Exhaust Components
  - Incinerator
  - Vacuum Lines
  - Storage Cabinets
  - Freezers
  - Wall Cabinets
  - Bench Tops/Tables
  - Sink Traps/Strains

- **A summary of the estimated volume, in cubic feet, of each solid radwaste type summarized in Line 1 above**

  It is estimated that approximately 68,000 pounds (approximately 5440 ft^3) of solid radiological waste may be generated during the D&D of the Aptuit SO facility.

- **A summary of the radionuclides (including the estimated activity of each radionuclide) in each estimated solid radwaste type summarized in Line 1 above**

  Solid radiological waste will be comprised of ^{3}H and ^{14}C. The estimated activity is less than 1 Curie ^{3}H and less than 2 Ci ^{14}C.

- **A summary of the volumes of Class A, B, C, and Greater-than-Class-C solid radwaste that will be generated by decommissioning operations** - All waste generated during decommissioning will be Class A.

- **A description of how and where each of the solid radwaste summarized in Line 1 above will be stored onsite prior to shipment for disposal**

  All radioactive material will be handled, stored and managed in accordance with Aptuit's radioactive materials license and Aptuit WI-006, *Management of Decontamination and Decommissioning Waste for Decommissioning Activities*. Post removal, all solid waste will be stored in staged containers proximal to the API area. The containers will be appropriate for the type of waste to be stored.

- **A description of how the each of the solid radwastes summarized in Line 1 above will be treated and packaged to meet disposal site acceptance criteria prior to shipment for disposal**

  All known or suspected radioactive waste will be packaged and labeled at the point of generation. Prior to packaging, all required survey data will be obtained to support proper management and characterization for impending disposition.

  All potentially contaminated waste media generated during the project that cannot be adequately characterized by field survey (e.g. liquids, vacuum contents, drain solids, filter media, etc.) or by the on-site laboratory will be analyzed by an off-site laboratory.

  The following basic criteria related to acceptance for shallow land burial will be followed:

  - Any medium that is potentially or known to be hazardous shall not be commingled with radioactive wastes.
  - Packages shall contain no standing water or excessive moisture.
  - All clean industrial trash shall always be segregated unless potentially contaminated.
  - No chemical containers or pressurized aerosol cans will be included.

- **If appropriate, how the licensee intends to manage volumetrically contaminated material**

  Volumetrically contaminated material is not expected. Historically, the nature of the contamination has been surface contamination.

- **A description of how the licensee will prevent contaminated soil, or other loose solid radwaste, from being re-disbursed after exhumation and collection**

  Aptuit anticipates no contaminated soil or loose solid waste will be generated.

- **The name and location of the disposal facility that the licensee intends to use for each solid radwaste type summarized in Line 1 above**

  Aptuit will use a licensed radioactive waste broker for disposal of all decommissioning wastes. The broker will determine the appropriate destination for disposal.

B. LIQUID RADWASTE

- **A summary of the types of liquid radwaste that are expected to be generated during decommissioning operations**

  Liquid radwaste expected to be generated during decommissioning activities include LSC cocktail and aqueous waste (e.g. from sink traps and decontamination efforts).

- **A summary of the estimated volume, in liters, of each liquid radwaste type summarized in Line 1 above**

  It is conservatively estimated that approximately 100 gallons (380 liters) of

liquid radiological waste may be generated during the D&D activities. Of this it is estimated that approximately 40 liters would be LSC cocktail and the remainder being aqueous waste.

A summary of the radionuclides (including the estimated activity of each radionuclide) in each liquid radwaste type summarized in Line 1 above-

Liquid radwaste will be comprised of ^{14}C and ^{3}H only. Estimated activity is projected to be less than 0.01 Curies.

- **A summary of the estimated volumes of Class A, B, C, and Greater-than-Class-C liquid radwaste that will be generated by decommissioning operations**

  All waste generated during decommissioning will be Class A.

- **A description of how and where each of the liquid radwastes summarized in Line 1 above will be stored onsite prior to shipment for disposal.**

  All radioactive material will be handled, stored and managed in accordance with Aptuit's radioactive materials license. Liquid waste will be stored with secondary containment. Liquid waste containers will remain closed except when material is being added or removed, or for inspection of the contents.

- **A description of how the each of the liquid radwastes summarized in Line 1 above will be treated and packaged to meet disposal site acceptance criteria prior to shipment for disposal**

  Liquid radwaste handling will follow guidelines as stated for solid radwaste above.

- **The name and location of the disposal facility that the licensee intends to use for each liquid radwaste type summarized in Line 1 above**

  Aptuit will use a licensed radioactive waste broker for disposal of all decommissioning wastes. The broker will determine the appropriate destination for disposal.

C. MIXED WASTE

Although it is not expected that any mixed waste will be generated, there is provision in the financial assurance for disposal of up to 500 lbs of mixed waste.

- **A summary of the types of solid and liquid mixed waste that are expected to be generated during decommissioning operations**

  Mixed waste could include asbestos containing materials (ACM) or mercury with ^{14}C and ^{3}H.

- **A summary of the estimated volumes in cubic feet of each solid mixed waste type summarized in Line 1 above, and in liters for each liquid mixed waste**

  It is not anticipated that any sizable quantity of mixed waste will be generated (i.e. <500 lbs).

- **A summary of the radionuclides (including the estimated activity of each radionuclide) in each type of mixed waste type summarized in Line 1 above**

  As stated above, mixed waste could include ACM or mercury with ^{3}H and ^{14}C.

- **A summary of the estimated volumes of Class A, B, C, and Greater-than-Class-C mixed waste that will be generated by decommissioning operations**

  Any mixed waste generated will be Class A.

- **A description of how and where each of the mixed wastes summarized in Line 1 above will be stored onsite prior to shipment for disposal**

  Any radioactive mixed waste generated will be stored in the API lab area until it can be disposed of properly by the Waste Disposal Subcontractor.

- **A description of how the each of the mixed wastes summarized in Line 1 above will be treated and packaged to meet disposal site acceptance criteria prior to shipment for disposal**

  Mixed waste handling will follow guidelines as stated for solid radwaste above.

- **The name and location of the disposal facility that the licensee intends to use for each mixed waste type summarized in Line 1 above.** Aptuit will use a licensed radioactive waste broker for disposal of all decommissioning wastes. Aptuit plans on using Bionomics, Inc for disposal of any mixed wasted generated from decommissioning activities. However, Aptuit reserves the right to contract with another appropriately licensed waste disposal contractor depending on a number of factors including cost, schedule, services provided, etc. The broker will determine the appropriate destination for disposal.

- **A discussion of the requirements of all other regulatory agencies having jurisdiction over the mixed waste**

  Other regulatory agencies having jurisdiction over the mixed waste generated during decommissioning activities include the Missouri Department of Natural Resources and the U.S. Environmental Protection agency.

- **A demonstration that the licensee possesses the appropriate EPA or State permits to generate, store, and/or treat the mixed wastes**.

  Aptuit has filed a "Notification of Regulated Waste Activity" with the Missouri Department of Natural Resources to comply with Section 260.380 of the Missouri Hazardous Waste Management Law and Section 3010 of the Resource Conservation and Recovery Act. The EPA ID Number is MOR000542761.

XIII. QUALITY ASSURANCE PROGRAM

A. *ORGANIZATION*

- **QA Program Management Organization**

  All levels of authority, lines of communication, and functional responsibilities shall be defined to ensure that all decommissioning activities that affect quality are controlled. The organizational structure and assignment of responsibility shall be such that:

  - Quality is achieved and maintained by those who have been assigned responsibility for performing the work.
  - Quality work will be conducted under the guidance of approved work plans and site specific procedures.
  - Quality achievement is verified through audits, inspections and surveillance by persons or organizations not directly responsible for performing the work.

  Individuals or groups who examine, audit, inspect, or otherwise verify quality activities shall be independent of the individuals or groups performing the activities. Independence shall be achieved by assigning such responsibilities to the quality assurance organization, the quality control organization, or to individuals or groups not responsible for performing the original activity.

  The organization shall have sufficient authority to access to work areas, establish effective lines of communication with senior management, and provide organizational freedom to identify quality problems; initiate, recommend, or provide solutions; and to assure that further processing or project delivery is controlled until proper disposition has occurred. This authority shall include stop work. The QA organization shall report to a level of management that provides sufficient authority and organizational freedom to assure that appropriate action can be taken to resolve conditions adverse to quality and shall have sufficient independence from cost and schedule considerations.

  Quality issues that cannot be resolved on the lowest appropriate management level will be escalated to the next higher level. This could ultimately result in the problem being brought to the attention of the Project Senior Management for resolution.

- **Duties and Responsibilities**

  Quality Assurance Manager

  A Site Quality Assurance Manager shall be assigned to the project and shall participate in all relevant project activities to assure that adequate qualified personnel, equipment, and procedures are available to perform quality activities in support of the project schedule. This includes responsibility for quality surveillance of work let to subcontractors who are working to their own, project approved, and quality assurance program with their own Quality Control Inspection.

Site Quality Control Manager

An individual will be designated as the Site Quality Control Manager for all inspections and test activities. This individual is responsible for the management and implementation of the Quality Control Program and interfaces with the Site Project Manager. The positions of Site Project Quality Assurance Manager and Site Quality Control Manager may be filled by the same person.

Quality Assurance/Quality Control Staff

The quality assurance and quality control organization shall be adequately staffed throughout the life of a project. The project scope shall be reviewed by the QA organization to determine the personnel requirements to support quality assurance and quality control activities and staff to provide required support.

Delegation of Authority

When duties are to be delegated to another individual, the following shall be adhered:

- When a job title is mentioned in this QAP, the expression "or designee" is implied for the execution of the task and is interpreted to mean that a qualified designee of the person may perform the specified duty.
- Any person with authority may delegate performance of duties to assigned subordinate personnel. This delegation does not need to be formal or in writing but needs to be communicated to all stakeholders.
- Management and supervisory personnel may at any time perform the duties of their subordinates. When such duties are specialized tasks requiring qualification they shall be required to hold the appropriate qualification.
- Whenever performance of duties is delegated to personnel other than subordinate personnel, this delegation shall be formal, in writing, and in such terms as to retain the responsibility as established in this QAP. Management delegating performance in this manner shall assure that the personnel delegated to perform the duties have received the necessary training and satisfy the requirements established for implementing the activity. When both responsibility and performance are re-assigned, the applicable project plans shall identify the responsible management.

Outside Organizational Interface

- Because there is more than one organization involved in the execution of the decommissioning activities, the responsibilities, interfaces, and authority of each organization shall be clearly defined and documented.
- **Evaluation of Work Performance**

  The performance of work, whether performed internally or externally delegated to other organization, will be evaluated using a system of audits, surveillance and inspection. Inspections will be conducted at the onset of the project to ensure readiness to start work and follow-up inspections and surveillance will be

conducted while the work is in process to ensure that the work is being implemented in accordance with the project guidance documents. One final inspection will be conducted at the conclusion of the field activities. At least one audit will be conducted depending upon the duration of the field activity. The methods that will be utilized are presented in Section XIII.g, "*Audits and Surveillances*".

- **QA Program Authority**

Quality Assurance Manager

Project Quality Assurance (QA) manager is assigned duties and responsibilities at the project level for enforcing quality plans and procedures, or specific duties and responsibilities for implementing elements of the corporate quality management program. To assure independence, each Project QA manager reports directly to a Corporate QA manager (Aptuit) and indirectly to the project manager. The project QA manager is delegated the responsibilities and authorities commensurate with their assigned projects or tasks. The Project QA manager will interface with program and project management, engineering, and other applicable functional organizations. At the project level, each Project QA manager will direct the QC staff specialists/inspectors in implementing quality program, project plans, and procedures, and will update the QA program Plan as frequently as needed based upon the duration of the project.

Site Quality Control Manager

The site quality control (QC) manager has the responsibility and authority for implementing the QA program at the project level. The site QC manager conducts surveillance and inspections on the work that is being performed. The site QC manager has the authority to identify deficiencies while work is in process. If the deficiency cannot be resolved at that time the QC manager has the authority to advance the issue to the next level of management for resolution. Due to the size and scope of the project the QA manager may also serve as the project and site QC manager.

Quality Assurance/Quality Control Staff

The QA/QC Staff will include the Project Manager, the Site Superintendent, and the Project QA manager, and all the members of the field team. The entire QA/QC staff, all with the support of upper level management, is responsible for achieving quality. All workers have the responsibility and authority to "stop work" if imminent risks to safety, environment, or mission are identified. The worker has the responsibility and authority to notify the necessary management of the discrepant conditions so that appropriate corrective action can be taken.

- **Organizational Chart**

Figure 9-1 shows the overall project organization and the key project personnel for decommissioning activities at Aptuit. The figure includes position titles and show clear lines of authority and communication for managing the decommission efforts.

B. *QUALITY ASSURANCE PROGRAM*

The purpose of this section is to communicate the QA policy and commitments to develop implementing procedures; conduct training where appropriate; and implement assessments under this program. Should additional procedures associated with decommissioning activities be needed, Aptuit will develop, implement and maintain procedures associated with those decommissioning activities. These procedures will be approved by Aptuit management.

- **Commitment to Quality**

  This program document communicates the QA policy and commitments to develop the implementing procedures under this program. Training is scheduled, conducted and documented on applicable quality policies, manuals, and procedures as determined by the project team. A scheduled audit program assures that these requirements are implemented as follows:

  - Activities affecting quality shall be documented, as appropriate, in drawings, specifications, instructions, and procedures.
  - Activities affecting quality shall be conducted under controlled conditions.

  These shall include appropriate equipment, such as tools and test equipment, suitable environmental conditions, and assurance that all specified conditions have been met.

- **Quality Assurance Policy Statement**

  It is the policy of Shaw to conduct decommissioning activities in such a manner as to ensure the health and safety of the public, personnel on site, and protect the environment. One way to accomplish this critical objective is to have an aggressive and comprehensive QA program in place for those activities that can impact safety and quality.

  The policies, requirements, and tasks described in this QA program gave been developed to fulfill a recognized need for assurance that requisite quality is achieved in the engineering, procurement, and decommissioning of the Shaw scope of work for the Aptuit project.

  This QA program meets the requirements and guidance set forth in the NUREG 1757 Volume 1 Rev 2, subsection 17.6.2, *Quality Assurance Program,* and shall be applied in accordance with contract requirements.

  One of the fundamental aspects of this QA program is that the individuals performing the work determine the quality that is achieved. Although plans, procedures, and instructions are a basic part of any quality program, the individual employee on this project has the responsibility for the overall quality. Each individual, when properly trained and provide with appropriate guidance, will achieve the highest quality of performance.

  The Aptuit Scientific Operations decommissioning project management has directed the establishment of a formal and comprehensive QA program for the project. This program places accountability for quality on each person working on the project. In

addition, it emphasizes the creation of an atmosphere in the workplace where the reporting and resolution of conditions adverse to quality are encouraged and aspect at all levels.

QA objectives shall not be subordinate to cost or schedule objectives. To ensure compliance with the QA program requirements, independent verifications assessments shall be conducted to provide management a measure of the program's effectiveness and adequacy in meeting the requirements of the QA program and it's implementing

- **Technical and Quality Procedures**

  Procedures, which are used to implement this quality assurance program, shall be written, controlled and consistent with the commitments of this program. Should procedures need to be written based upon site specific activities, they shall be reviewed by the appropriate subject matter expert. Each review shall be documented and concurrence shall be maintained as a project QA record. Each revised procedure will receive a designation of "Revision XXX" whichever is applicable to the revision status.

- **Management Reviews of Technical and Quality Procedures**

  Project management shall be included in the technical and quality procedure review process. The reviewer will provide comments and the document author will incorporate responses where appropriate. This management review of the document shall be documented and will be maintain in the project records as a quality record.

- **Quality-affecting Procedural Controls of the Principal Contractors**

  Workers will be provided with the most current procedure for them to conduct their specific task. Should changes be required to written procedures, the changes will be controlled and subject to the same review as the original document. When concurrence has been granted by all of the document reviewers, the revised procedure will be provided to the affected workers. Should the changes be significant, training will be provided. The superseded procedure will be removed from the work area as to prevent any inadvertent usage.

- **Project Changes**

  The Project Manager shall notify all applicable stake holders of any changes in the QA program for acceptance and approval before those changes have been implemented. Should changes be required in the organization, the project manager shall notify all applicable stakeholders within 30 days following the announcement of the change.

- **MANAGEMENT ASSESSMENT**

  Planned and periodic assessment of project activities will be conducted and will involve management at all levels. The primary emphasis of management assessments will be to identify problems or barriers that could affect achievement of goals and to assess the effectiveness of system controls to establish and achieve quality.

1. Responsibilities

The Project Manager is responsible for all management assessments. The Project Manager shall participate in and provide project input to management assessments. The QA manager will periodically assess the adequacy and implementation of the QA program to meet the requirements of NUREG 1757 Volume 1 Rev2.

2. Project Process

Management assessments of the project will be conducted by project management personnel through a review of projected-related activities and project control activities. The assessments will focus on elements that affect work processes and the achievement of project goals to include quality, health and safety, strategic planning, organizational interfaces, cost control, use of performance indicators, training and qualifications, and supervisory oversight and support.

3. Project Review

Reviews of this project are typically made on a monthly basis during the project status review meeting. The meeting may be attended by the Project Manager, Project QA manager, EH&S Representative (or their designees), and other appropriate management personnel. Project senior management may be represented at the meeting. The meeting will focus on the project status, EH&S issues, quality issues, lessons-learned, and other project operations.

Other assessments completed by the Project Manager may include, but are not limited to:

- Review QA program requirements to ensure the project complies with all necessary requirements.
- Ensure all criteria have been met for readiness reviews.
- Require a QA/QC status report from the functional site personnel or project QA manager.
- Perform training effectiveness reviews.

4. Documents and Records

The results of the project review meeting, including results of any management assessments, will be reported in the Project Manager's Project Status report. Any corrective actions or areas for improvement will be notified in the report and reviewed in the subsequent project reviews for effective implementation. If necessary, interim corrective actions will be initiated while final corrective actions are being developed. Based upon the review of project activities, senior management, the Project Manager, and project or corporate QA/QC staff may request an independent assessment to be performed.

o **Instruction Provided to Personnel**

- **Indoctrination and Training**

  Indoctrination, training, and qualification programs shall be established and implemented, to familiarize workers with the procedures and systems developed to govern and support quality related and quality assurance/quality control activities, including tests, inspections, examinations, and audits. Each worker is required to have current certification commensurate with the assigned task and duties. This training will be documented and the appropriate certification or attendee list will be maintained on site where it was be available for inspection upon request. Examples of training required in preparation for this decommissioning effort include but is not limited to the following:

  - Site Specific Awareness Indoctrination
  - Radiation Worker Training
  - 40 Hour OSHA and subsequent 8 Hour HAZWOPER Training

- **Formal Training and Qualification Program**

  A formal training program is not required for this project. All workers that will be employed for the decommissioning project will have all the required training necessary for their assigned task and shall possess the appropriate certifications as evidence of qualification to perform work on this site.

- **Self Assessments**

  Self assessments are designed and conducted to provide a measure of performance and compliance and to ensure involvement of the project senior management. The purpose of these assessments is to confirm that activities affecting quality comply with the QA program. Self assessments will be performed at a frequency based upon the estimated duration for decommission completion.

- **Persons Conducting Self-Assessments**

  Self-assessments will be conducted by individuals not directly responsible in the area that is being assessed. Self assessments will include an evaluation of quality affecting procedures; project quality assurance audits and surveillance program to verify that the commitments of this program are being implemented. Reports of these assessments, along with any recommendations, shall be submitted to the project senior management.

- **Organizational Responsibility for Implementing the Project Guidance Documents**

  Effective implementation of the decommissioning project activities requires efforts at all levels of the organization. Management personnel are responsible and accountable for establishing and maintaining appropriate plans and procedures for achieving quality, conducting work in accordance with the established requirements, and evaluating the related work. All personnel are responsible for the implementation of requirements applicable to their work and for achieving quality in their work. It is also the responsibility of management to ensure that all work guidance documents are current and the latest version of available work instructions

are provided to the workers to ensure that all work activities are controlled and implemented in accordance with the appropriate guidance document.

- **A description of the procedures to ensure that instructions, procedures, and drawings include quantitative acceptance criteria and qualitative acceptance criteria for determining the important activities have been satisfactorily performed.**

  Instructions, procedures and drawings will receive qualitative acceptance via review by subject matter experts (SMEs).

C. *DOCUMENT CONTROL*

The purpose of this section is describe how methods and practices are established for the preparation, review, approval, issuance, use, and revision of documents that prescribe processes, specify requirements, or establish design.

- **Types of QA Documents**

  The project QA documents will consist of the following:

  - The Decommissioning Plan (includes the Quality Assurance Program)
  - Project Health and Safety Plan
  - Radiation Protection Plan
  - Site specific procedures

  Documents that prescribe processes, specify requirements, or establish design must be prepared to ensure requirements of this decommissioning activity are met. The following section describes the process by which documents are developed, issued, revised, and retired.

- **Document Lifecycle Process**

  The project manager is responsible for identifying required documents, assigning an individual to be responsible for each document, and establishing the review and approval authority for each. The project manager must commit the necessary resources for developing the documents, ensuring that they meet applicable requirements, and updating the assigned documents as needed. Documents shall be prepared so that they are accurate, technically defensible, and properly reviewed and approved. Required reviews will be performed and documented by technically competent and knowledgeable individuals.

  The document preparer leads the effort to fully define the work description and, with the assistance of subject matter experts (SMEs), leads the effort to identify all significant hazards and the associated hazard analysis. The documents will be prepared to effectively identify and communicate the hazards, and associated controls to mitigate the hazards, to the project personnel. The preparer shall utilize, as applicable, SMEs and project personnel knowledgeable in the work activities to assist in the preparation of the documents. The preparer will identify the specific requirements and incorporate those requirements into the document to ensure that the activity complies with those requirements.

Document Control

A formal system of controlling document distribution shall be used. The following method is provided for controlling document distribution. Either method may be selected by the project manager with the determination based on the document, the project scope, and the level of distribution required.

- Controlled document distribution that includes a unique identifier for each document copy, a distribution list for each document, and acknowledgment-of-receipt records from individuals receiving a controlled copy. The system must include distribution of all changes and revisions of controlled documents to all copyholders.
- Controlled document access by posting a noneditable (e.g., Adobe Acrobat pdf) electronic copy of the document to the "Controlled Documents" portion of the project SharePoint (extranet) site. Ability to post documents to this portion of the SharePoint site is administratively limited to the document control coordinator and the project QA manager. Project personnel will have reading and printing access only. Documents posted to the "Controlled Documents" portion of the SharePoint site will contain a disclaimer indicating that the document is uncontrolled when printed. Changes and revisions will be posted in the same manner.

Document Change Control

Documents that require change shall include approval by the same level of approval as the original document. The document reviewers shall have the same access to pertinent background data or information necessary on which to base their approval. The change control method shall include a revision identification system so that the effective revisions can be readily determined.

The document control system shall ensure that the changes are provided to document users in a timely manner and that changes are incorporated on a basis consistent with usability and support of the activities performed. Superseded or obsolete documents that are targeted to be retired shall be identified and removed from the work area in a timely manner to prevent inadvertent usage.

D. *CONTROL OF MEASURING AND TEST EQUIPMENT*

The purpose of the description of the test and measurement equipment calibration program is to verify that equipment used to support decommissioning activities is properly controlled, calibrated, and maintained.

- ***Summary of Measurement and Test Equipment to be used on Site***

  Personnel shall ensure that measuring and test equipment (M&TE) are of the accuracy and type suitable for the intended use. The use, calibration, and maintenance of M&TE shall be controlled by the Aptuit Work Instruction WI-002 and work plans, and supplemented by manufacturer's equipment operation manuals. A summary of the type of measurement and test equipment that will be used as part of the decommissioning effort is provided in Table 10-3.

- ***How and Frequency of M&TE Calibration***

  All M&TE are subject to calibration prior to use and at prescribed intervals thereafter using appropriate procedures or manufacturer's technical documents. Calibration must be performed by qualified personnel, approved external agencies, or the equipment manufacturer. Calibration shall be performed using standards traceable to nationally recognized references such as National Institute of Standards and Technology or accepted values of natural physical constants. If no traceable standard is available, the basis for calibration will be documented and approved by the project QA manager.

  If M&TE is lost, damaged, or found to be out of calibration, the validity and acceptability of previous measurements will be evaluated and/or replaced based upon the results of the evaluation.

- **Daily Calibration Checks**

  During M&TE usage, operational checks of the equipment will be performed to verify the equipment's continued accuracy and operational function. Operational calibration checks of equipment will be performed in accordance with approved plans/procedures or manufacturer's recommendations. It is the responsibility of personnel using the equipment to verify that the instrument's calibration status is current prior to use and to properly document this verification. This documentation shall be maintained as a project record as evidence that only properly maintained M&TE were used during this decommissioning.

- **Documentation**

  The (M&TE) used in the performance of inspections or acceptance tests shall be calibrated and properly maintained as described below. A calibration log will be maintained for each instrument. The log will contain a specific checklist of items that verify compliance as well as the standard by which the equipment has been calibrated. Calibration shall be performed using standards traceable to nationally recognized references such as National Institute of Standards and Technology or accepted values of natural physical constants. Any item or work determined to be defective shall be segregated, when practical, and tagged "out-of-service" to prevent inadvertent use and shall be either labeled as a nonconforming item or disposed of.

E. *CORRECTIVE ACTION*

The purpose of this section is to demonstrate that measures have been established to assure that conditions adverse to quality are promptly indentified and corrected. The project processes for detecting, preventing, and correcting quality problems are discussed in this section. The project manager and the project QA manager focus on continuous improvement of the products and services provided during the decommissioning activity at the Aptuit Scientific Operations. Items and processes that do not meet established criteria shall be identified, controlled, and corrected, as applicable. Personnel at all levels are responsible for identifying problems and process improvement opportunities and are encouraged to offer solutions.

- **Corrective Action Procedures**

  It is the responsibility of all project personnel and subcontractor personnel to assess activities and inspect items used within the project to verify that each item meets specified requirements and to identify and document incidences of nonconforming items, activities, or conditions. It is the responsibility of the project management team to promptly report, respond to, and resolve nonconforming conditions, and to foster a "no-fault" attitude that encourages the identification of nonconforming items and processes.

  Personnel who identify a nonconforming condition that is potentially hazardous to workers, the public, or the environment, or that jeopardizes the integrity of the program or project have the responsibility and authority to suspend work and report the condition to the responsible manager.

  Control and Disposition of Nonconforming Items

  Items that do not meet specified requirements, known as nonconforming items, shall be identified by marking, tagging, or other methods that do not adversely affect their end use. The identification shall provide traceability to the related nonconformance report (NCR) and shall be legible and easily recognizable. Nonconforming items shall be segregated, when practical, by placing them in a clearly identified and designated hold area until properly dispositioned. If segregation is impractical or impossible due to physical conditions, then other administrative controls and precautions shall be employed to preclude inadvertent use of nonconforming items.

  The nonconforming characteristics shall be reviewed, and recommended dispositions of nonconforming items shall be proposed. Personnel performing evaluations to determine a disposition shall have demonstrated competence in the specific area they are evaluating, have an adequate understanding of the requirements, and have access to pertinent background information.

  Nonconforming Activities

  Activities or documentation identified as out of compliance with requirements shall be documented as a nonconformance for the purpose of identification of corrective actions and evaluation of the effect on the project objectives. When the integrity of the work is left in question, the work will be performed again, if possible. When not possible, limitations of the results of the work must be documented in the final investigation report. The disposition of nonconforming activities shall be identified and documented as an NCR. A system for tracking NCRs to closure will be developed and shall be maintained by the project QA manager as an NCR log.

- **Corrective Actions Documentation and Tracking**

  The responsible manager, as determined by the project manager, shall develop and document corrective action for all nonconformances and assessment findings based upon a graded approach. The corrective action should target both the primary causes of the problem as well as correcting the resulting nonconforming

condition. These actions shall be reviewed for adequacy and effectiveness in correcting the problem and approved by the project QA manager or a designee. The corrective actions shall be documented and tracked as follow-up until all corrective actions have been completed. This action shall be documented and maintain in the project files as a project quality record. All corrective actions will be tracked from inception to completion on a Corrective Action Log.

F. *QUALITY ASSURANCE RECORDS*

The purpose of this section is to present how the quality assurance (QA) records for the decommissioning project are managed and maintained and to demonstrate that a program has been established to include procedures and facilities that adequately store the QA program records.

A QA record is an authenticated record that provides objective evidence of the quality of items, activities, or services, and/or compliance to the contract or regulatory requirements. Documentation required by federal regulations and specified in individual procedures shall be considered QA records. At a minimum, QA records shall include, but not limited to the following: results of reviews, inspections, tests, audits, material analyses; monitoring of work performed; records on qualifications o project personnel, procedures, and equipment. All records produced during this decommissioning project shall be legible, accurate, and appropriate to the work performed and may be in a variety of forms including electronic, written or printed, photographic, or optical disks.

- **QA Records Management**

  In general, project records will be managed and stored in accordance with the D&D Subcontractor's Records Management procedures. Exceptions, such as personnel H&S or copies of training records, shall be specifically identified in project implementing plans and procedures. Original copies, when available, will be submitted for filing; if not available, a first generation duplicate will be provided. The project manager is responsible for ensuring that project QA records are managed in a manner that precludes loss or damage.

- **On-site Files**

  Appropriate control methods shall be established to maintain in-process field records. In-process records and on-site copies of training and qualification records will be maintained in a manner that facilitates ease of retrieval and ensures that they are protected from loss or damage. At the conclusion of all field related activities, all on-site in-process records will be transferred to, authenticated, and integrated with, the project records stored in the D&D Subcontractor's Records Management System as specified in the Records Management procedures.

- **Quality Control**

  All records generated as a result of field related activities shall receive a thorough review by the site QC manager or designee prior to submittal for inclusion into the project Records Management system. QC shall conduct periodic

assessments to ensure that records are being managed in a manner prescribed in the Aptuit Records Management procedures.

The QA manager is responsible for the performance of surveillance or audits to verify the all QA related documents are controlled in manner consistent with the Apuit Records Management system.

- **QA Records Storage Facility**

  All project quality records generated as a result of field-related activities will be transferred from the D&D Subcontractor's office in Lenexa, Kansas to the D&D Subcontractor's long-term records management and storage company, Iron Mountain. Iron Mountain will store the project documents in a safe and secure facility.

G. Audits and Surveillance

The purpose of this section is to describe the responsibilities and requirements for planning, scheduling, and performing Quality Assurance Program audits to ensure compliance with all aspects of this document.

- **The Audit Program**

  Audits, surveillance, and inspections will be conducted in accordance with the D&D Subcontractor's procedures. Personnel participants will be qualified to perform audits, surveillance, or inspections in accordance with established procedures. Personnel will be assigned based on their independence and their technical expertise in the intended area of their participation.

  Independent audits, surveillance, and inspection will be scheduled for all project activities. These assessments will be based on established frequencies and other appropriate requirements, documents, trend data of activity, complexity of activity, history of compliance, and importance to safety and associated consequences as related to the public, environment, and workers. The assessment schedules will be prepared with flexibility to permit unscheduled assessments to take place for activities of unquestionable performance. Assessment frequency and scope will be determined on a graded approach in accordance with contractual requirements.

- **Audit Records Documentation**

  Audit reports will be generated to provide evidence that the QA program is being implemented as prescribed in the document. The audit report will be signed by the audit team leader and shall be distributed to the appropriate recipients and will include the following information, as appropriate:

  - Description of the audit scope.
  - Identification of the auditors.
  - Identification of persons contacted during audit activities.
  - Summary of audit results, including a statement on the effectiveness of the quality assurance program elements, which were audited.

Description of each reported audit finding in sufficient detail to enable corrective action to be taken by the audited organization.

- **Follow-up Activities Associated with Audits or Surveillance**

  Management of the audited organization or activity shall investigate audit findings, determine the root cause of the condition identified in the finding, and schedule corrective action for the finding, including measures to prevent recurrence, evaluate the impact of the finding on completed work, and notify QA in a written report of action taken or planned. The adequacy of audit responses shall be evaluated by QA.

  A tracking system for audit findings shall be established to help assure that all findings are appropriately addressed and to trend audit findings for significant conditions adverse to quality. Follow-up action, including re-audit of deficient areas when necessary, shall be taken to verify whether corrective action is effective.

- **Trend Analysis**

  Trend analysis will be performed on nonconforming conditions, deficiencies and audit findings by the QA manager to identify any possible negative trends. Adverse trends will be reported to the responsible project management personnel immediately, and a request for a corrective action will be issued. All corrective actions will be managed consistent with Section XIII.e. *Corrective Actions.*

XIV. FACILITY RADIATION SURVEYS

This section describes the purpose, methods, and techniques to be employed for conducting radiation surveys for decommissioning activities. Surveys will be performed for release of materials and equipment (M&E), segregating waste materials, assessing the nature and extent of contamination (scoping and characterization surveys and media sampling), defining radiological controls and verifying the adequacy of controls, guiding remedial actions, and demonstrating compliance with NRC release criteria (final status surveys). In general, radiation surveys will consist of instrument scans, direct measurement surveys, and wipe sampling. Radiological surveys will consist of measurements of both removable (^{3}H and ^{14}C) and total contamination (^{14}C).

Radiological release surveys will be performed in accordance with the facility NRC license for all materials removed during decommissioning that are to be released from radiological controls. Survey locations, methods, and findings will be documented. Screening surveys will consist of bias measurements of gross beta activity; both direct measurements using a gas-flow proportional counter and wipe sampling. PGM detectors may be used for some screening applications, based on accessibility and purpose of the survey, at the discretion of the RSO.

Surveys to support decommissioning activities will be performed in accordance with Aptuit WI-001, *Surface Contamination Surveys for Decommissioning Activities*.

A. *RELEASE CRITERIA*

- **A summary table or list of the $DCGL_w$ for each radionuclide and impacted media of concern**

  Derived concentration guideline levels (DCGL) have been determined for the FSSs for the two radiological contaminants of concern, tritium (^{3}H) and carbon-14 (^{14}C). These DCGLs are 3.7E5 disintegrations per minute (dpm)/100 square centimeters (cm^2) for ^{14}C total contamination and 3.7E4 dpm/100 cm^2 for removable contamination for ^{3}H and ^{14}C combined.

- **Area factors and $DCGL_{EMC}$ for Class 1 survey units** – Although Class 1 survey units are present, Aptuit will not calculate a $DCGL_{EMC}$ for elevated areas. Aptuit will remediate any areas that exceed the $DCGL_w$ therefore a $DCGL_{EMC}$ is not relevant. Investigation levels are based on the $DCGL_w$.

  If multiple radionuclides are present, the appropriate $DCGL_w$ for the survey method to be used – The DCGLs are 3.7E5 disintegrations per minute (dpm)/100 square centimeters (cm^2) for ^{14}C total contamination measured by gas flow proportional detectors and 3.7E4 dpm/100 cm^2 for removable contamination for ^{3}H and ^{14}C combined as measured by swipe sampling and LSC counting.

B. *CHARACTERIZATION SURVEYS*

Scoping surveys were performed to provide initial estimates of the level of effort for remediation and information for planning characterization surveys. The information obtained from routine operational surveys and scoping surveys was used for preliminary classification of survey units. Table 8-1 contains a description of the survey units with a summary of the survey data used in determining the preliminary

survey classification. The table also provides a description of the path forward for decommissioning. Final characterization of the impacted areas has been pending cessation of principal operations, removal of materials and equipment from the areas, and approval from the NRC of characterization activities that may need regulatory approval to proceed. Characterization surveys will be conducted in accordance with Aptuit work instructions WI-001, *Surface Contamination Surveys for Decommissioning Activities*, and WI-007, *Radiological Characterization of Systems, Surface, and Equipment for Decommissioning Activities.*

Characterization survey will be performed to:

- Provide sufficient characterization data to make a determination on the scope of decontamination and decommissioning (D&D) activities that are warranted to make the site suitable for unrestricted use.
- Provide data for remediation alternatives and waste characterization.
- Provide data for establishing/verifying radiological controls.
- Provide input into the final status survey design.

When possible the characterization survey will be designed to meet the objectives of the final status survey (FSS). Instrumentation and procedures sufficient to meet final status survey objectives will be used. The discussion below addresses the characterization surveys that will be performed to support decommissioning activities.

- **A description and justification of the survey measurements for impacted media**

  Characterization surveys will consist of instrument scans, direct measurement surveys, and wipe sampling. Surveys will consist of measurements of both removable (^{3}H and ^{14}C) and total contamination (^{14}C).

- **A description of the field instruments and methods that were used for measuring concentrations and the sensitivities of those instruments and methods**

  Field instruments and methods used for characterization surveys will be the same as those used for final status surveys.

  Gross surface beta activity will be measured with gas flow proportional detectors (Ludlum 43-68 and 43-37 GFPDs or functional equivalents). These detectors will be used for both scanning and static measurements. No reliable survey instruments are available for scanning or direct counts of H-3 activity.

  Scan surveys will be used during the Characterization and FSS to detect small areas of elevated activity that may not be detected by the systematic measurements.

  Paper smears to measure removable ^{3}H and ^{14}C will be collected at each direct measurement location. Smears are counted on a Packard TriCarb 2900 TR liquid scintillation counter.

The expected minimum detectable concentrations (MDCs) meet the design objectives (Static MDC should be 10 to 50% of the DCGLw and the scan MDC is less than the DCGLw). Expected MDCs are:

MDCs for Instrumentation Used for Characterization & Final Status Surveys[1]

Description	Application	MDC	Scan MDC
Ludlum Model 2360 Scaler/ratemeter with Model 43-68 GFPD (with 0.4 mg/cm^2 window)	Scanning and static surveys for C-14	<600 dpm/ 100 cm^2	<2000 dpm/ 100 cm^2
Ludlum Model 2360 Scaler/ratemeter with Model 43-37 GFPD (with 0.8 mg/cm2 window) floor monitor	Floor scanning1 for C-14	<300 dpm/ 100 cm^2	<1000 dpm/ 100 cm^2
Packard TriCarb 2900 TR liquid scintillation counter	Removable H-3 and C-14 contamination	<30 dpm/ 100 cm^2	NA

- **A description of the laboratory instruments and methods that were used for measuring concentrations and the sensitivities of those instruments and methods**

  A Packard TriCarb 2900 TR liquid scintillation counter (or functional equivalent) will be used for analysis of wipe samples and other samples as appropriate. The sensitivity of the LSC for wipe samples is given above. The procedure for LSC operation is Aptuit WI-003, *Liquid Scintillation Counter Procedure for Beta Radiation Screening of Surface Wipe Samples*.

- **The survey results, including tables or charts of the concentrations of residual radioactivity measured**

  A summary of scoping survey results for API are presented in Table 1-3. Table 8-1 contains a summary of survey data for each survey unit. Final characterization of the impacted areas will be completed upon approval of the DP.

[1] Based on nominal background values of 200 and 600 cpm for the 43-68 and 43-37, respectively. Static count time is 1 minute. Scan speed is 1 detector width per second. Detector widths are 8.8 cm for the 43.68 and 13.40 cm for the 43-37.

- **Maps or drawings of the site, area, or building, showing areas classified as non-impacted or impacted**

  Impacted areas are shown in Figures 1-4 to 1-6. These areas are shown as "Radioactive Material Use and Storage Areas" on the drawings. All other areas are non-impacted.

- **Justification for considering areas to be non-impacted**

  Areas considered non-impacted are based on the results of historical site assessments (Shaw 2006a, 2011a) and scoping surveys. All historical radioactive material use and storage areas have been identified.

- **A discussion of why the licensee considers the characterization survey to be adequate to demonstrate that it is unlikely that significant quantities of residual radioactivity have gone undetected**

  The characterization survey, when completed, will provide a detailed assessment of the nature and extent of contamination in all of the impacted areas. The surveys will include surface scanning, static measurements and smears. Scanning will be conducted in areas likely to contain residual activity. Systematic and biased static measurements will be performed. Biased measurements/sampling will be performed in areas of elevated activity as determined by scanning and at locations likely to contain elevated levels such as expansion joints, stress cracks, and wall/floor interfaces.

- **For areas and surfaces that are inaccessible or not readily accessible, a discussion of how they were surveyed or why they did not need to be surveyed**

  Characterization surveys will be performed in accordance with Aptuit WI-007, *Radiological Characterization of Systems, Surface, and Equipment for Decommissioning Activities.* This procedure provides instructions for characterization of inaccessible or not readily accessible surfaces such as exhaust systems, drains and traps, and overhead areas. Potentially contaminated inaccessible or not readily accessible areas in or coming from impacted areas will be investigated.

- **For sites, areas, or buildings with multiple radionuclides, a discussion justifying the ratios of radionuclides that will be assumed in the final status survey or an indication that no fixed ratio exists and each radionuclide will be measured separately**

  The radionuclides of concern (ROC) are ^{3}H and ^{14}C. No fixed ratio exists between the two ROCs. Smear sampling will be conducted for determination of ^{3}H and ^{14}C removable activity since ^{3}H activity cannot be reliably measured directly. Scanning and static measurements will be made for ^{14}C activity determination.

C. *IN-PROCESS SURVEYS*

- **A description of field screening methods and instrumentation**

  In-process surveys will be performed using the same methods and instrumentation

as used for characterization and final status surveys. In addition, a pancake G-M detector (PGM) may be used for personnel frisking when leaving contamination zones. PGM detectors may also be used for some screening applications, based on accessibility and purpose of the survey, at the discretion of the RSO.

- **A demonstration that field screening should be capable of detecting residual radioactivity at the DCGL**

  The MDCs for field instruments to be used for in-process, characterization and final status surveys are shown in Section XIV.B. above. The MDCs for the additional instruments that may be used are presented below. All instruments are capable of detecting residual radioactivity below the DCGL.

  - **MDCs for Instrumentation Used for Screening Surveys**

Description	Application	MDC[1]	Scan MDC[1]
Ludlum Model 3 Ratemeter with Model 44-9 PGM or equivalent	Frisking and screening surveys	<4000 dpm/100 cm^2	<12,000 dpm/ 100 cm^2
Ludlum Model 177 Alarming Ratemeter with Model 44-9 PGM or equivalent	Frisking and screening surveys	<4000 dpm/100 cm^2	<12,000 dpm/ 100 cm^2

D. *FINAL STATUS SURVEY DESIGN*

Upon completion of the D&D field activities, an FSS will be performed. The FSS will be performed in accordance with MARSSIM guidance.

- **A brief overview describing the final status survey design**

  The FSS process is accomplished through the performance of radiological surveys and sampling activities of sufficient scope to detect and quantify residual radioactivity present in the Aptuit facilities. Collected data will be used in the data assessment process to determine the final status for facility release. The FSS design includes scanning and static measurements of total ^{14}C contamination and wipes sampling to determine removable ^{3}H and ^{14}C contamination. Instruments and methods to be used are capable of measuring residual contamination at levels below 10% of the DCGL. The site has been divided into eight survey units based on the historical investigation and preliminary survey results. There are five Class 1 survey units, two Class 2 survey units, and one Class 3 Survey Unit. Scenario A will be used. The number of samples in each survey unit is based on the Sign test since the background levels are a small fraction of the DCGL and background is subtracted from each measurement. Using reasonable estimates of the average and standard deviation of the contaminant in the survey unit, 14 measurements

will be made in each survey unit to meet the requirements of the statistical tests. Measurements in Class 1 and Class 2 survey units will be on a random start triangular grid. Measurement locations in the Class 3 survey unit will be randomly selected. Surface scanning coverage will be 100 % of the impacted surfaces in the Class 1 area, 10% to 100% in the Class 2 area, and at the discretion of the survey team in the Class 3 area.

- **A description and map or drawing of impacted areas of the site, area, or building classified by residual radioactivity levels (Class 1, 2, or 3) and divided into survey units with an explanation of the basis for division into survey units**

  The impacted areas of the site have been classified into eight survey units. There are five Class 1 survey units, two Class 2 survey units and one Class 3 survey unit. The survey units are shown in the table below and the justification for the classification is contained in Table 8-1. The table below also includes the length of the leg (L) of the triangular sampling grid for 14 samples. Figures 14-1 through 14-3 show the impacted areas by area classification.

FSS Survey Units and Sample Spacing Based on 14 Sample Locations

Survey Unit	Survey Class	Areas	Floor Area (m^2)	Total Surface Area (m^2)	L (m)
SU1-B3298	1	B3-298	57	125.37	3.22
SU1-B2GMP	1	B2-155 thru B2-164	102	334.24	5.25
SU1-B2165	1	B2-165	54	116.34	3.10
SU1-B2166	1	B2-166	115	228.56	4.34
SU1-B2AE	1	B2-167/167A/170	28	102.53	2.91
SU2-B2	2	B2-103A/112/116/117/119	170	381.07	5.61
SU2-Hill	2	Rad Waste Storage on the Hill	179	288.91	4.88
SU3-B2	3	B2 Dock 5/API Common	192	192	3.98

- **A description of the background reference areas and materials, if they will be used, and a justification for their selection**

  Material specific backgrounds have been collected in non-impacted areas of the site. These materials represent the variety of materials that will be encountered

during the FSS. Material specific backgrounds may be re-established as directed by the RSO if new materials are encountered or if instrument operating parameters change (e.g. change due to recalibration). Material backgrounds are presented in Section IV.A.

- **A summary of the statistical tests that will be used to evaluate the survey results**

  The Sign test is used when the contaminant is not present in background, is present at such a small fraction of the DCGLw as to be considered insignificant, or an average background is subtracted from each measurement. The Sign test will be used to evaluate the survey results since average background will be subtracted from survey unit measurements or background will be ignored.

- **A description of scanning instruments and instruments used for in-situ (static) measurements, methods, calibration, operational checks, coverage, and sensitivity for each media and radionuclide/ a description of the instruments, calibration, operational checks, sensitivity, and sampling methods, with a demonstration that the instruments and methods have adequate sensitivity**

  Gross surface beta activity will be measured with gas flow proportional detectors (Ludlum 43-68 and 43-37 GFPDs or functional equivalents). These detectors will be used for both scanning and static measurements.

  Scan surveys will be performed with the instrument in operation at a nominal height of 1 centimeter above the area to be surveyed. The detector is moved over the surface across the area to be surveyed. Using the audible response of the instrument, locate the area of maximum count rate for each area surveyed and document the instrument reading at that location on the survey map. Areas that exhibit elevated readings during scanning will have follow-up monitoring conducted in the form of integrated direct measurements and judgmental wipe samples.

  Direct measurements will be performed by placing the detector directly on the surface to be surveyed at the desired location. With the instrument operating in "scaler" mode, take a measurement at the selected sample point for count time determined during instrument setup required to meet static minimum detectable concentration requirements for the parameter being measured. Document the direct surface contamination reading measured at the location on the survey data forms.

  Instrumentation has been selected consistent with the type, use, and sensitivity necessary to accomplish the FSS. These instruments are listed in Table 10-3. Instruments will have current calibration to the manufacturer's specifications, and a daily performance test will be performed and documented. Instruments will be properly calibrated, charged, and in good general working condition at the beginning of each day of use. Field and laboratory personnel will be responsible for checking the status of their instruments prior to use and for reporting any problems encountered.

Most instruments will not be repaired in the field. Any nonoperational instrument will be removed from service and returned to its source for a properly functioning replacement. However, some selected spare parts may be kept in the field or laboratory to be inserted as replacements on an as-needed basis.

All field instruments will be calibrated at least annually according to the manufacturer's recommendations. Calibration will be performed by the manufacturer or a calibration vendor (such as Shaw, TMA Eberline, or Ludlum) in accordance with American National Standards Institute Standard N323A-1997, *American National Standard, Radiation Protection Instrumentation, Test and Calibration, Portable Survey Instruments*.

For direct measurement instruments, daily instrument checks will be performed to verify proper instrument operation. The daily check will include counting of a known reference standard and measurement of the background activity. The instrument checks will be repeated after maintenance activities or the observation of anomalous readings. All daily instrument checks will be recorded in the field or laboratory records and shall include results of the instrument check (i.e., if the instrument is satisfactory or unsatisfactory for use).

Surface scanning coverage will be 100 % of the impacted surfaces in the Class 1 area, 10% to 100% in the Class 2 area, and at the discretion of the survey team in the Class 3 area.

The instruments selected for scanning and direct measurements have adequate sensitivity to meet the objectives of the FSS as discussed in Section XIV.B. Instrument MDCs are less than 10% of the DCGL.

- **A description of the analytical instruments for measuring samples in the laboratory, as well as calibration, sensitivity, and methods with a demonstration that the instruments and methods have adequate sensitivity**

A Packard TriCarb 2900 TR liquid scintillation counter will be used for counting samples.

An automatic instrument performance assessment (IPA) will be performed each day of LSC operation. IPA monitors the system background, efficiencies for both ^{3}H and ^{14}C, Figure of Merit (E^2/B) and Chi-squared values for both ^{3}H and ^{14}C. IPA is performed using ^{14}C and ^{3}H quenched standards and a background standard. Instrument operation must be within pre-established limits.

For FSS samples, quality control samples consisting of background and $^{3}H/^{14}C$ spikes will be counted with each LSC sample batch. Relative bias will be determined by comparing the results obtained from the $^{3}H/^{14}C$ spike sample run with the sample batch. Bias measurements should be within plus or minus 20 percent.

The MDC for wipe samples is 30 dpm/100 cm^2.

- **A description of how the samples to be analyzed in the laboratory will be collected, controlled, and handled**

  Wipe samples are collected in the field and are placed directly into pre-labeled and pre-filled liquid scintillation vials. Sample information is entered on the survey form and the samples and forms are delivered to B2-117 for counting.

- **A description of the final status survey investigation levels and how they were determined**

  The investigation levels for the FSS are given below.

Survey Investigation Levels

Survey Unit Classification	Flag Direct Measurement or Sample Result When:	Flag Scanning Measurement When:
Class 1	>$DCGL_w$ (>370,000 dpm/100 cm^2 total)	>$DCGL_w$
Class 2	> 0.5$DCGL_w$ (>185,000 dpm/100 cm^2 total)	>2X material background
Class 3	>0.1 $DCGL_w$ (>37,000 dpm/100 cm^2 total)	>2X material background

  The direct measurement/sample investigation level is based on the DCGL. These investigation levels ensure that all areas with activity above the DCGL (or fractional part) will be investigated.

- **A summary of any significant additional residual radioactivity that was not accounted for during site characterization**

  Final site characterization is pending approval of this DP.

- **A summary of direct measurement results and/or soil concentration levels in units that are comparable to the DCGL, and if data is used to estimate or update the survey unit**

  Final site characterization is pending approval of this DP.

- **A summary of the direct measurements or sample data used to both evaluate the success of remediation and to estimate the survey unit variance**

  Remediation is pending approval of this DP.

E. *FINAL STATUS SURVEY REPORT*

Upon completion of the data collection, data assessment will begin. At the culmination of data assessment, a Final Status Survey Report (FSSR) will be prepared for submittal to the NRC. If the data evaluation indicates that the survey unit is acceptable for release, that release will be recommended in the FSSR and, with concurrence of the NRC, the Aptuit facilities can be released for unrestricted use and the License will be terminated.

The FSSR will be prepared using the guidance provided in Section 4.5 of NUREG 1757, Volume 2 (NRC, 2006a). The report will provide the following information as outlined in Section XIV.E. of Appendix D of NUREG-1757, Vol. 1 (NRC, 2006):

- An overview of the results of the final status survey
- A discussion of any changes that were made in the final status survey from what was proposed in the DP or other prior submittals
- A description of the method by which the number of samples was determined for each survey unit
- A summary of the values used to determine the number of samples and a justification for these values
- The survey results for each survey unit include:
    - The number of samples taken for the survey unit;
    - A description of the survey unit, including (a) a map or drawing of the survey unit showing the reference system and random start systematic sample locations for Class 1 and 2 survey units and random locations shown for Class 3 survey units and reference areas, and (b) a discussion of remedial actions and unique features;
    - The measured sample concentrations in units that are comparable to the DCGL;
    - The statistical evaluation of the measured concentrations;
    - Judgmental and miscellaneous sample data sets reported separately from those samples collected for performing the statistical evaluation;
    - A discussion of anomalous data, including any areas of elevated direct radiation detected during scanning that exceeded the investigation level or measurement locations in excess of DCGLW ; and
    - A statement that a given survey unit satisfied the DCGLW and the elevated measurement comparison if any sample points exceeded the DCGLW.
- A description of any changes in initial survey unit assumptions relative to the extent of residual radioactivity (e.g., material not accounted for during site characterization)
- A description of how ALARA practices were employed to achieve final activity levels
- If a survey unit fails, a description of the investigation conducted to ascertain the reason for the failure and a discussion of the impact that the failure has on the conclusion that the facility is ready for final radiological surveys and that it satisfies the release criteria

- If a survey unit fails, a discussion of the impact that the reason for the failure has on other survey unit information

XV. FINANCIAL ASSURANCE

A. *COST ESTIMATE*

- **A cost estimate that appears to be based on documented and reasonable assumptions**

  Documentation for financial assurance can be found in the decommissioning funding plan (DFP) (Shaw 2010b). The decommissioning cost estimate was prepared using the format and the cost estimating tables in Appendix A of NUREG-1757, Vol. 3. Labor estimates and component physical descriptions were taken from *Revised Analyses of Decommissioning Reference Non-Fuel-Cycle Facilities*, NUREG/CR-6477. Assumptions regarding contamination levels and waste generation were based on operational experience and an HSA conducted in accordance with the MARSSIM by Shaw in September 2006 (Shaw, 2006a).

  The estimated decommissioning cost, including a 25 percent contingency, is $2,011,375.

  A certification of financial assurance for $2,011,375 is included in Appendix A of the DFP. An originally signed duplicate of the financial instrument is included in Appendix B of the DFP.

B. *CERTIFICATION STATEMENT*

A certification of financial assurance for $2,011,375 is included in Appendix A of the DFP. An originally signed duplicate of the financial instrument is included in Appendix B of the DFP.

- **The certification statement is based on the licensed possession limits and the applicable quantities specified in 10 CFR 30.35, 40.36, or 70.25**
- **The licensee is eligible to use a certification of financial assurance and, if eligible, that the certification amount is appropriate**

C. *FINANCIAL MECHANISM*

The financial assurance mechanism supplied by the licensee consists of a surety bond and is documented in Appendix B of the DFP. There are no site stabilization or long-term surveillance costs included.

XVI. RESTRICTED USE/ALTERNATE CRITERIA

Non Applicable – Aptuit is not requesting Alternate Criteria. The site is being released unrestricted.

XVII. REFERENCES

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Tables

Table 1-1

Overview of Materials License No. 24-15595-01 and Amendments
Decommissioning Plan
Aptuit, LLC, Kansas City, Missouri

Date	Company	Address	New/Amend	Rad	Form	Limit (mCi)	Uses	Comments
Spring 1973	Marion Laboratories, Inc.	10236 Bunker Ridge Rd	New	Ni-63	Detector cell	15	chromatograph	
				H-3	Detector cell	150	chromatograph	
September 29, 1978	Marion Laboratories, Inc.	10236 Bunker Ridge Rd	Amend 5	Ni-63	Detector cell	15	chromatograph	Added 2 Ni-63 sources
				H-3	Detector cell	150	chromatograph	
November 30, 1978	Marion Laboratories, Inc.	10236 Bunker Ridge Rd	Amend 6					New Type C license?
December 19, 1980	Marion Laboratories, Inc.	10236 Bunker Ridge Rd	New Appl	C-14	Any	100		
				H-3	Any	100	Research and development in the synthesis of labeled pharmaceutical for non-human experimentation and in vivo and/or in vitro animal studies	
				P-32	Any	10		
				S-35	Any	10		
				I-125	Any	10		
				I-131	Any	10		
				Cs-137	Sealed	1	Calibration material for detection equipment to be purchased.	
February 6, 1984	Marion Laboratories, Inc.	10236 Bunker Ridge Rd	Amend 8	C-14	Any	100		Use is described as being the bottom floor of a two story building in a 3 room suite (119, 120, 122).
				H-3	Any	100		
				P-32	Any	10	Laboratory research including animal studies.	
				S-35	Any	10		
				I-125	Any	10		
				I-131	Any	10		
May 25, 1988	Marion Laboratories, Inc.	Marion Park Drive	Amend 10	H-3	Any	1 Curie		
				C-14	Any	1 Curie		
				P-32	Any	20		
				S-35	Any	20	Research and development as defined in 10CFR 30.4(q)	
				I-125	Any	70		
				I-131	Any	30		
				Ca-45	Any	10		
April 17, 1989	Marion Laboratories, Inc.	Marion Park Drive	Amend 11	Same as above				Changed RSO to Gregory Urbanski
December 14, 1989	Marion Laboratories, Inc.	Marion Park Drive	Amend 12	Added Cr-51	Any	20		Added Marion site and Cr-51
March 6, 1990	Marion Merrell Dow, Inc.	Marion Park Drive	Amend 13					Named changed to Marion Merrel Dow, Inc.
January 14, 1991	Marion Merrell Dow, Inc.	Marion Park Drive	Amend 14	Added Tc-99m	Any	10	Research and development as defined in 10CFR 30.4(q)	Added 10 mCi Tc-99m
January 6, 1992	Marion Merrell Dow, Inc.	Marion Park Drive	Amend 15	Added Na-22 & K-42	Any	20		Added Na-22 & K-42. 20 mCi each.
October 19, 1992	Marion Merrell Dow, Inc.	Marion Park Drive	Amend 16					Troost & Marion Park Drive. Corrected error from Amend 12
March 15, 1989	Marion Laboratories, Inc.		Amend Req					

Table 1-1

Overview of Materials License No. 24-15595-01 and Amendments
Decommissioning Plan
Aptuit, LLC, Kansas City, Missouri

Date	Company	Address	New/Amend	Rad	Form	Limit (mCi)	Uses	Comments
September 13, 1993	Marion Merrell Dow, Inc.	Marion Park Drive	Amend 17	H-3 C-14 S-35 I-125 I-131	Any Any Any Any Any	1 Curie 1 Curie 20 70 30	Research and development as defined in 10 CFR Part 30, Section 30.4.	
March 2, 1995	Marion Merrell Dow, Inc.	Marion Park Drive	Amend 18	H-3 C-14 S-35 I-125 I-131	Any Any Any Any Any	1 Curie 1 Curie 20 70 30	Research and development as defined in 10 CFR Part 30, Section 30.4.	Named Pam Barton as RSO
July 12, 1995	Hoechst Marion Roussel	Marion Park Drive	Amend 19	H-3 C-14 S-35 I-125 I-131	Any Any Any Any Any	1 Curie 1 Curie 20 70 30	Research and development as defined in 10 CFR Part 30, Section 30.4.	Name changed to Hoechst Marion Roussel
August 25, 1997	Hoechst Marion Roussel	Marion Park Drive	Amend 20	Same as above			Research and development as defined in 10 CFR Part 30, Section 30.4.	Marion Park become main location of use. Troost was decommissioned 8/14/97
December 31, 1998	Quintiles, Inc.	10245 Hickman Mills Drive	Amend 21	H-3 C-14 S-35 I-125 I-131	Any Any Any Any Any	1 Curie 1 Curie 20 70 30	Research and development as defined in 10 CFR 30.4.	
January 9, 2002	Quintiles, Inc.	10245 Hickman Mills Drive	Amend 22	H-3 C-14 S-35 I-125 I-131	Any Any Any Any Any	1 Curie 1 Curie 20 70 30	Research and development as defined in 10 CFR 30.4.	RSO changed to Brian Cogbill
August 26, 2004	Quintiles, Inc.	10245 Hickman Mills Drive	Amend 23 (renewed in entirety)	Same as above			Research and development as defined in 10 CFR 30.4.	RSO changed to Mike Sturgeon

Table 1-1

Overview of Materials License No. 24-15595-01 and Amendments
Decommissioning Plan
Aptuit, LLC, Kansas City, Missouri

Date	Company	Address	New/Amend	Rad	Form	Limit (mCi)	Uses	Comments
August 30, 2005	Aptuit, Inc.	10245 Hickman Mills Drive	Amend 24 (amended in entirety)	H-3	Any	1 Curie	Research and development as defined in 10 CFR 30.4, including animal studies.	C-14 limit raised to 2 Ci
				C-14	Any	2 Curies		
				S-35	Any	20		
				I-125	Any	70		
				I-131	Any	30		
July 17, 2007	Aptuit, Inc.	10245 Hickman Mills Drive	Amend 25	H-3	Any	1 Curie	Research and development as defined in 10 CFR 30.4.	Pam Barton named RSO. L Building released from license.
				C-14	Any	2 Curies		
				S-35	Any	20		
				I-125	Any	70		
				I-131	Any	30		
January 23, 2008	Aptuit, Inc.	10245 Hickman Mills Drive	Amend 26 (amended in entirety)	H-3	Any	1 Curie	Research and development as defined in 10 CFR 30.4.	
				C-14	Any	2 Curies		
				S-35	Any	20		
				I-125	Any	70		Clint Gregg named RSO
				I-131	Any	30		
April 8, 2008	Aptuit, Inc.	10245 Hickman Mills Drive	Amend 27	H-3	Any	100 Curies	Research and development as defined in 10 CFR 30.4 and radiosynthesis of radiolabeled organic compounds. Sealed sources is in LSCs.	Increased license limits, added AUs, and added areas of use.
				C-14	Any	100 Curies		
				S-35	Any	1.5 Curies		
				I-125	Any	70		
				Ba-133	Sealed source	20		
				Cs-137	Sealed source	90 microcuries		
May 1, 2009	Aptuit, Inc.	10245 Hickman Mills Drive	Amend 28	H-3	Any	100 Curies	Research and development as defined in 10 CFR 30.4 and radiosynthesis of radiolabeled organic compounds. Sealed sources is in LSCs.	Added rad support rooms.
				C-14	Any	100 Curies		
				S-35	Any	1.5 Curies		
				I-125	Any	70		
				Ba-133	Sealed source	20		
				Cs-137	Sealed source	90 microcuries		
August 10, 2009	Aptuit, Inc.	10245 Hickman Mills Drive	Amend 29	H-3	Any	100 Curies	Research and development as defined in 10 CFR 30.4 and radiosynthesis of radiolabeled organic compounds. Sealed sources is in LSCs.	Revised AU list.
				C-14	Any	100 Curies		
				S-35	Any	1.5 Curies		
				I-125	Any	70		
				Ba-133	Sealed source	20		
				Cs-137	Sealed source	90 microcuries		
November 17, 2009	Aptuit, Inc.	10245 Hickman Mills Drive	Amend 30	H-3	Any	100 Curies	Research and development as defined in 10 CFR 30.4 and radiosynthesis of radiolabeled organic compounds. Sealed sources is in LSCs.	Revised AU list.
				C-14	Any	100 Curies		
				S-35	Any	1.5 Curies		
				I-125	Any	70		
				Ba-133	Sealed source	20		
				Cs-137	Sealed source	90 microcuries		

Table 1-1

Overview of Materials License No. 24-15595-01 and Amendments
Decommissioning Plan
Aptuit, LLC, Kansas City, Missouri

Date	Company	Address	New/Amend	Rad	Form	Limit (mCi)	Uses	Comments
June 9, 2010	Aptuit, Inc.	10245 Hickman Mills Drive	Amend 31	H-3	Any	100 Curies	Research and development as defined in 10 CFR 30.4 and radiosynthesis of radiolabeled organic compounds. Sealed sources is in LSCs.	Revised AU list, added the Rad Waste Storage Area (the Hill), removed LSC.
				C-14	Any	100 Curies		
				S-35	Any	1.5 Curies		
				I-125	Any	70		
				Ba-133	Sealed source	20		
				Cs-137	Sealed source	90 microcuries		
February 11, 2011	Aptuit, Inc.	10245 Hickman Mills Drive	Amend 32	H-3	Any	100 Curies	Research and development as defined in 10 CFR 30.4 and radiosynthesis of radiolabeled organic compounds. Sealed sources is in LSCs.	Added B2-195 pipe chase.
				C-14	Any	100 Curies		
				S-35	Any	1.5 Curies		
				I-125	Any	70		
				Ba-133	Sealed source	20		
				Cs-137	Sealed source	90 microcuries		
January 4, 2012	Aptuit, LLC.	10245 Hickman Mills Drive	Amend 33	H-3	Any	100 Curies	Research and development as defined in 10 CFR 30.4 and radiosynthesis of radiolabeled organic compounds. Sealed sources is in LSCs.	Change in ownership from Aptuit, Inc to Aptuit, LLC
				C-14	Any	100 Curies		
				S-35	Any	1.5 Curies		
				I-125	Any	70		
				Ba-133	Sealed source	20		
				Cs-137	Sealed source	90 microcuries		
April 9, 2012	Aptuit, LLC.	10245 Hickman Mills Drive	Amend 34	H-3	Any	100 Curies	Research and development as defined in 10 CFR 30.4 and radiosynthesis of radiolabeled organic compounds. Sealed sources is in LSCs.	Changed authorzed use of S-35 and I-125 to "in storage incident to disposal". Deleted authorized users.
				C-14	Any	100 Curies		
				S-35	Any	1.5 Curies		
				I-125	Any	70		
				Ba-133	Sealed source	20		
				Cs-137	Sealed source	90 microcuries		

Table 1-2

Aptuit Acceptable Surface Contamination Levels (based on NUREG-1556, Vol. 11)[1] Decommissioning Plan Aptuit, LLC Kansas City, Missouri

Nuclide	Average[a, b]	Maximum[a, c]	Removable[a, d]
^{3}H, ^{14}C	5,000 dpm/100 cm^2	15,000 dpm/100 cm^2	1,000 dpm/100 cm^2

[a] As used in this table, dpm (disintegration per minute) means the rate of emission by radioactive material as determined by correcting the counts per minute observed by an appropriate detector for background, efficiency, and geometric factors associated with the instrumentation. For example for ^{14}C, using published efficiency for a PGM detector (5%) with a 15 cm^2 probe and a background count rate of 40 cpm, it is possible to detect <5000 dpm/100 cm^2 with the probe stationary and <13,000 dpm/100 cm^2 while scanning. Under these conditions, a reading of 2X background is approximately 5000 dpm/100 cm^2.

[b] Measurements of average contaminant should not be averaged over more than 1 square meter. For objects of less surface area, the average should be derived for each such object.

[c] The maximum contamination level applies to an area of not more than 100 cm^2.

[d] The amount of removable radioactive material per 100 cm^2 of surface area should be determined by wiping that area with filter or soft absorbent paper, applying moderate pressure, and assessing the amount of radioactive material on the wipe with an appropriate instrument of known efficiency. When removable contamination on objects of less surface area is determined, the pertinent levels should be reduced proportionally and the entire surface should be wiped.

[1] Aptuit Radiation Safety Program Manual, March 2008

Table 1-3

Summary of API Scoping Survey
Decommissioning Plan
Aptuit, LLC
Kansas City, Missouri

	Total (dpm/100 cm^2)			Removable ^3H (dpm/100 cm^2)			Removable ^{14}C (dpm/100 cm^2)		
Location	**Min[1]**	**Max**	**Average[1]**	**Min**	**Max**	**Average**	**Min**	**Max**	**Average**
Interior hood surfaces	-9.5E2	4.0E6	7.4E5	0	6.1E4	7.2E3	150	2.4E5	4.8E4
Sinks	-2.9E3	5.8E5	1.2E5	8	2.7E4	3.2E3	73	2.6E5	3.7E4
Lab bench & tables	-4.8E3	4.9E4	9.7E3	0	2.1E3	240	9	6.7E4	9.5E3
Floor	-9.5E2	5.6E5	3.7E4	0	250	36	8	7.5E3	1E3
Wall & door knobs	-4.8E3	2.9E3	-1.1E3	0	74	13	0	1.4E3	120
Overhead	-2.9E3	1.1E5	7.7E3	0	9.4E3	1.3E3	0	1.2E4	1.6E3

[1] Negative numbers indicate a measurement below the material background measurement.

Table 8-1
Summary of Survey Units for Aptuit Decommissioning
Decommissioning Plan
Aptuit LLC
Kansas City, Missouri

Impacted Area	Preliminary Class	Survey Unit	Justification	Floor Area ft^2 (m^2)	Characterization Data	Scope of D&D
B3-298	Class 1	SU1-B3298	Although existing contamination levels on the casework and floor are below the DCGLs, those items will be removed or deconned for ALARA purposes. Since remediation is being performed this area will be classified as a Class 1 area.	612 (57)	There are two documented incidents in B3-298 that resulted in C-14 contamination or the further spread of contamination on a lab bench and a section of the floor. Fixed contamination levels of 100,000 dpm/100 cm^2 were noted from the first spill. The second incident was a release of water into the contaminated area, which resulted in removable contamination levels of up to 8,000 dpm/100 cm^2. These areas are marked as contaminated, and there is no known contamination outside of these areas. Routine monthly contamination surveys were performed prior to August of 2008. Since that time, the laboratory has not been used for radioactive material studies and has been moved to a semiannual frequency for contamination surveys. Results of routine surveys are consistently below the action limit of 200 dpm/100 cm^2 for removable H-3 and C-14. Radionuclides: H-3 and C-14. Only contamination found is C-14 in spill area. Spill area: Max removable - 8,000 dpm/100 cm^2 General area: Removable <200 dpm/100 cm^2	Remove/decon contaminated casework and flooring from the spill area. Survey newly exposed surfaces and remediate as required. Establish reference grid. Design and perform characterization survey to meet FSS DQOs.

Table 8-1
Summary of Survey Units for Aptuit Decommissioning
Decommissioning Plan
Aptuit LLC
Kansas City, Missouri

Impacted Area	Preliminary Class	Survey Unit	Justification	Floor Area ft^2 (m^2)	Characterization Data	Scope of D&D
B2-API (floors & walls to 2m) Walls above 2m will be characterized to determine if they should be: included in the Class 1 survey units, set up as Class 2 survey units, or not impacted.)	Class 1	SU1-B2GMP (155-164) SU1-B2165 SU1-B2166 SU1-B2AE (167/167A/170)	Remediation	3222 (299)	Laboratories B2-155 through B2-179 comprise the radiosynthesis suite for API. Routine operational surveys for removable contamination reveal that there is low-level H-3 and C-14 surface contamination throughout the laboratory, but it is generally maintained below 2,000 dpm/100 cm^2 removable. Routine survey areas include floors, hood sashes, hood hand wheels and ledges, and miscellaneous equipment. Biased scoping surveys were performed on December 15, 2011. This survey included assessment of total and removable contamination levels on internal hood surfaces, hood ledges, floors, walls, tables, sinks, and ceiling tiles. Direct measurements were made with a with a Pancake Geiger-Mueller (PGM) detector. The highest average C-14 contamination levels (direct measurements) of 7.4E5 dpm/100 cm^2 and 1.2E5 dpm/100 cm^2 were found on internal hood surfaces and in sinks, respectively. The highest average removable levels of H-3 and C-14, 7.2E3 dpm/100 cm^2 and 4.8E4 dpm/100 cm^2, respectively, were found on internal hood surfaces. Similar removable contamination levels were found in the sinks. Average C-14 levels on hood surfaces, sinks, lab benches, floors, and overhead were areas above Aptuit's acceptable surface contamination level for <u>total</u> activity. Only the walls had average C-14 contamination levels below Aptuit's limits. Average <u>removable</u> H-3 contamination levels on hood surfaces, sinks, and overhead areas exceeded the Aptuit acceptable surface contamination level. Average removable C-14 contamination levels on hood surfaces, sinks, lab benches, and overhead areas exceeded Aptuit's limits. Radionuclides: H-3 and C-14. Characterization for FSS design cannot be completed until remediation has been completed.	Survey and remove all materials, instrumentation, and equipment from the area. Wipe down work surfaces and clean debris and visible contamination from fume hoods. Remove and characterize all storage cabinets, freezers, wall cabinetry, bench tops and tables for disposal. Items less than release criteria will be disposed as construction debris. Items greater than release limit will be disposed as rad waste. Remove and characterize p-traps and strainers associated with sinks in the fume hoods. Disconnect, remove, characterize, and dispose exhaust hoods and ductwork. Characterize and remove floor covering for disposal Establish reference grid. Characterize room surfaces (Evaluate whether it makes sense to combine characterization and final status surveys). FSS plan & FSS survey.

Table 8-1
Summary of Survey Units for Aptuit Decommissioning
Decommissioning Plan
Aptuit LLC
Kansas City, Missouri

Impacted Area	Preliminary Class	Survey Unit	Justification	Floor Area ft^2 (m^2)	Characterization Data	Scope of D&D
B2-103A (Incinerator)	Class 2	SU2-B2 (103A/112/116/117/119)	Elevated levels have been noted but attributed to NORM. Area is used for rad waste packaging so low levels of contamination are possible.	217 (20)	Radioactive wastes containing H-3 and C-14 were burned in an on-site incinerator until 2005. The incinerator was vented through a dedicated stack, which was left in place when the incinerator was removed from service. B2-103A contains the incinerator and is also currently used for accumulation of radioactive waste. Surveys performed indicate elevated readings (up to 5,000 dpm/100 cm^2 total) on the refractory lining of the incinerator attributable to naturally occurring radioactive material (NORM) in the fire brick. Removable contamination surveys were performed in the incinerator burn chamber, in the stack and blower access ports, and on the concrete pad underneath the stack access port. All results were below 50 dpm/100 cm^2. An ash sample from the burn chamber was collected and analyzed in 2006. All results were below the sample specific minimum detectable concentrations) of 0.078 picocuries per gram (pCi/g) H-3 and 18 pCi/g C-14. Additional ash samples have been collected from the bottom of the stack and have been analyzed for H-3 and C-14 (H-3 8.74 pCi/g; C-14 4.35 pCi/g) Radionuclides: H-3 and C-14. Characterization for FSS design cannot be completed until waste packaging activities cease and incinerator is removed.	The incinerator, along with the associated ductwork, filter, and stack, will be removed and disposed of appropriately. The incinerator and components will be surveyed for waste characterization purposes. It is anticipated that the incinerator will be characterized as radiologically contaminated waste and disposed of accordingly. Prior to removal of the incinerator, the incinerator will be prepared by blanking or sealing all openings in the incinerator and the attached pipe, instruments, and equipment. A section of the south wall of B2-103A will be removed to provide access to move the incinerator out of the building using a heavy duty forklift or crane. After the incinerator has been removed, the floor area under where it had been located will be cleaned and surveyed. Any residual contamination will deconned by cleaning or removal. Establish reference grid. Design and perform characterization survey to meet FSS DQOs.
B2-112	Class 2	SU2-B2 (103A/112/116/117/119)	Potential for contamination during exhaust system removal.	869 (81)	B2-112 contains the high-efficiency particulate air (HEPA) filter system (supply and exhaust) that services the API radiosynthesis area. The exhaust system is active and will remain so during some decontamination and decommissioning (D&D) efforts in the API area. The exhaust system prior to the exhaust HEPAs is contaminated but it has not been characterized. Contamination levels in the ductwork and stack beyond the HEPA filters have not been assessed.	The HEPA filters will be removed utilizing the bag-in/bag-out system and will be disposed as radioactive waste. The HEPA filter housing will be disassembled with hand tools or power tools, as necessary. Open ends of the housing will be covered with plastic

Table 8-1
Summary of Survey Units for Aptuit Decommissioning
Decommissioning Plan
Aptuit LLC
Kansas City, Missouri

Impacted Area	Preliminary Class	Survey Unit	Justification	Floor Area ft^2 (m^2)	Characterization Data	Scope of D&D
					Radionuclides: H-3 and C-14. Characterization for FSS design cannot be completed until the HEPA system has been removed.	sheeting. The HEPA filter housing will either be decontaminated or disposed of as radiological waste. The duct connecting the HEPA system, fans, and stack will be disassembled, removed, and surveyed for radiological contamination. A fixative to prevent removable radiological contamination from becoming airborne may be sprayed on the interior surfaces of the duct sections prior to removing each section. Any ductwork with suspect internal contamination will have the ends wrapped and taped. Ductwork sections that do not meet the release criteria will be placed in the radiological waste container for disposal. Ductwork that does meet the release criteria may be disposed of as construction debris. The fans and stack associated with the API exhaust system will be removed and surveyed for radiological contamination. The open ends of the fans and stacks will be covered with plastic sheeting. If the fans and stack sections do not meet the radiological release criteria, they will be placed in the radiological waste container for

Table 8-1
Summary of Survey Units for Aptuit Decommissioning
Decommissioning Plan
Aptuit LLC
Kansas City, Missouri

Impacted Area	Preliminary Class	Survey Unit	Justification	Floor Area ft^2 (m^2)	Characterization Data	Scope of D&D
						disposal. If the fans and stack sections meet the release criteria, they may be disposed of as construction debris.
B2-116, 117, 119	Class 2	SU2-B2 (103A/112/116/117/119)	Contamination above DCGLs or above Aptuit unrestricted release levels are not expected.	740 (69)	These HP support areas include B2-119 (the RSO office, instrument and record storage), B2-116 liquid scintillation counter (LSC) room and B2-117 (LSC waste storage). These areas are on the routine survey schedule. Results are consistently below Aptuit's acceptable surface contamination levels of 5,000 dpm/100 cm^2 total activity and 1,000 dpm/100 cm^2 removable activity. Radionuclides: H-3 and C-14. Routine survey results: <5,000 dpm/100 cm^2 total activity; < 1,000 dpm/100 cm^2 removable activity Characterization surveys for FSS design cannot be completed into decommissioning activities have been completed.	The final spaces to be decommissioned are B2-116, 117, and 119. Survey and remove equipment, bench tops, tables, and cabinets. Establish reference grid. Design and perform characterization survey to meet FSS DQOs.
Rad Waste Storage (The Hill)	Class 2	SU2-Hill	Some contamination has been found on floor.	1930 (179)	The waste storage building is an active area for staging and storage of contaminated equipment and waste. Radioactive materials are packaged for disposal in this building. Scoping surveys will be performed in this building once waste and equipment have been removed. No contamination above Aptuit's acceptable surface contamination levels is expected. Radionuclides: H-3 and C-14. Characterization/FSS surveys will be completed when equipment and materials have been removed.	Remove all equipment and materials. Perform biased scoping surveys on building surfaces to evaluate the need for remediation. Decon removable contamination and remove any surfaces with fixed radiological contamination above the release criteria. Establish reference grid. Design and perform characterization survey to meet FSS DQOs.

Table 8-1
Summary of Survey Units for Aptuit Decommissioning
Decommissioning Plan
Aptuit LLC
Kansas City, Missouri

Impacted Area	Preliminary Class	Survey Unit	Justification	Floor Area ft^2 (m^2)	Characterization Data	Scope of D&D
Dock 5	Class 3	SU3-B2 (Dock5/B2 API Common)	No contamination is known or expected to exist.	298 (28)	Dock 5 is an active shipping and receiving dock servicing the B2 area. Radioactive materials shipped and received at this dock are already packaged for transportation. Scoping surveys will be performed in this area, although no contamination above Aptuit's acceptable surface contamination levels is expected. Still in use. Radionuclides: H-3 and C-14.	After completion of D&D activities that could impact the area: Establish reference grid. Design and perform characterization survey to meet FSS DQOs.
B2-API common	Class 3	SU3-B2 (Dock5/B2 API Common)	A spill occurred in this area but all survey results were below FSS DCGLs	1762 (164)	Radionuclides: C-14 from spill.	Establish reference grid. Design and perform characterization survey to meet FSS DQOs.

Table 10-1

General Guidelines for Internal Dose Monitoring
Decommissioning Plan
Aptuit, LLC
Kansas City, Missouri

Nuclide	Form	Use Level[1]	Frequency	Method
^{3}H	HTO and tritiated compounds	>100 mCi at one time	Within 4 to 72 hours following use	Urinalysis
^{14}C	Monoxide	>50 Ci[2]	Within 24 to 72 hours following use	Urinalysis
	Dioxide	> 5 Ci[2]		
	Compounds	> 50 mCi[2]		

[1]The quantities also apply to the cumulative amount handled during a one month period.
[2] Based on handling 25 times the ALI at one time or cumulative over 1 month.

Table 10-2
Action Levels for Decommissioning Activities
Decommissioning Plan
Aptuit, LLC
Kansas City, Missouri

Action	**^{3}H (dpm/100 cm^{2})**	**^{14}C (dpm/100 cm^{2})**
Release of materials & equipment	≤1000 removable	≤1000 removable ≤5000 average ≤15000 maximum
Aptuit DCGLs	3.7E4 removable (^{3}H & ^{14}C combined)	3.7E5 total 3.7E4 removable (^{3}H & ^{14}C combined)
NRC Screening DCGLs[1]	1.2E8	3.7E6
Consideration of additional radiological controls – building surfaces	>3E10	>6E8
Consideration of additional radiological controls – exhaust system	>5E10	>1E9

[1] Included for comparison. These building surface screening levels represent surface concentrations of individual radionuclides that would be deemed in compliance with the 25 mrem/y unrestricted release dose limit in 10 CFR 20.1402.

Table 10-3

Instrumentation for D&D Activities
Decommissioning Plan
Aptuit, LLC
Kansas City, Missouri

Description	Application	MDC[1]	Scan MDC[1]
Ludlum Model 2360 or 2221 Scaler/ratemeter with Model 43-68 GFPD (with 0.4 mg/cm^2 window) or equivalent	Frisking, scanning and static surveys for ^{14}C	<600 dpm/100 cm^2	<2000 dpm/100 cm^2
Ludlum Model 2360 or 2221 Scaler/ratemeter with Model 43-37 GFPD (with 0.8 mg/cm^2 window) floor monitor or equivalent	Floor scanning for ^{14}C	<300 dpm/100 cm^2	<1000 dpm/100 cm^2
Ludlum Model 3 Ratemeter with Model 44-9 PGM or equivalent	Frisking and contamination surveys	<4000 dpm/100 cm^2	<12,000 dpm/100 cm^2
Ludlum Model 177 Alarming Ratemeter with Model 44-9 PGM or equivalent	Frisking and contamination surveys	<4000 dpm/100 cm^2	<12,000 dpm/100 cm^2
Ludlum Model 19 microR meter or equivalent	Exposure rate surveys	NA	NA
Packard TriCarb 2900 TR liquid scintillation counter	Removable ^{3}H and ^{14}C contamination	<30 dpm/100 cm^2	NA

[1]Based on nominal background values of 60, 200 and 600 cpm for the 44-9, 43-68 and 43-37, respectively. Scan speed is 1 detector width per second.

Figures

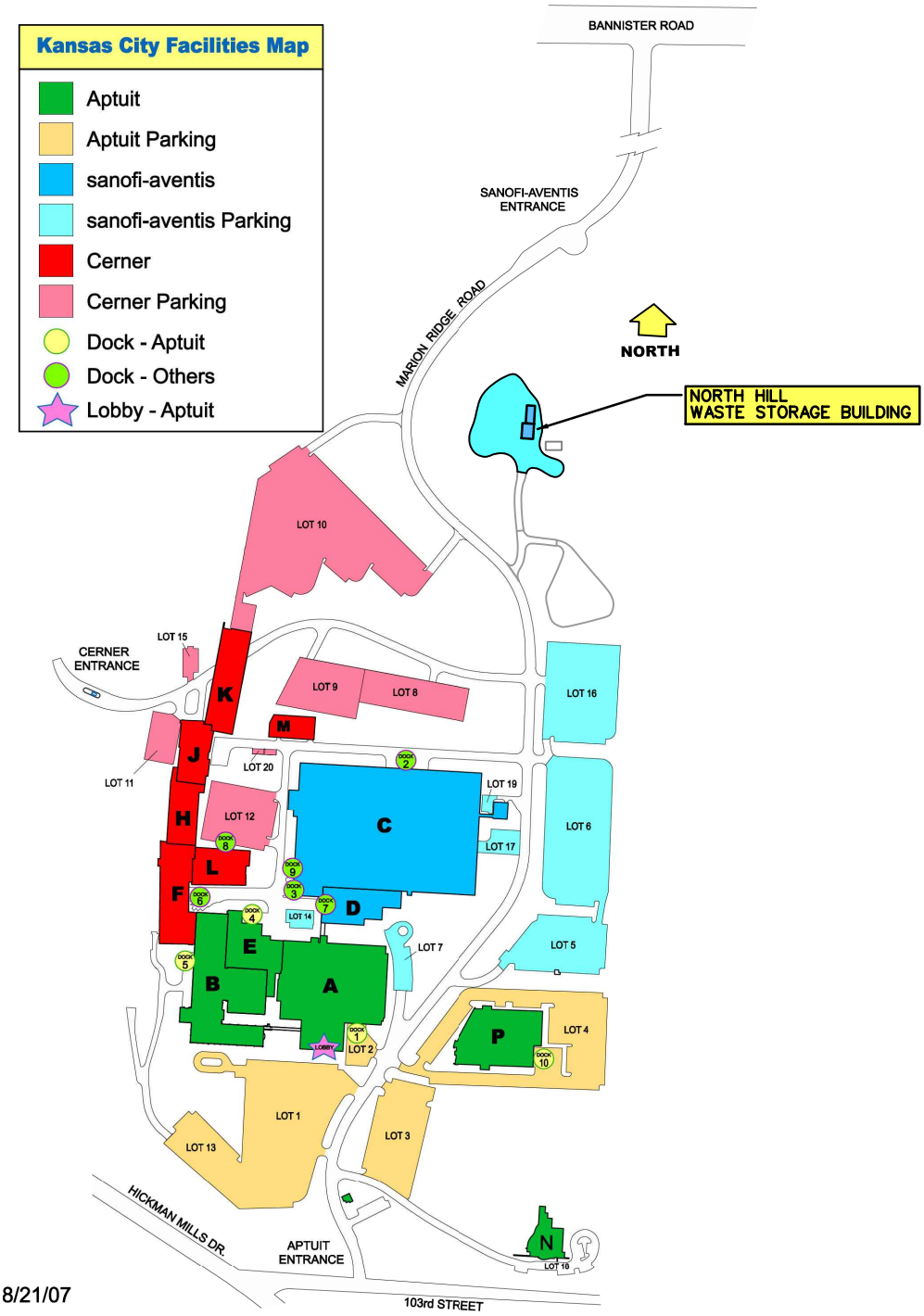

FIGURE 1-1
APTUIT FACILITY SITE DRAWING

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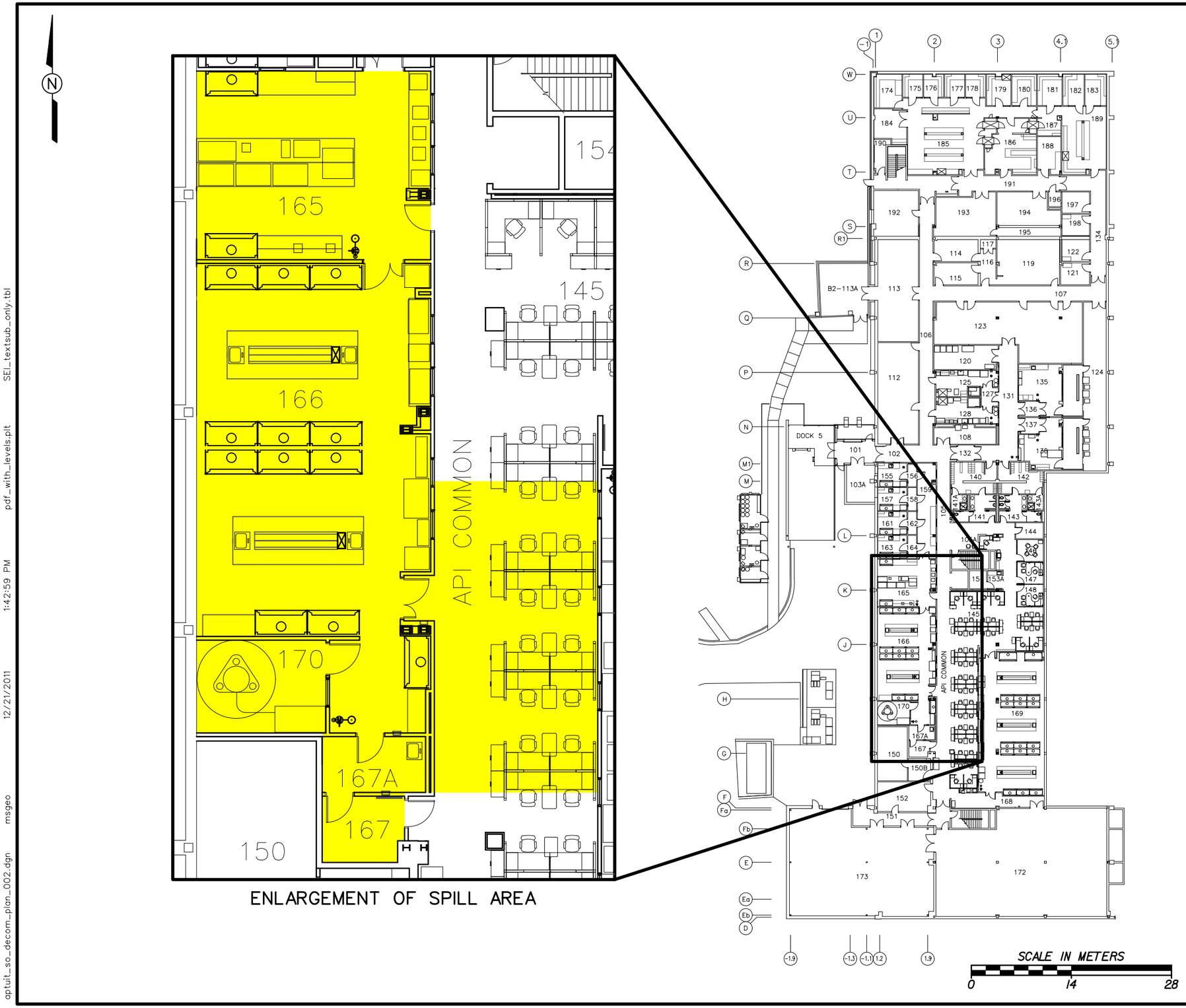

LEGEND:

APPROXIMATE AREA OF SPILL

FIGURE 1-2
LOCATION OF SPILL
B BUILDING B2

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LEGEND:

APPROXIMATE AREA OF SPILL

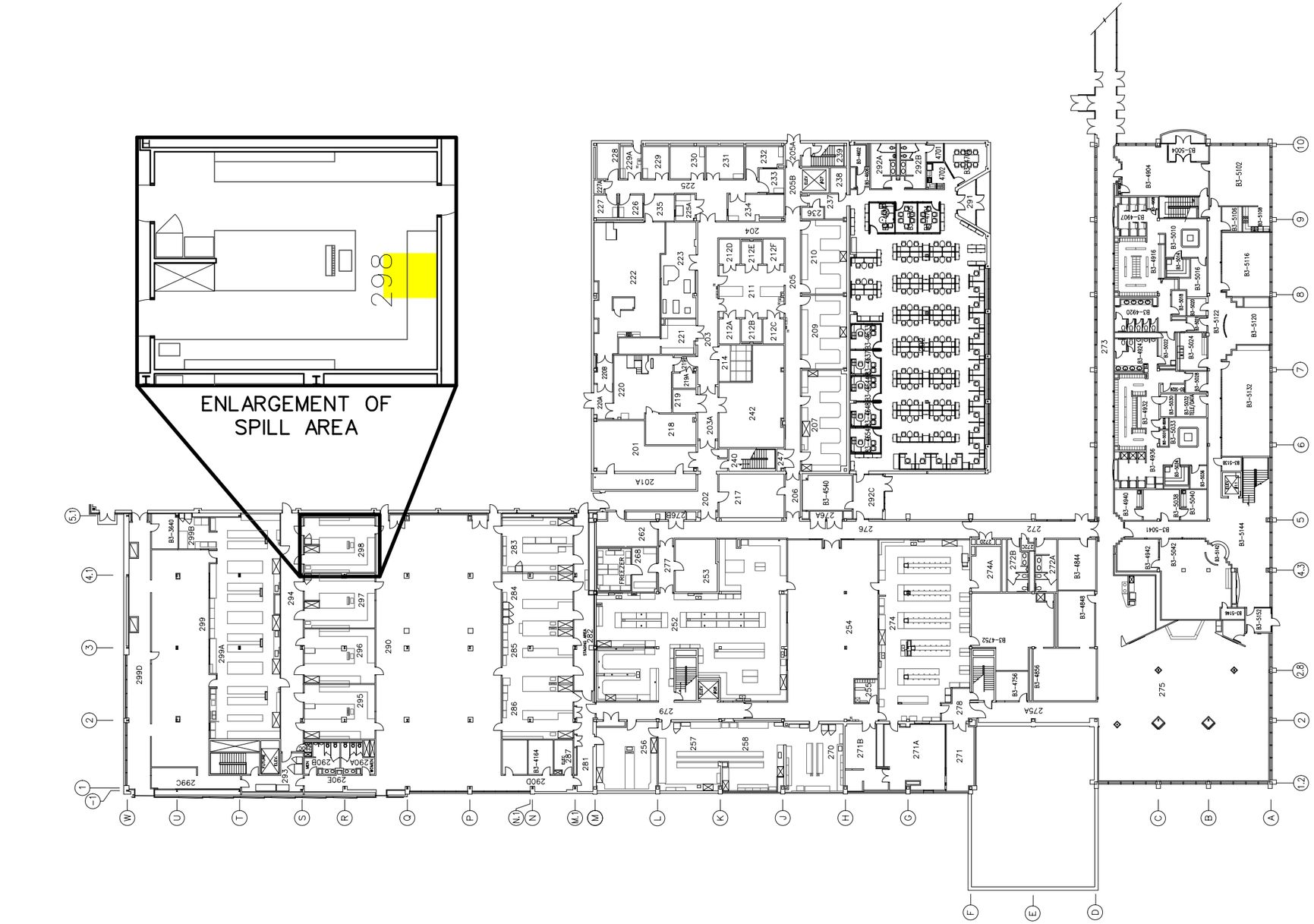

FIGURE 1-3
LOCATION OF SPILL
B BUILDING B3

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LEGEND:

- RADIOACTIVE MATERIAL USE AND STORAGE AREAS
- API (RADIOSYNTHESIS) LABORATORY SUITE

SCALE IN METERS

0 14 28

FIGURE 1-4
RADIOACTIVE MATERIAL USE AND STORAGE AREAS B BUILDING B2

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LEGEND:

RADIOACTIVE MATERIAL USE AND STORAGE AREAS

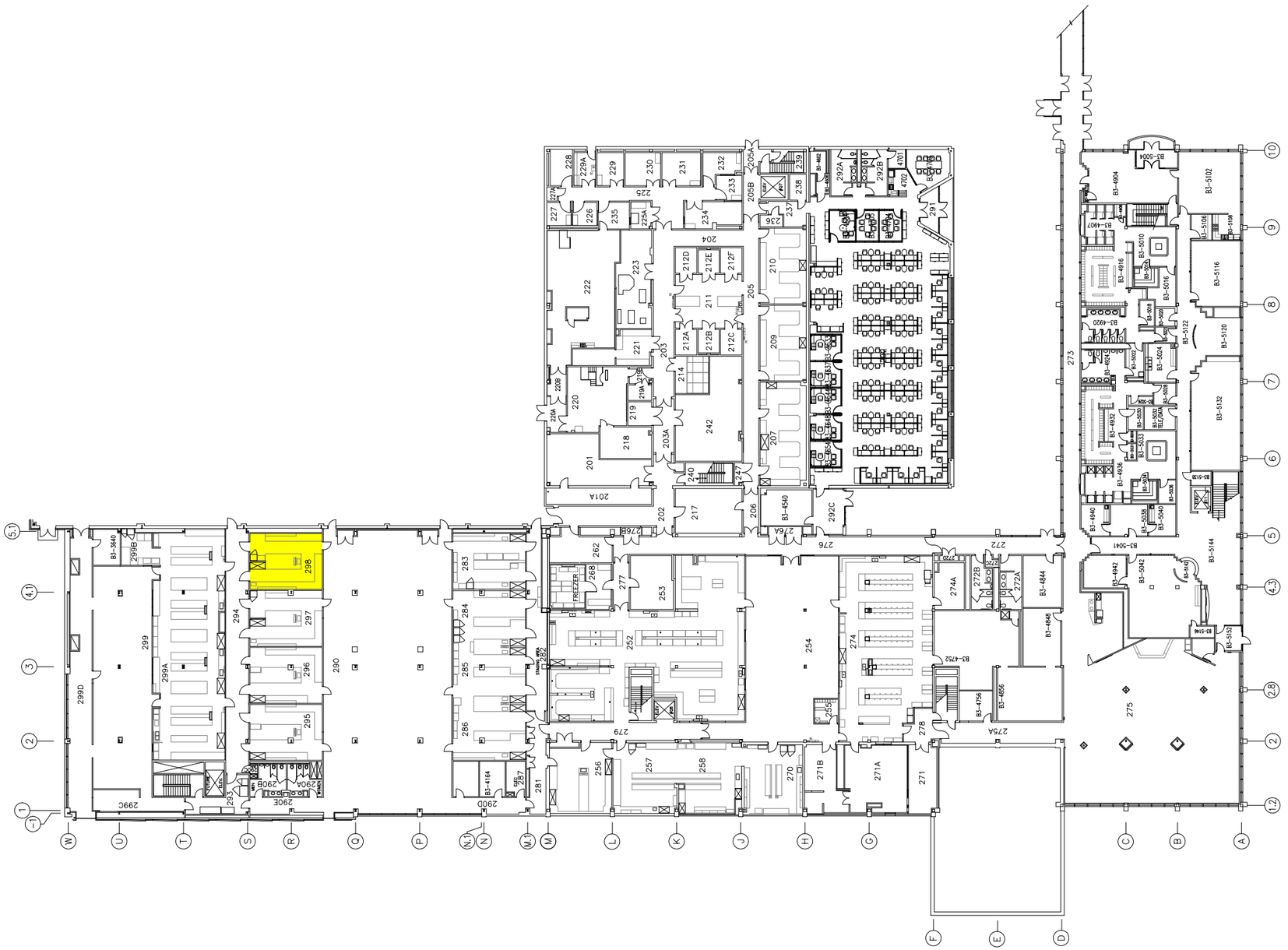

FIGURE 1-5
RADIOACTIVE MATERIAL USE AND STORAGE AREAS
B BUILDING B3

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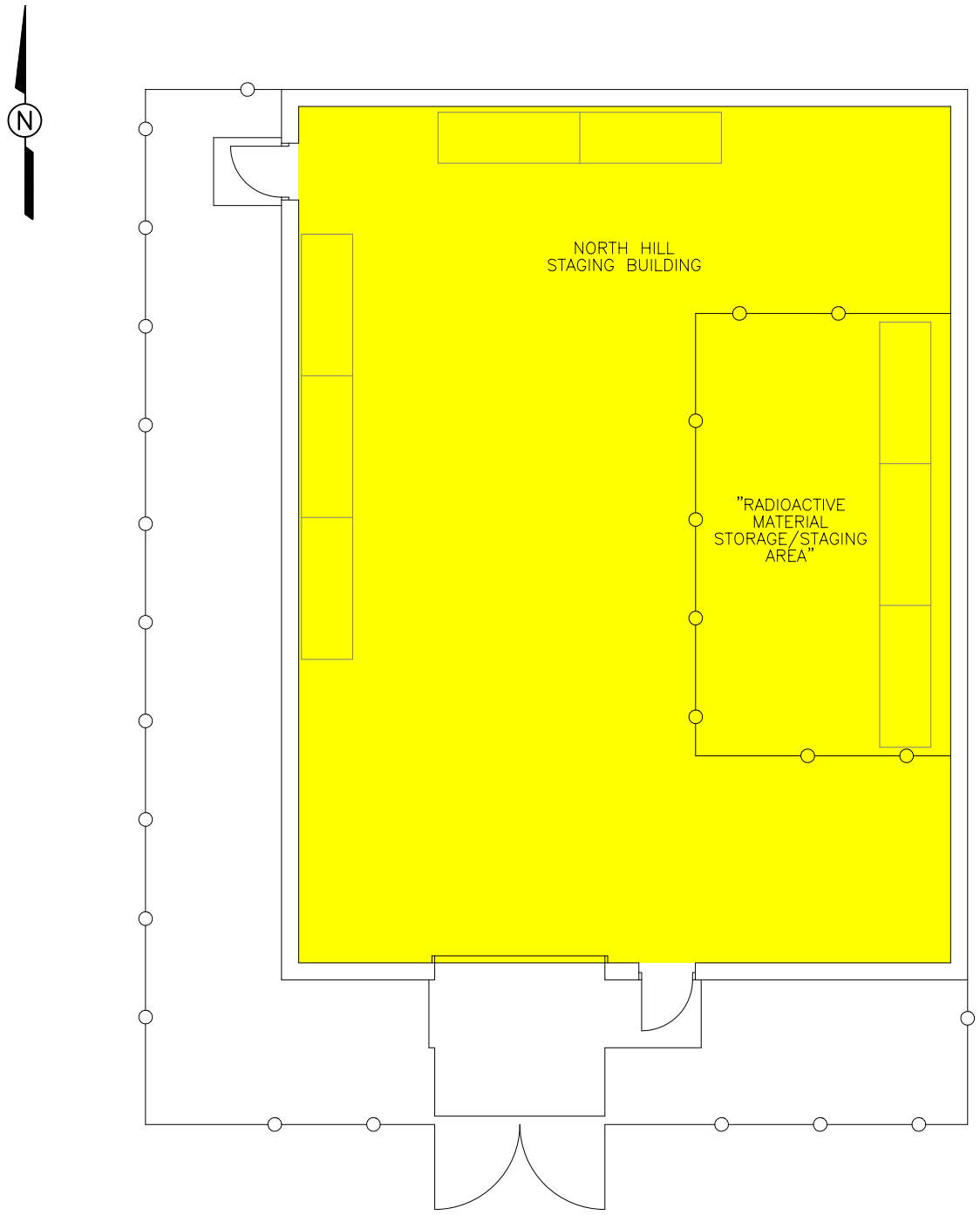

LEGEND:

RADIOACTIVE MATERIAL USE AND STORAGE AREAS

SCALE IN METERS

0 3 6

FIGURE 1-6

RADIOACTIVE MATERIAL USE AND STORAGE AREAS, NORTH HILL STAGING BUILDING (RAD WASTE STORAGE)

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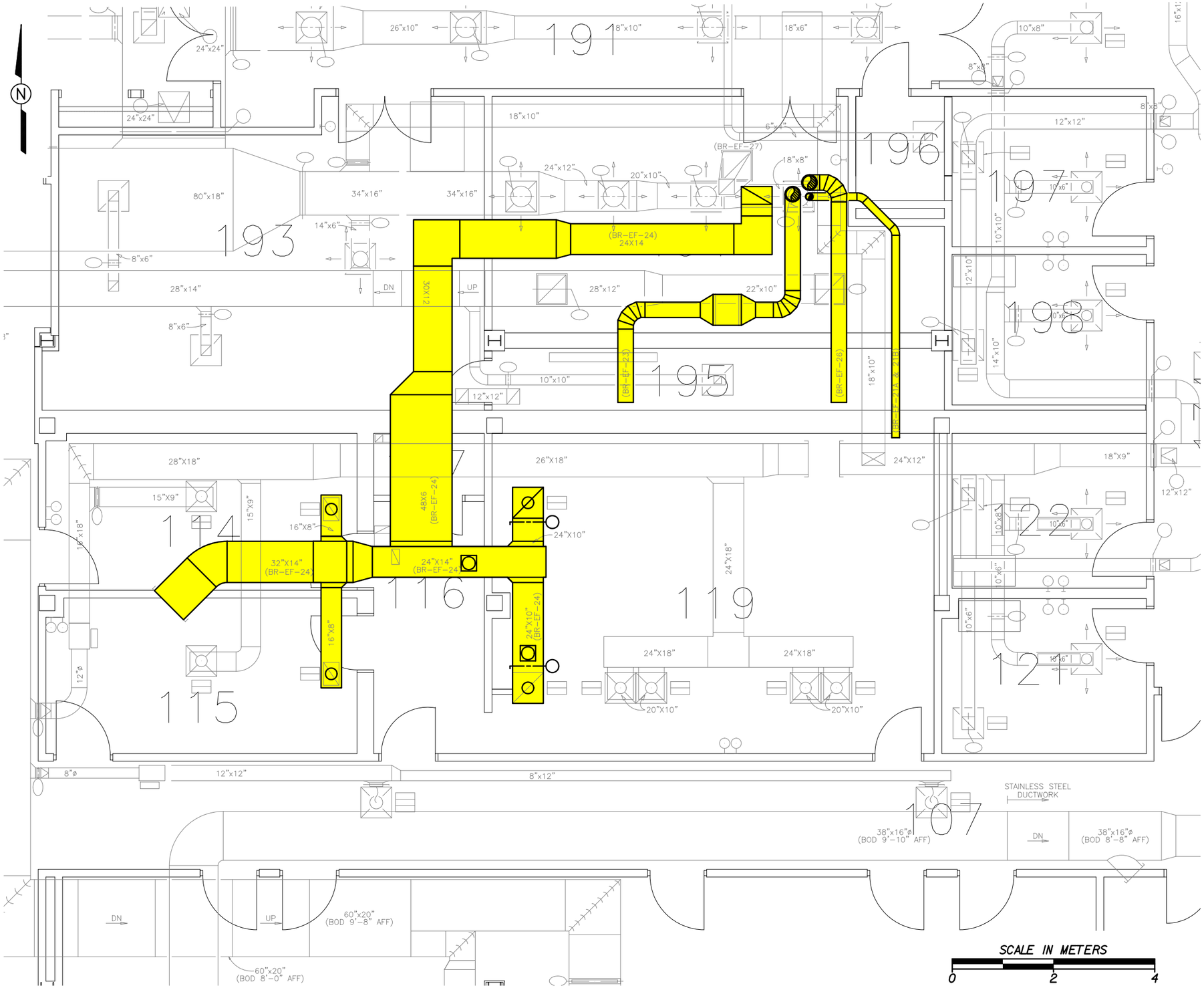

LEGEND:

AREA OF POTENTIAL CONCERN

FIGURE 1-7
LEGACY DUCTWORK OF POTENTIAL CONCERN, B BUILDING B2

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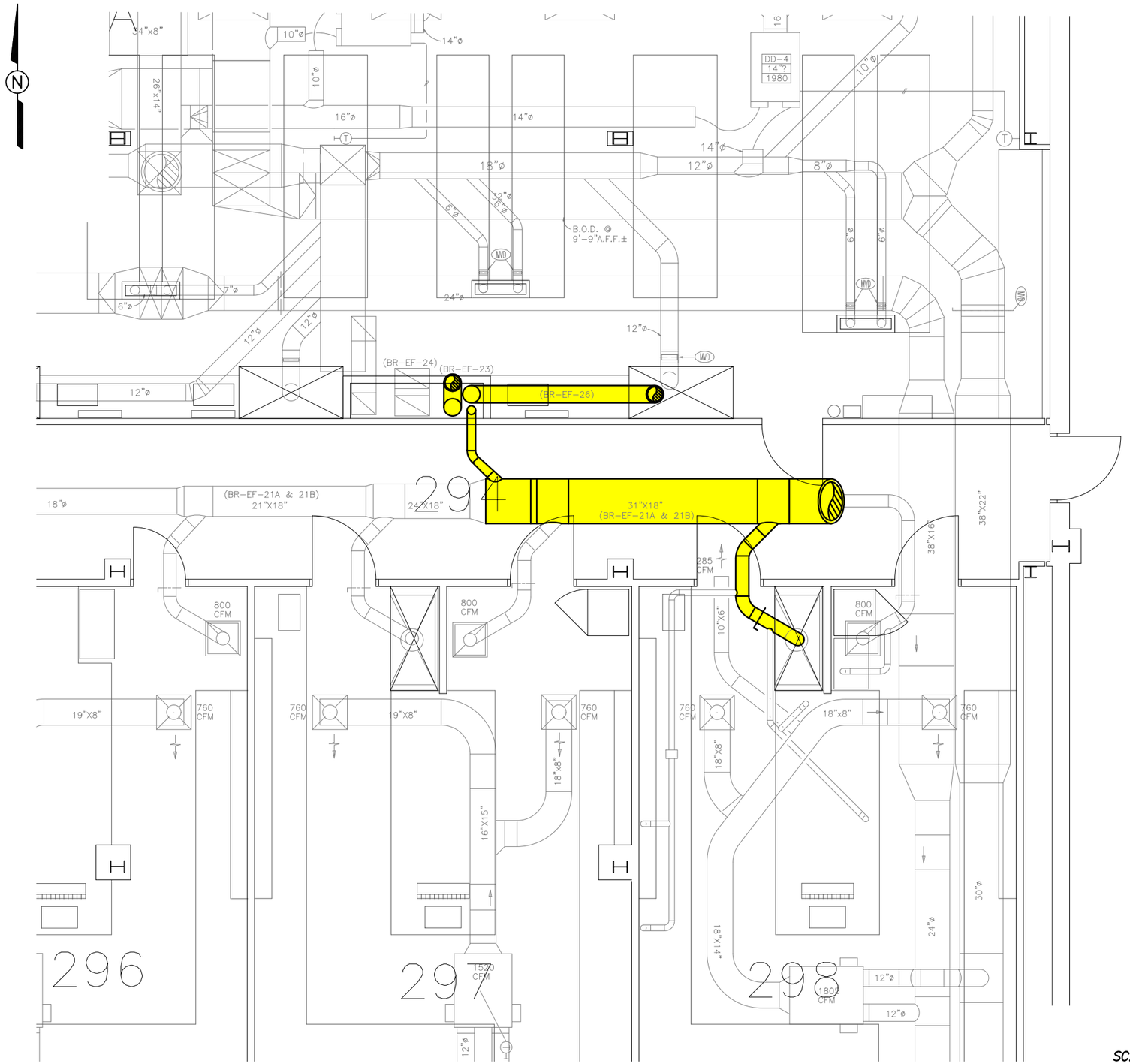

LEGEND:

AREA OF POTENTIAL CONCERN

FIGURE 1-8
LEGACY DUCTWORK OF
POTENTIAL CONCERN,
B BUILDING B3

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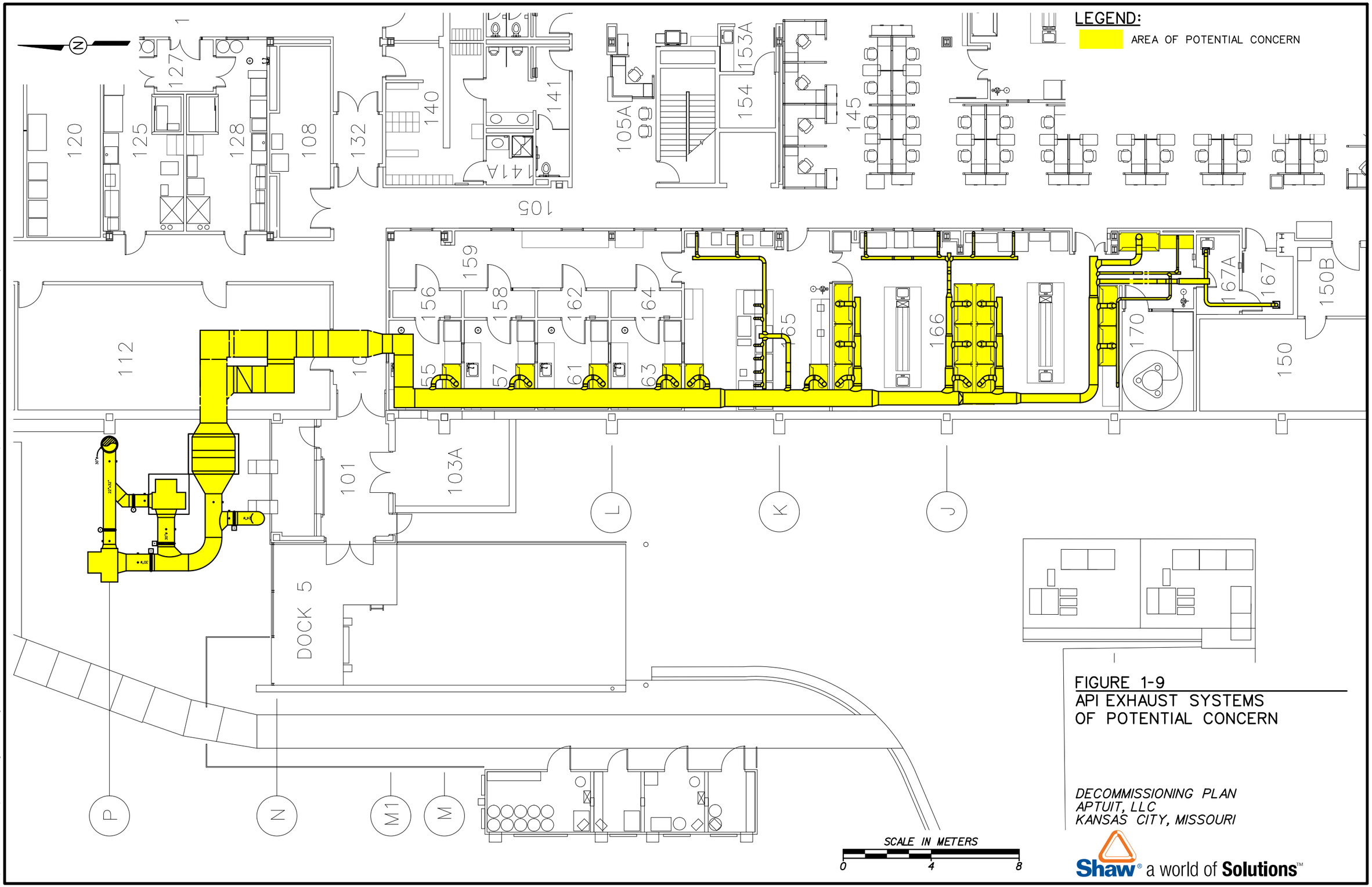

FIGURE 1-9
API EXHAUST SYSTEMS
OF POTENTIAL CONCERN

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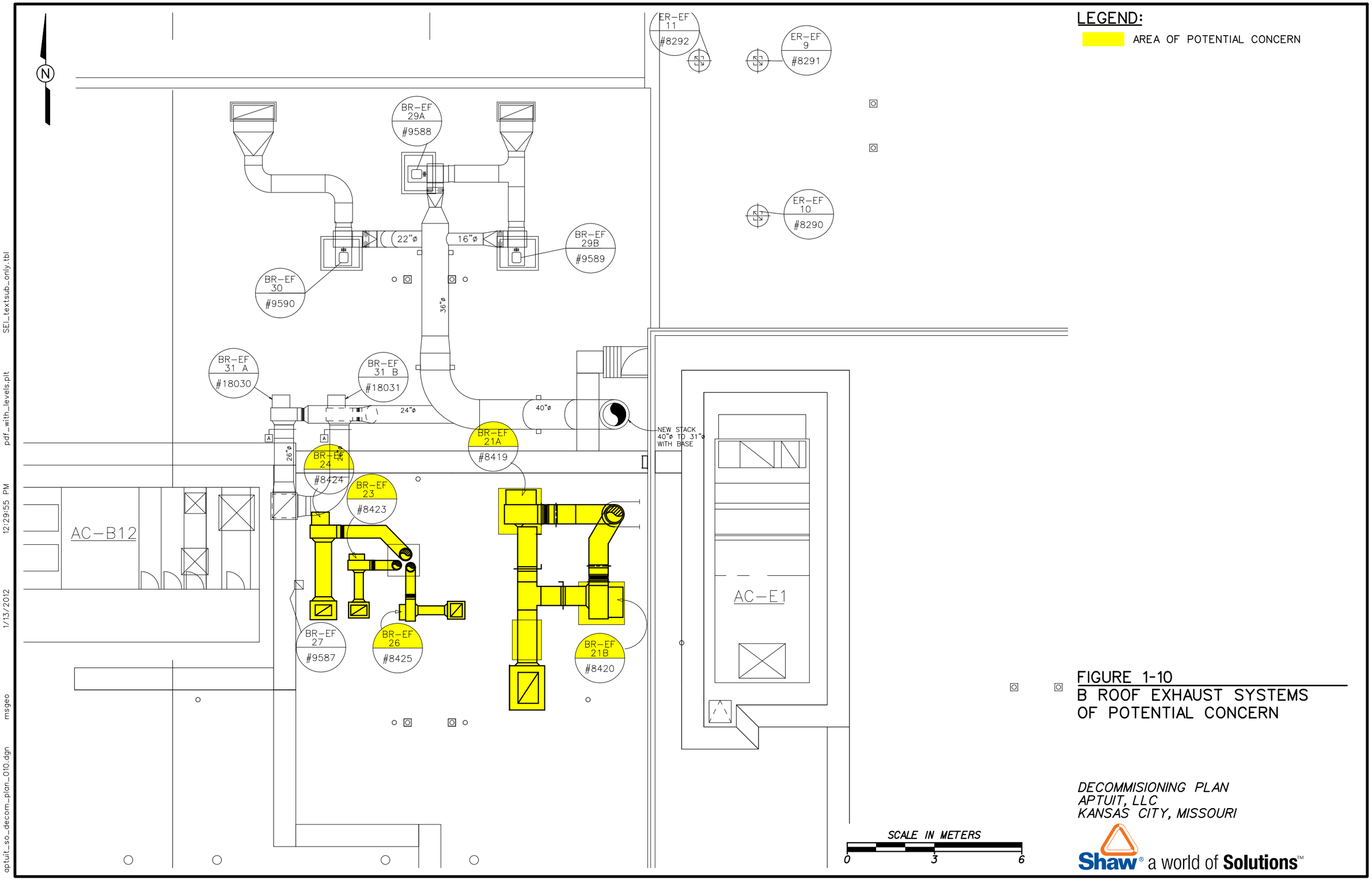

FIGURE 1-10
B ROOF EXHAUST SYSTEMS
OF POTENTIAL CONCERN

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LEGEND:

HISTORICAL RADIOACTIVE MATERIAL USE AND STORAGE AREAS

PREVIOUSLY REMEDIATED

FIGURE 2-1
HISTORICAL RADIOACTIVE MATERIAL USE AND STORAGE AREAS
B BUILDING LAR

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SCALE IN METERS
0 8 16

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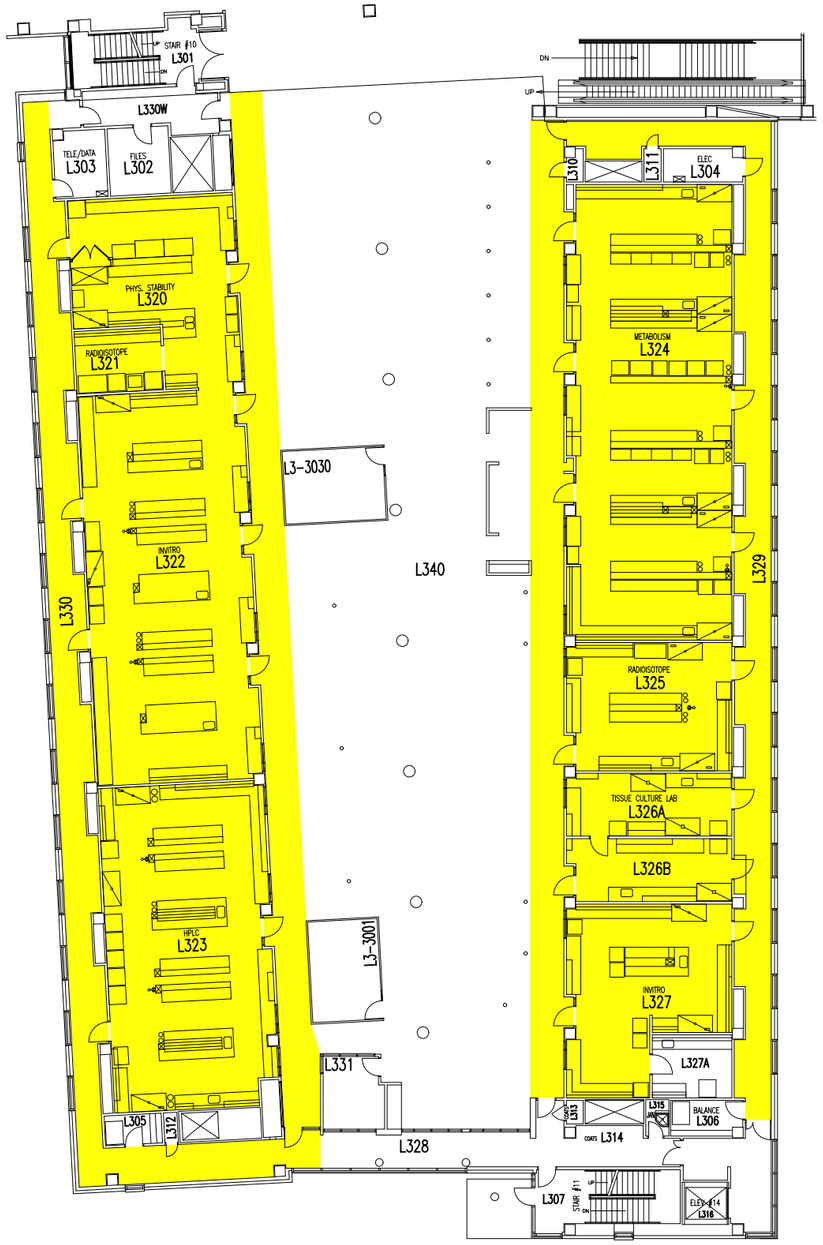

LEGEND:

HISTORICAL RADIOACTIVE MATERIAL USE AND STORAGE AREAS

SCALE IN METERS

0 8 16

FIGURE 2-2
HISTORICAL RADIOACTIVE MATERIAL USE AND STORAGE AREAS
L BUILDING L3

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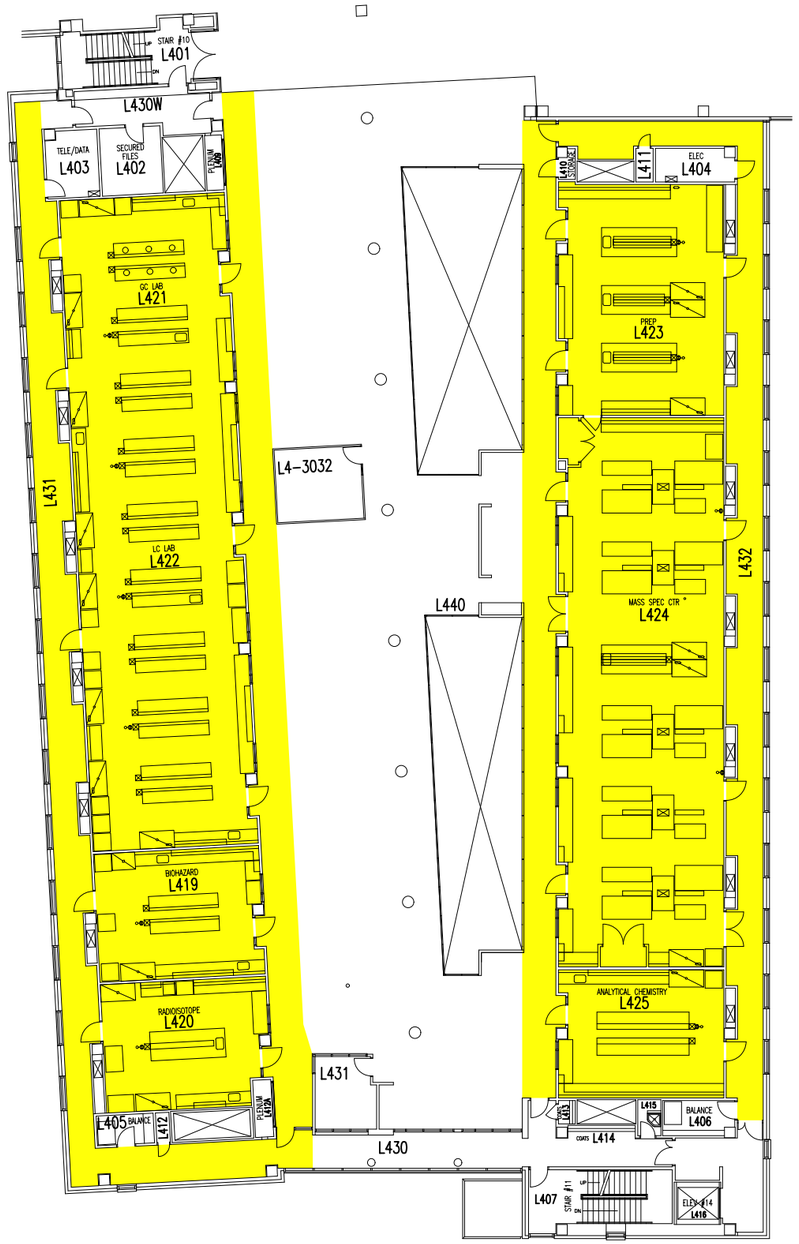

LEGEND:

HISTORICAL RADIOACTIVE MATERIAL USE AND STORAGE AREAS

SCALE IN METERS

0 8 16

FIGURE 2-3
HISTORICAL RADIOACTIVE MATERIAL USE AND STORAGE AREAS
L BUILDING L4

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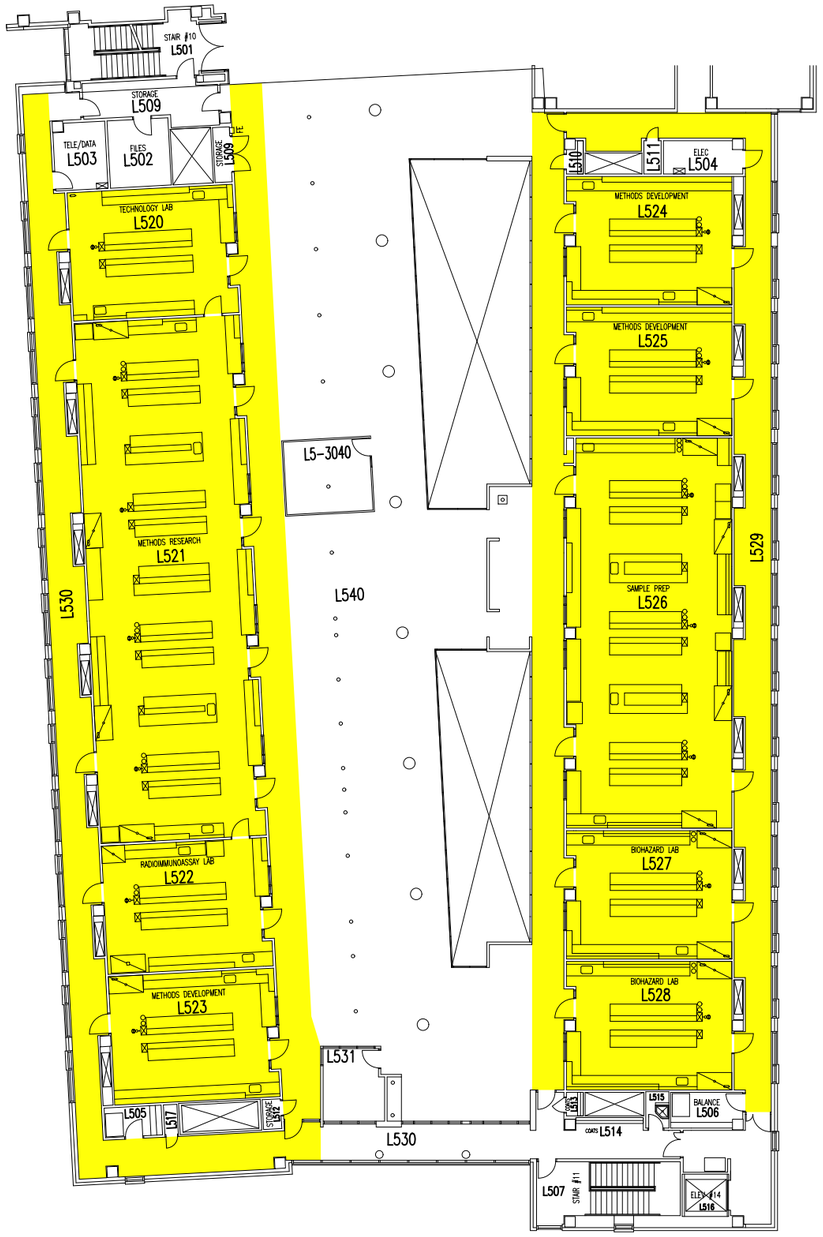

LEGEND:

HISTORICAL RADIOACTIVE MATERIAL USE AND STORAGE AREAS

SCALE IN METERS

0 8 16

FIGURE 2-4
HISTORICAL RADIOACTIVE MATERIAL USE AND STORAGE AREAS L BUILDING L5

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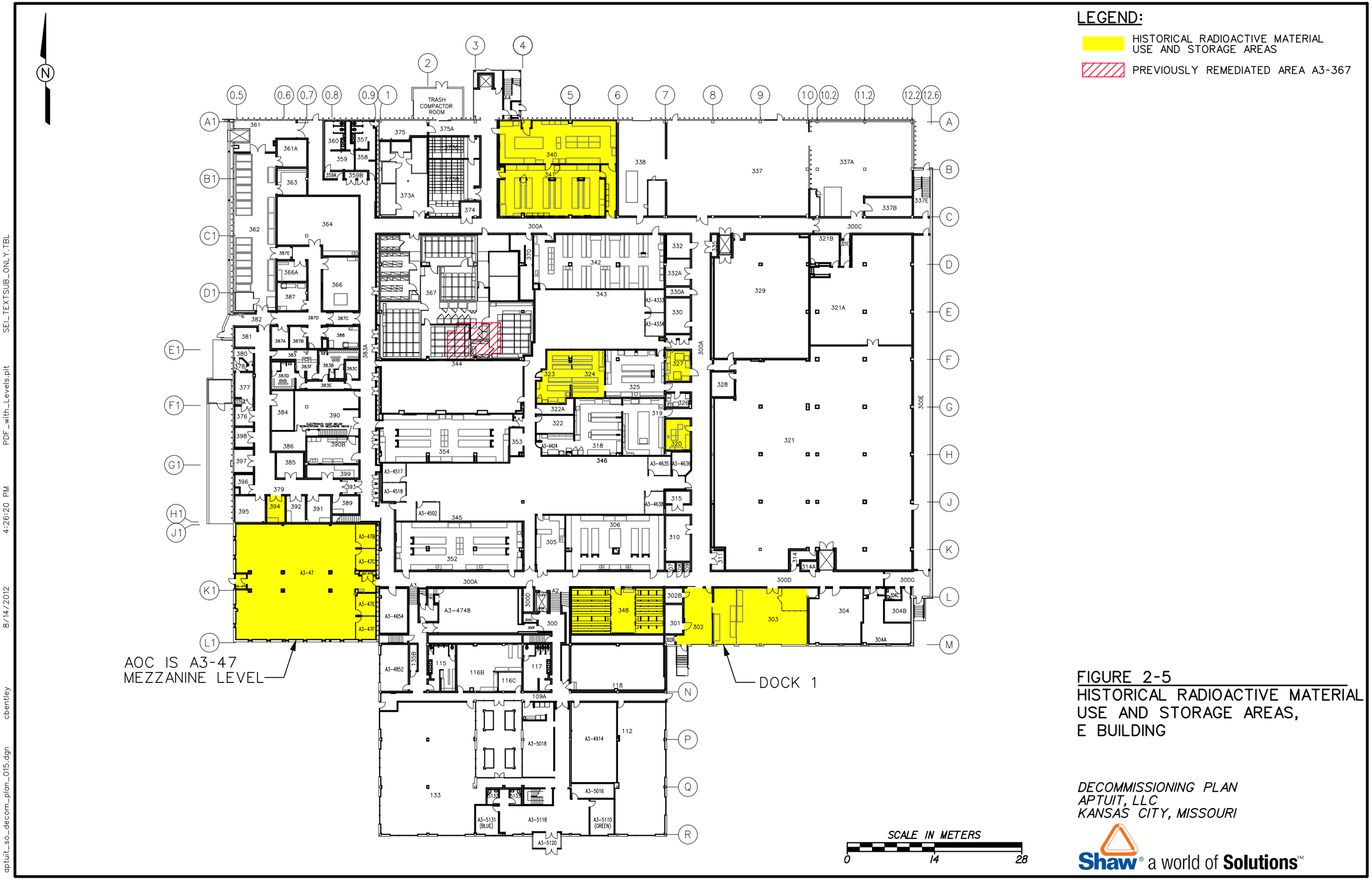

FIGURE 2-5
HISTORICAL RADIOACTIVE MATERIAL USE AND STORAGE AREAS, E BUILDING

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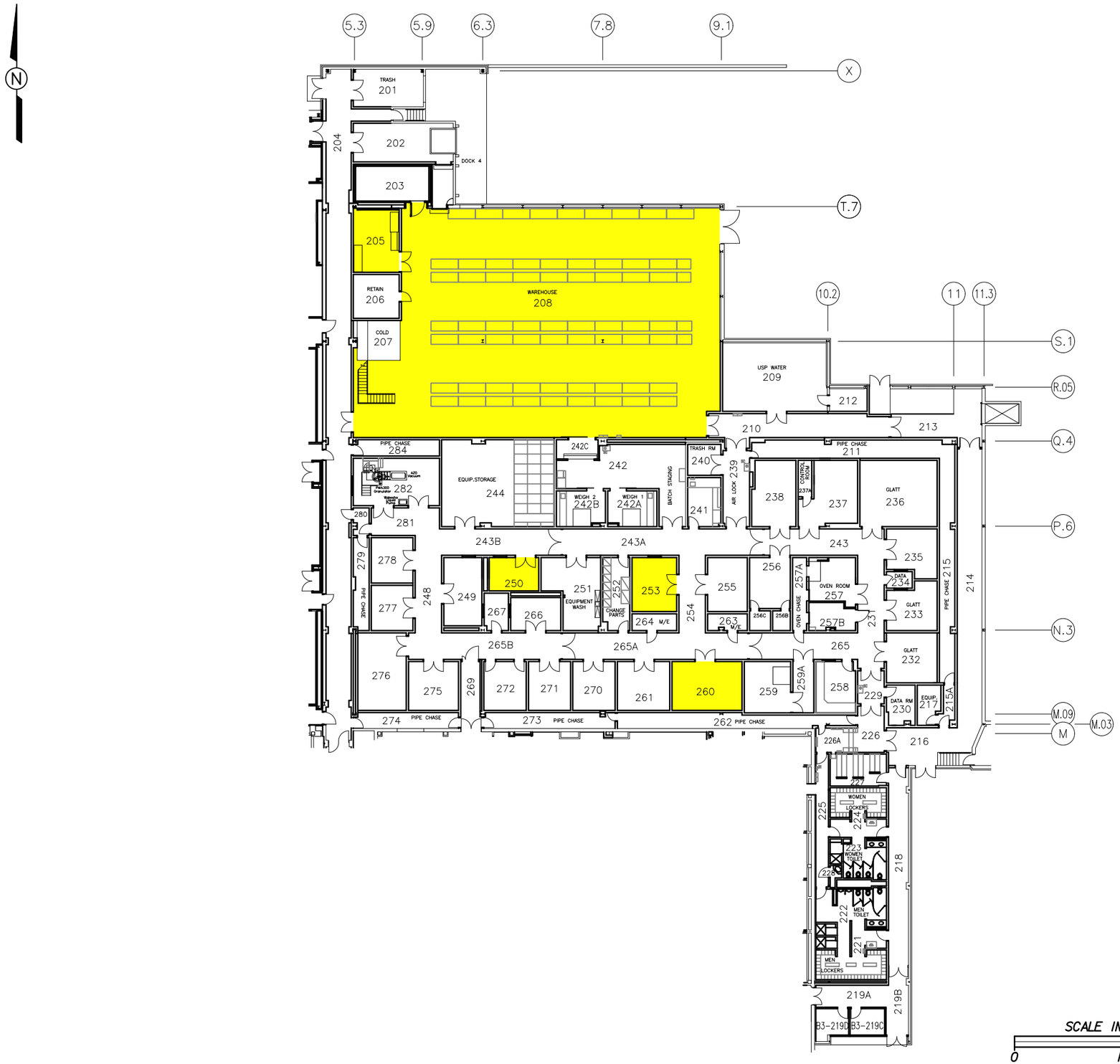

LEGEND:

HISTORICAL RADIOACTIVE MATERIAL USE AND STORAGE AREAS

SCALE IN METERS

0 10 20

FIGURE 2-6
HISTORICAL RADIOACTIVE MATERIAL USE AND STORAGE AREAS, E BUILDING

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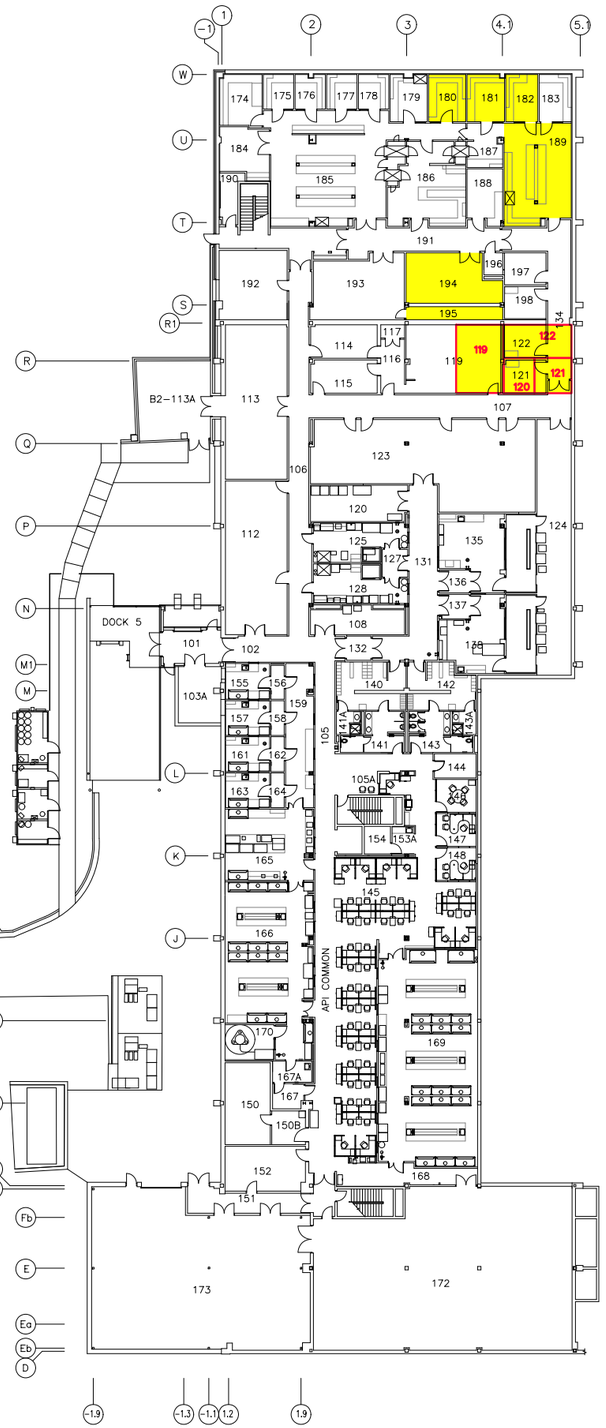

LEGEND:

- HISTORICAL RADIOACTIVE MATERIAL USE AND STORAGE AREAS
- USE AREA REFERENCED IN AMENDMENT NO. 8

SCALE IN METERS

0 14 28

FIGURE 2-7
HISTORICAL RADIOACTIVE MATERIAL USE AND STORAGE AREAS, B BUILDING B2

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LEGEND:

HISTORICAL RADIOACTIVE MATERIAL USE AND STORAGE AREAS

FIGURE 2-8
HISTORICAL RADIOACTIVE MATERIAL USE AND STORAGE AREAS, B BUILDING B3

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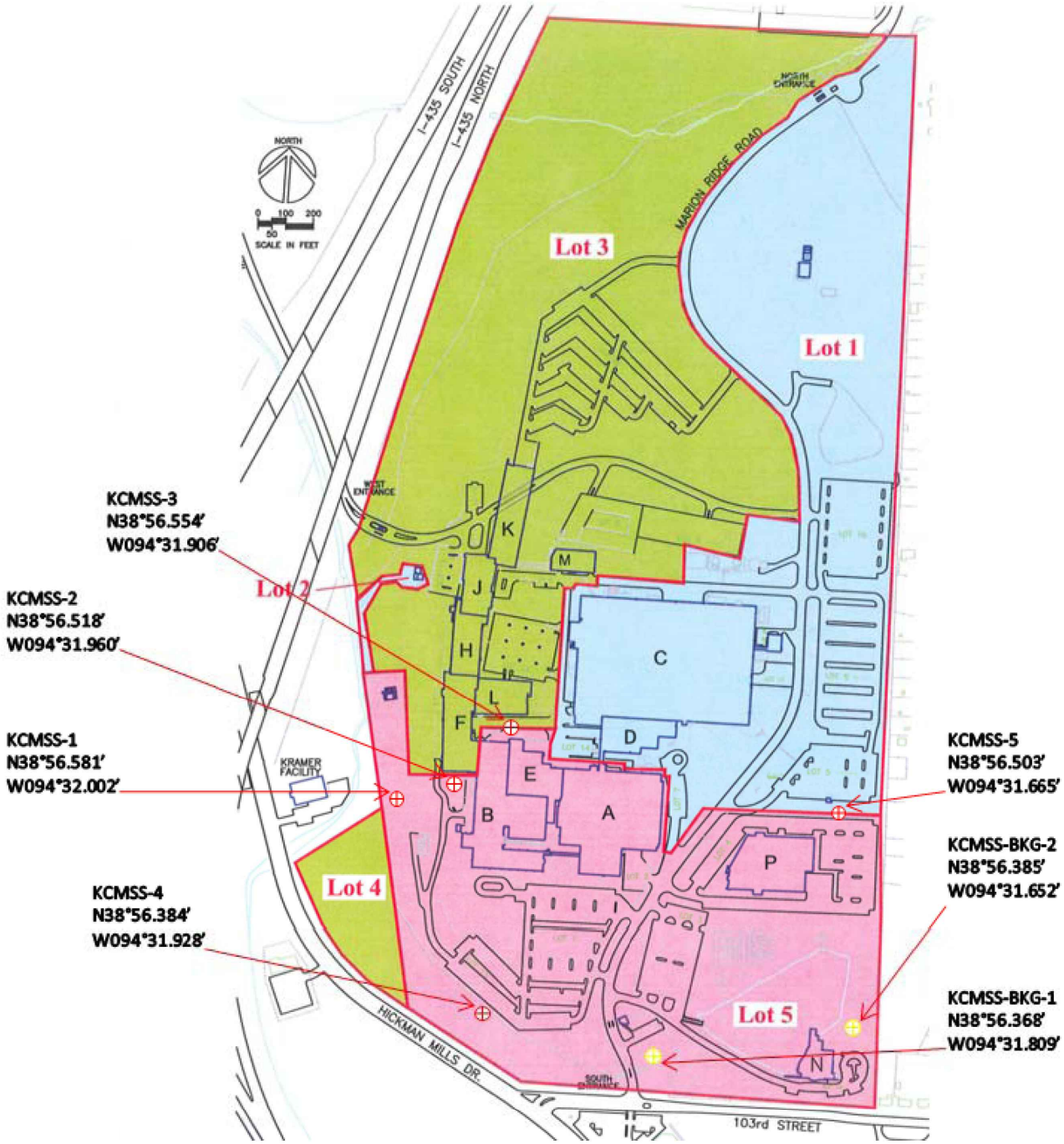

FIGURE 3-1
SOIL SAMPLE LOCATIONS AT APTUIT LLC COLLECTED ON SEPTEMBER 24, 2010

DECOMMISSIONING PLAN
APTUIT, LLC
KANSAS CITY, MISSOURI

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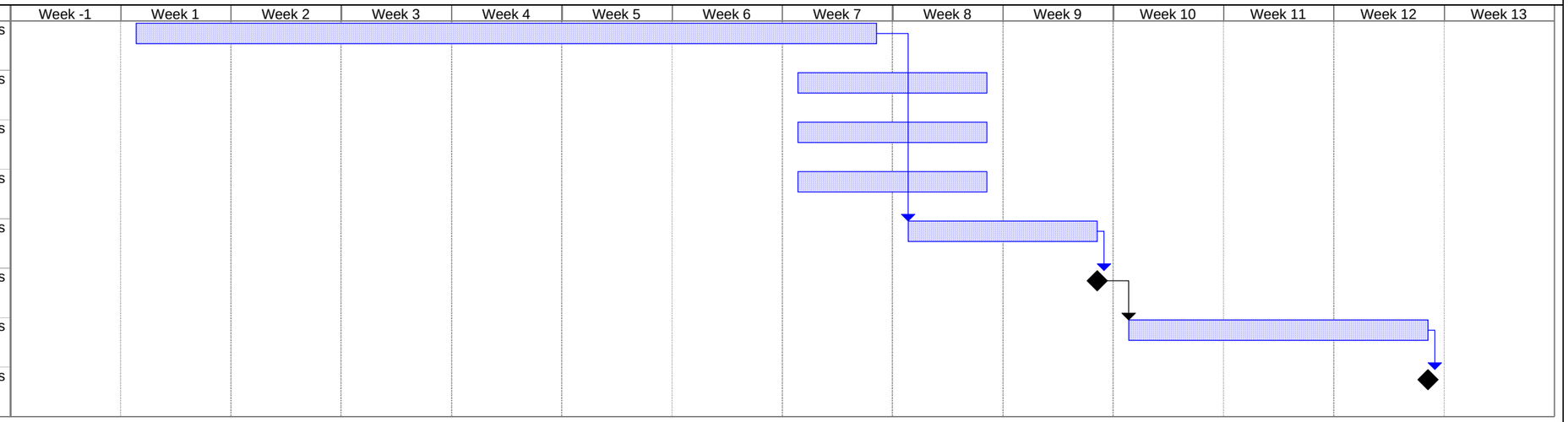
Figure 8-1
Aptuit SO Decommissioning Fieldwork Schedule

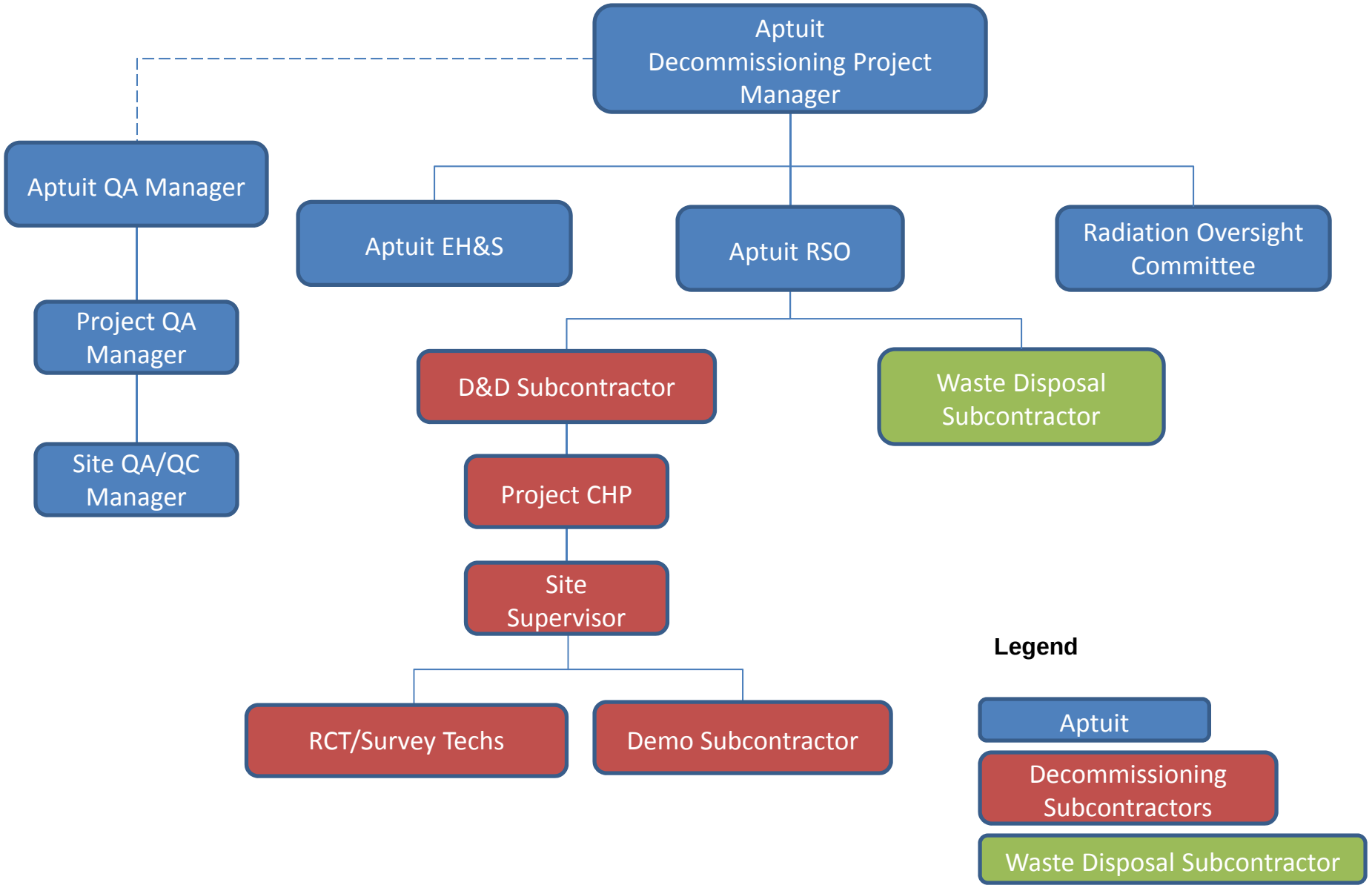
ID	Task Name	Duration
1	Laboratory D&D	35 days
2	Ventilation System Removal	10 days
3	Fan & Stack Removal	10 days
4	Incinerator Removal	10 days
5	Characterization Surveys	10 days
6	D&D Fieldwork Complete	0 days
7	Final Status Survey	15 days
8	FSS Fieldwork Complete	0 days

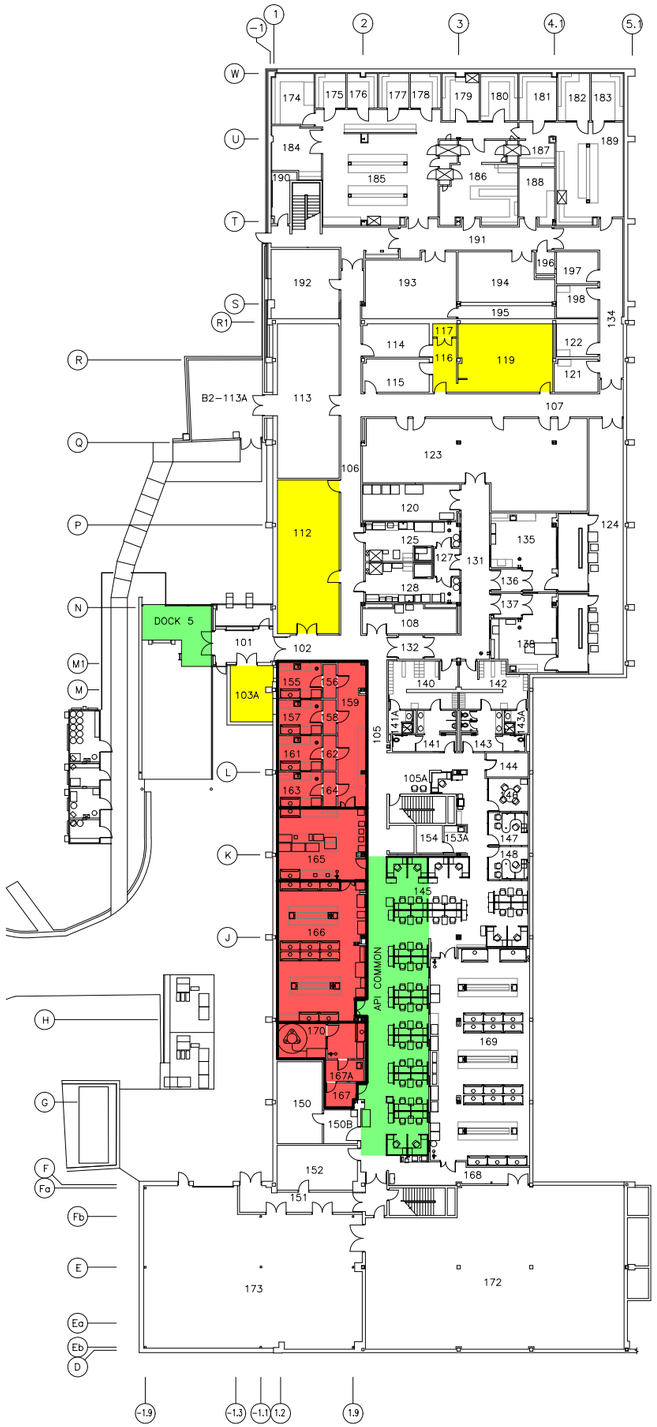


Project: Aptuit SO Decommissioning
Date: January 13, 2012

Task | Progress | Summary | External Tasks | Deadline
Split | Milestone | Project Summary | External Milestone

Figure 9-1
Aptuit Decommissioning Organization Chart





LEGEND:

- CLASS 1 SURVEY UNITS
- CLASS 2 SURVEY UNIT
- CLASS 3 SURVEY UNIT

SCALE IN METERS

0 14 28

FIGURE 14-1
SURVEY UNIT CLASSIFICATIONS,
B BUILDING B2

DECOMMISSIONING PLAN
APTUIT, LLC
KANSAS CITY, MISSOURI

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LEGEND:

CLASS 1 SURVEY UNIT

FIGURE 14-2
SURVEY UNIT CLASSIFICATIONS,
B BUILDING B3

DECOMMISSIONING PLAN
APTUIT, LLC
KANSAS CITY, MISSOURI

SCALE IN METERS
0 14 28

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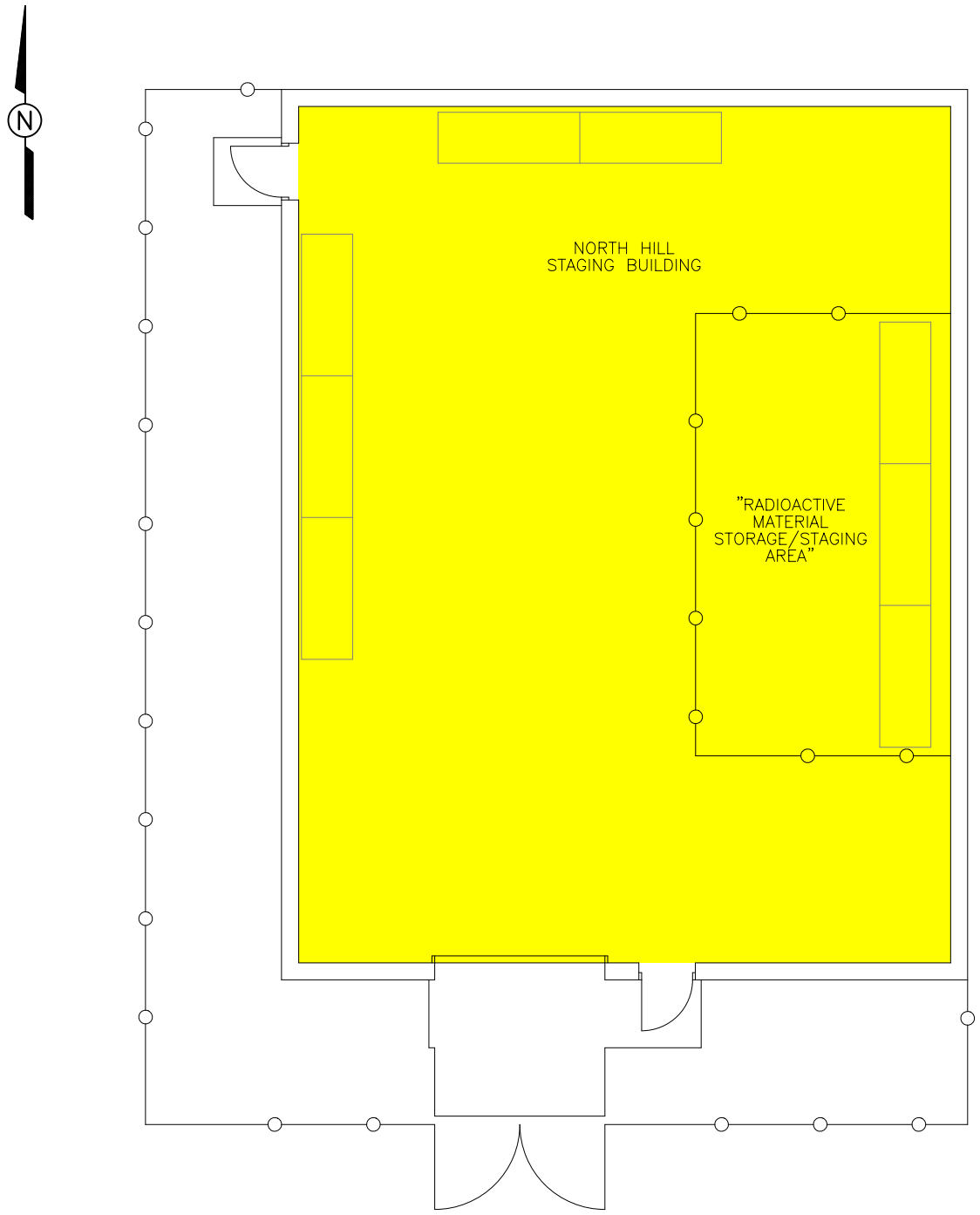

LEGEND:

CLASS 2 SURVEY UNIT

FIGURE 14-3
SURVEY UNIT CLASSIFICATIONS,
NORTH HILL STAGING BUILDING
(RAD WASTE STORAGE)

DECOMMISSIONING PLAN
APTUIT, LLC
KANSAS CITY, MISSOURI

SCALE IN METERS
0 3 6

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Appendix A

Radioactive Materials License

Rec 4/17/12

UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION III
2443 WARRENVILLE ROAD, SUITE 210
LISLE, ILLINOIS 60532-4352

APR 09 2012

Clinton J. Gregg
Radiation Safety Officer
Aptuit, LLC
10245 Hickman Mills Drive
Kansas City, MO 64134

Dear Mr. Gregg:

Enclosed is Amendment No. 34 to your NRC Material License No. 24-15595-01 in accordance with your request. Please note that the changes made to your license are printed in **bold** font.

Please note that this amendment only addresses paragraph 2 of your letter dated January 13, 2012 and your letter dated March 29, 2012, the deletion of five authorized users. Your decommissioning plan will be addressed in a future amendment.

Please review the enclosed document carefully and be sure that you understand all conditions. If there are any errors or questions, please notify the U.S. Nuclear Regulatory Commission, Region III office at (630) 829-9887 so that we can provide appropriate corrections and answers.

In accordance with 10 Code of Federal Regulations 2.390 of the NRC's "Rules of Practice," a copy of this letter and its enclosure will be available electronically for public inspection in the NRC Public Document Room or from the NRC's Agencywide Documents Access and Management System (ADAMS), accessible from the NRC Web site at http://www.nrc.gov/reading-rm/adams.html.

Sincerely,

Toye L. Simmons
Materials Licensing Branch

License No. 24-15595-01
Docket No. 030-09415

Enclosure: Amendment No. 34

U.S. NUCLEAR REGULATORY COMMISSION **Amendment No. 34**

MATERIALS LICENSE

Pursuant to the Atomic Energy Act of 1954, as amended, the Energy Reorganization Act of 1974 (Public Law 93-438), and Title 10, Code of Federal Regulations, Chapter I, Parts 30, 31, 32, 33, 34, 35, 36, 39, 40, and 70, and in reliance on statements and representations heretofore made by the licensee, a license is hereby issued authorizing the licensee to receive, acquire, possess, and transfer byproduct, source, and special nuclear material designated below; to use such material for the purpose(s) and at the place(s) designated below; to deliver or transfer such material to persons authorized to receive it in accordance with the regulations of the applicable Part(s). This license shall be deemed to contain the conditions specified in Section 183 of the Atomic Energy Act of 1954, as amended, and is subject to all applicable rules, regulations, and orders of the Nuclear Regulatory Commission now or hereafter in effect and to any conditions specified below.

Licensee	In accordance with the letters dated **January 13, 2012 and March 29, 2012,**
1. Aptuit, LLC	3. License number 24-15595-01 is amended in its entirety to read as follows:
2. 10245 Hickman Mills Drive Kansas City, MO 64134-0708	4. Expiration date September 30, 2014
	5. Docket No. 030-09415 Reference No.

6. Byproduct, source, and/or special nuclear material	7. Chemical and/or physical form	8. Maximum amount that licensee may possess at any one time under this license
A. Hydrogen-3	A. Any	A. 100 curies
B. Carbon-14	B. Any	B. 100 curies
C. Sulfur-35	C. Any	C. 1.5 curies
D. Iodine-125	D. Any	D. 70 millicuries
E. Barium-133	E. Sealed source (Model No. IND 1401)	E. 20 millicuries
F. Cesium-137	F. Sealed source	F. 90 microcuries

9. Authorized Use:

A. through B. To be used for research and development as defined in 10 CFR 30.4, and for radiosynthesis of radiolabeled organic chemicals.

C. and D. In storage incident to disposal

D. To be used in a Perkin Elmer Tricarb 2900TR liquid scintillation counter.

E. To be used in a Beckman Model 100C, 3801, or 6500 or equivalent liquid scintillation counter.

CONDITIONS

10. Licensed material shall be used only at the licensee's facilities located at 10245 Hickman Mills Drive, Kansas City, Missouri.

11. The Radiation Safety Officer for this license is Clint Gregg.

MATERIALS LICENSE
SUPPLEMENTARY SHEET

License Number
24-15595-01

Docket or Reference Number
030-09415

Amendment No. 34

12. **Licensed material listed in Item 6 above is only authorized for use by, or under the supervision of, the following individuals and uses indicated:**

Authorized User	Materials and Use
Clint Gregg	Items 6.E. and 6.F.
Mike Marx, Ph.D.	Hydrogen-3 and Carbon-14 for research and development and radiosynthesis, and Items 6.E. and 6.F.
John Goehl	Hydrogen-3 and Carbon-14 for research and development and radiosynthesis, and Items 6.E. and 6.F.
Jim Windels	Hydrogen-3 and Carbon-14 for research and development, and Items 6.E. and 6.F.

13. The licensee shall not use licensed material in or on human beings except as provided otherwise by specific condition of this license.

14. The licensee shall not use licensed material in field applications where activity is released except as provided otherwise by specific condition of this license.

15. A. Sealed sources shall be tested for leakage and/or contamination at intervals not to exceed the intervals specified in the certificate of registration issued by the U.S. Nuclear Regulatory Commission under 10 CFR 32.210 or under equivalent regulations of an Agreement State.

B. In the absence of a certificate from a transferor indicating that a leak test has been made, within the intervals specified in the certificate of registration issued by the U.S. Nuclear Regulatory Commission under 10 CFR 32.210 or under equivalent regulations of an Agreement state, prior to the transfer, a sealed source received from another person shall not be put into use until tested and the test results received.

C. Sealed sources need not be leak tested if they contain only hydrogen-3; or they contain only a radioactive gas; or the half-life of the isotope is 30 days or less; or they contain no more than 100 microcuries of beta and/or gamma emitting material or not more than 10 microcuries of alpha emitting material.

D. Sealed sources need not be tested if they are in storage, and are not being used. However, when they are removed from storage for use or transferred to another person, and have not been tested within the required leak test interval, they shall be tested before use or transfer. No sealed source shall be stored for a period of more than 10 years without being tested for leakage and/or contamination.

E. The leak test shall be capable of detecting the presence of 0.005 microcurie (185 becquerels) of radioactive material on the test sample. If the test reveals the presence of 0.005 microcurie (185 becquerels) or more of removable contamination, a report shall be filed with the U.S. Nuclear Regulatory Commission in accordance with 10 CFR 30.50(c)(2), and the source shall be removed immediately from service and decontaminated, repaired, or disposed of in accordance with Commission regulations.

MATERIALS LICENSE
SUPPLEMENTARY SHEET

License Number
24-15595-01

Docket or Reference Number
030-09415

Amendment No. 34

F. Tests for leakage and/or contamination, limited to leak test sample collection, shall be performed by the licensee or by other persons specifically licensed by the U.S. Nuclear Regulatory Commission or an Agreement State to perform such services.

G. Records of leak test results shall be kept in units of microcuries and shall be maintained for 3 years.

16. The licensee is authorized to hold radioactive material with a physical half-life of less than or equal to 120 days for decay-in-storage before disposal in ordinary trash provided:

A. Before disposal as ordinary trash, byproduct material shall be surveyed at the container surface with the appropriate survey meter set on its most sensitive scale and with no interposed shielding to determine that its radioactivity cannot be distinguished from background. All radiation labels shall be removed or obliterated.

B. A record of each disposal permitted under this License Condition shall be retained for three years. The record must include the date of disposal, the date on which the byproduct material was placed in storage, the radionuclides disposed, the survey instrument used, the background dose rate, the dose rate measured at the surface of each waste container, and the name of the individual who performed the disposal

17. The licensee is authorized to transport licensed material only in accordance with the provisions of 10 CFR Part 71, "Packaging and Transportation of Radioactive Material."

18. Except as specifically provided otherwise in this license, the licensee shall conduct its program in accordance with the statements, representations, and procedures contained in the documents, including any enclosures, listed below. The Nuclear Regulatory Commissions's regulations shall govern unless the statements, representations, and procedures in the licensee's application and correspondence are more restrictive than the regulations.

A. Applications dated October 25, 2007 (limited to the change in the RSO and Attachment 5, "Facility Diagrams."), and April 1, 2008; and

B. Letters dated April 7, 2008, February 2, 2009, June 8, 2009, July 2, 2009, March 29, 2010, May 21, 2010, June 2, 2010, October 8, 2010, January 21, 2011, and October 20, 2011.

FOR THE U.S. NUCLEAR REGULATORY COMMISSION

Date APR 09 2012

By Toye L. Simmons

Toye L. Simmons
Materials Licensing Branch
Region IIII

Appendix B

Incident Reports

Incident in B3-298 on April 4, 2007

Incident Report 4Apr2007

While working in B3-298 on April 4, 2007, I observed that the tubing connecting the UV and BetaRAM detectors for instrument Q40003040 had become detached from the UV detector and was hanging out over the floor. A drop of liquid was on the end of the tubing and looked like it would soon fall. The tubing was reconnected to the UV detector and the benchtop, cabinet, and floor in the area were surveyed. The lower left corner of the cabinet and an area of the floor were found to be contaminated. The instrument had not been used for sample analysis since December, but the components other than the BetaRAM detector were calibrated February 28, 2007. Sometime after that calibration the tubing must have detached.

The authorized user for B3-298, Andy Damon, was contacted and informed of the situation. Following the survey of the area, the shoes of the analysts who most commonly work in B3-298 were surveyed. All were found to have no more activity than background. I attempted to clean the area using RadCon, but saw no decrease in the activity. Using the survey meter, the contaminated area was taped off and labeled as being radioactive. The analysts who most commonly work in B3-298 were informed to avoid this area. The authorized user contacted the Radiation Safety Officer, Pam Barton, and Kevin Tarwater to inform them of the situation.

It was surmised that the wax was most likely contaminated and attempts were made to remove the wax using a small amount of acetonitrile and a solution of bleach. Neither acetonitrile nor the bleach solution was very effective. The floor in front of the main door for B3-298 was also surveyed to see if any contamination had been tracked out of the contaminated area of the floor. Only background was detected.

Report Prepared by Jessica Lowry April 5, 2007

Survey Number Log

Project Name Aptuit
Project Number 120089

DATE	SURVEY DESCRIPTION	SURVEY NUMBER
4/12/07	Survey of Area (casework/floor) in B3.298	041207-1
	N/A	

Radiation/Contamination Survey Report

CONTAMINATION / RADIATION SURVEY REPORT

PROJECT NUMBER: 120089

LOCATION: Aptrit B3.298

SURVEYOR: A. Martinez/S. Brungardt

SURVEY NUMBER: 041207-1

MAP ID: Attached

ACCEPTABLE SURFACE CONTAMINATION LEVELS

Loose N/A dpm/100cm² Alpha 200 dpm/100cm² Beta-Gamma

Total N/A dpm/100cm² Alpha 2000 dpm/100cm² Beta-Gamma

Source Check Data	Contamination Surveys				Radiation Surveys
	α (LOOSE)	α (TOTAL)	β-γ (LOOSE)	β-γ (TOTAL)	Beta-Gamma
Instrument	N/A	N/A	LSC 6000	2360/43.68	N/A
Source Type and I.D.			Cl^{36}/H^3	C^{14}	
Source Strength in dpm			SADS	48,369	µCi
Efficiency Inst. E / Total E				3849/.0962	
MDA in dpm/100 cm²				454	Sat. ☐ Unsat. ☐
Background in cpm				121.8	N/A mrem/hr or µrem/hr

REASON FOR SURVEY
- ☐ PROCEDURE NO. _____
- ☒ SPECIAL Post Decon Survey
- ☐ ROUTINE _____

Contamination ☐ By Shift ☐ Daily ☐ Weekly ☐ Monthly ☐

Radiation ☐ By Shift ☐ Daily ☐ Weekly ☐ Monthly ☐

COMMENTS: Scan of 100% accessible areas
SADS = See Attached Data Sheets
GPDS = Gas Proportional Data Sheet

Contamination Survey INSTRUMENT / SERIAL #	ALPHA (LOOSE) N/A	BETA-GAMMA (LOOSE) LSC 6000 / 7060380
	ALPHA (TOTAL) N/A	BETA-GAMMA (TOTAL) 2360/237279 / 43.68/PR190298
Radiation Survey INSTRUMENT / SERIAL #	BETA-GAMMA N/A	BETA-GAMMA N/A

THE KNOWING & WILLFUL RECORDING OF FALSE, FICTITIOUS, OR FRAUDULENT STATEMENTS OR ENTRIES ON THIS DOCUMENT MAY BE PUNISHABLE AS A FELONY UNDER FEDERAL STATUTES.

DATE: 4/12/07 TIME START: 1300 TIME COMPLETE: 1400 PAGE ____ OF ____

Item #	Alpha Loose dpm/100cm²	Alpha Total dpm/100cm²	Beta-Gamma Loose dpm/100cm²	Beta-Gamma Total dpm/100cm²	Beta-Gamma ☐ mrem/hr. ☐ micro rem/hr ☐ Beta mrads/hr ☐	Item or Location
1	N/A	N/A	SADS	N/A	N/A	BKG LSC - South Wall Corner
2				GPDS		1st Floor
3						1st Floor
4						1st Floor
5						Casework side
6						
7						
8						
9						
10						
11						
12						
13						
14						
15					N/A	
16						
17						
18						
19						
20						
21						
22						
23						
24						
25						

RCS REVIEW Anthony Martinez DATE 4-12-07

Post-Decon Survey	B3-298	Casework/Floor Survey	Survey # 041207-1			4/12/2007	Total		DCGL	1.86	Aptuit
	Sample		Reference		Instrument	Probe area	efficiency	net	dpm/100 cm^2	dpm/100 cm^2	dpm/100 cm^2
area description	Location	gross cpm	bkg cpm	net cpm	Probe Model	cm^2	cpm/dpm	dpm/100 cm^2	3.70E+06	5.00E+03	2.00E+03
N/A-LSC Backgroun	1	N/A	N/A	#VALUE!	43-68	126	0.0962	#VALUE!	#VALUE!	#VALUE!	#VALUE!
Floor	2	14795	132.2	14662.8	43-68	126	0.0962	120968	OK	>RegGuide 1.86	>Aptuit limit
Floor	3	11422	132.2	11289.8	43-68	126	0.0962	93141	OK	>RegGuide 1.86	>Aptuit limit
Floor	4	1478	132.2	1345.8	43-68	126	0.0962	11103	OK	>RegGuide 1.86	>Aptuit limit
Casework	5	14587	120.7	14466.3	43-68	126	0.0962	119347	OK	>RegGuide 1.86	>Aptuit limit

Reviewed by: A. Mathis 4-12-07

Shaw® Shaw Environmental & Infrastructure, Inc.

By SCB Date 4/12/07 Subject Survey of Area Post Decon B3.298 Sheet No. _____ of _____

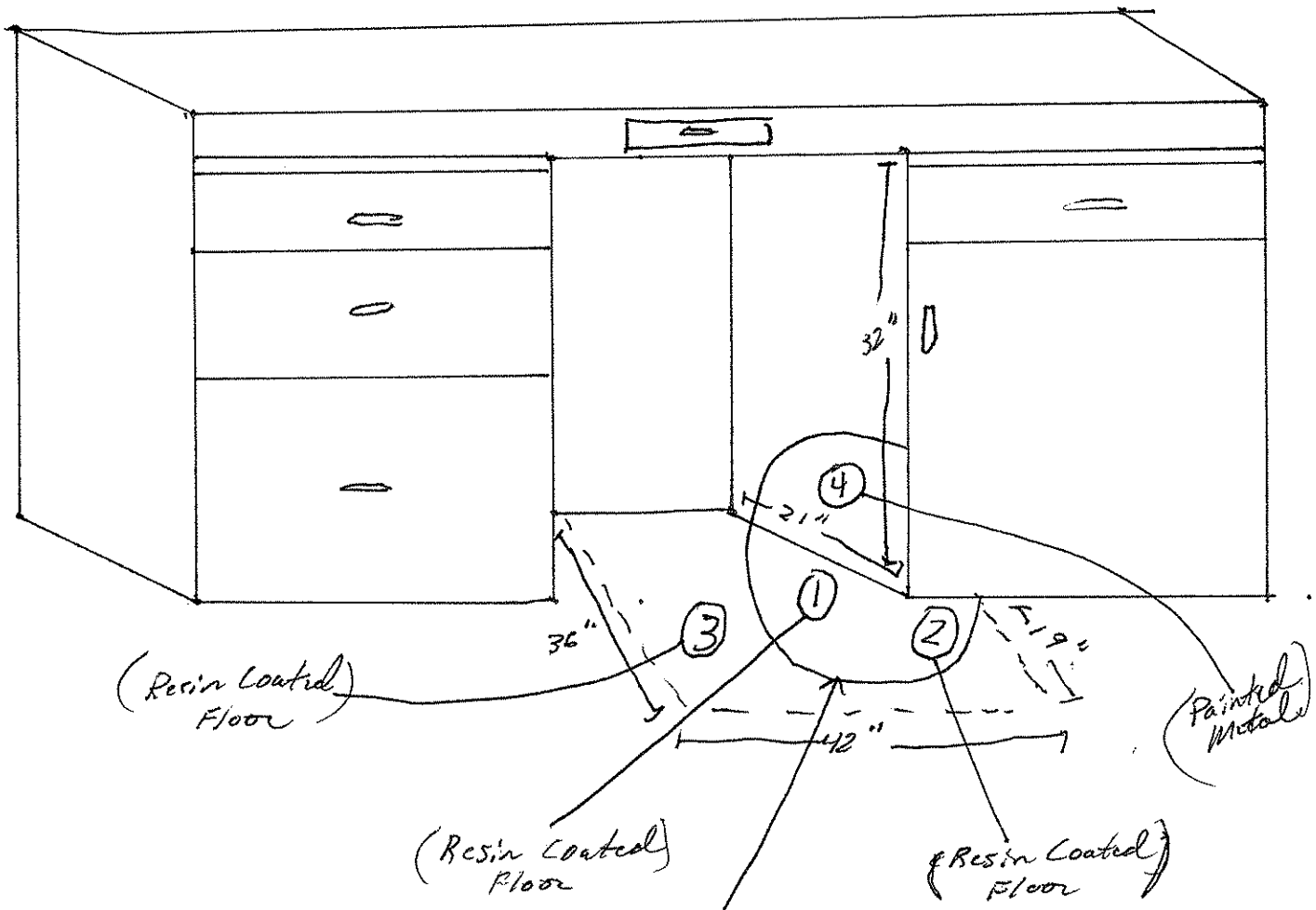
Chkd. By AM Date 4-12-07 Survey # 041207-1 Proj. No. 120089

.25 in. X .25 in.

43.68/PR190298
Material BKG:
Painted Metal: 120.70
Resin Coated Floor: 132.20

Post Decon Survey
South Wall Casework
and Floor

1) LSC BKG
Gross Static Counts
2) 14,795
3) 11,422
4) 1,478
5) 14,587



Area inside solid line was above 200 cpm utilizing model 3/44-9.

ID:C-14 3H 17 APR 2007 08:24
USER:10 COMMENT:SURVEY# 041207-1
PRESET TIME : 1.00
DATA CALC : DL DPM H# :YES SAMPLE REPEATS: 1 PRINTER : STD
COUNT BLANK : NO IC# : NO REPLICATES : 1 RS232 : STD
TWO PHASE : NO AQC :YES CYCLE REPEATS : 1
SCINTILLATOR: LIQUID LUMEX: NO LOW SAMPLE REJ: 0
LOW LEVEL : NO HALF LIFE CORRECTION DATE: none

ISOTOPE 1: 3H %ERROR: 0.01 FACTOR:1.0000 BKG. SUB: 0
ISOTOPE 2: 14C %ERROR: 0.01 FACTOR:1.0000 BKG. SUB: 0
CHAN: 0.0 - 1000.0 %ERROR: 0.01 FACTOR:1.0000 BKG. SUB: 0

BACKGROUND QUENCH CURVE: Off COLOR QUENCH CORRECTION: Off

Quench Limits Low: 5.218 High:313.56

SAM NO	POS	TIME MIN	H#	ISO	CORRECTED CPM	%ERROR	DPM	EFF-1	EFF-2	RATIO	LUMEX %	ELAPSED TIME
1	**-1	1.00	67.9	3H	22.00	42.64	38.00	49.26	0.70	2.113	0.75	1.54
				14C	14.00	53.45	17.98	18.25	76.36			
				WIND1	65.00	24.81						
2	**-2	1.00	69.0	3H	59.00	26.04	54.73	48.98	0.70	0.310	0.48	3.09
				14C	135.00	17.21	176.39	18.25	76.32			
				WIND1	231.00	13.16						
3	**-3	1.00	66.9	3H	44.00	30.15	63.53	49.50	0.70	0.924	0.40	4.69
				14C	53.00	27.47	68.79	18.25	76.40			
				WIND1	127.00	17.75						
4	**-4	1.00	66.5	3H	25.00	40.00	39.47	49.60	0.70	1.327	0.72	6.23
				14C	23.00	41.70	29.74	18.24	76.41			
				WIND1	72.00	23.57						
5	**-5	1.00	66.9	3H	26.00	39.22	39.62	49.51	0.70	1.133	0.67	7.82
				14C	27.00	38.49	34.98	18.25	76.40			
				WIND1	73.00	23.41						

Incident in B2 API on November 2, 2008

aptuit

ENVIRONMENTAL HEALTH AND SAFETY INCIDENT FORM

Description of Incident:

Potable water leak from reflux condenser in radio-lab resulted in the release of water contaminated with ^{14}C and ^{3}H. The spill was first identified by Hari Pennaka the morning of November 2, 2008. He immediately reported a spill that covered the radio chemistry laboratories B2-165, B2-166, B2-167, and B2-170 and was entering the hallway in the uncontrolled area.

Summary of Incident:

The spill was first identified by Hari Pennaka the morning of November 2, 2008. He immediately reported a spill that covered the radio chemistry laboratories B2-165, B2-166, B2-167, and B2-170. This spill migrated outside of laboratory B2-166 to the adjacent linoleum floor tiles and carpeted cubicle area. The spill was a result of a hose, connecting tap water to a hot water bath, becoming disconnected in a chemical hood. The hot water bath was unattended during this leak and water flowed from the chemical hood. The spill resulted in approximately 300 gallons of water being collected, and another approximate 110 gallons disposed of through the sanitary sewer.

Personnel Involved:

Hari Pennaka was working alone the morning the spill was identified. Shawn Earll was the first additional person from API to respond and help with the clean up efforts. Shaw Environmental personnel were also called to help clean up when the magnitude of the spill was fully identified.

Chemist Recommendation to prevent from Reoccurring:

Discussion with Marcello DiMare and John Goehl further identified that a portable recirculating chiller will be used in the future. Metal hose clamps have also been identified as a more secure connection.

Several deficiencies/opportunities were identified as a result of this incident.

Corrective Actions:

1. **The use of portable recirculating chillers must be used after hours to minimize the severity of this type of spill. Capacity is about 3 gallons.**
2. **Copper wire is not sufficient to maintain adequate connection for the tubing. Metal hose clamps were purchased to ensure a tight fitting connection.**

Preventative actions:

1. **Process Hazard Review- Initiate formal system to review, identify and mitigate known hazards and ensure correct project setup.**
2. **Projects that run outside of normal business hours will require inspection of the operations at least hourly, or the use of some type of alarm mechanism. This does depend on the severity of chemistry being performed and may be required at a much shorter frequency.**

3. **Working alone should not permitted. Security will be notified in these situations to check on personnel working alone.**

Reviewed by:

Title	Employee	Signature	Date
Supervisor	**John Goehl**		
RSO	**Clint Gregg**		
EH&S	**Kevin Tarwater**		
Director API	**Marcello DiMare**		

Supervisor Incident/Injury Report

aptuit

Employee Involved Hari Pennaka	Date Of Incident 11/01/08	Date Of Statement 11/21/08	Case Number
Department RadioChemistry	Job Performed RadioSynthesis		
Date Hired Sept 4, 2007	Time On Job 1 year 2 months		
Time Of Incident A.M.☐ P.M.☐ Sometime between 8pm (11/1) and 8am (11/2)	Time Reported A.M.☐ P.M.☐ 8:15am (11/2)		
Person Injury Was Reported To NA			
Type Of Incident Water leakage-property damage (☐Near Miss ☐Injury ☐Property Damage ☐Spills)			
Location of Incident B2 Room 166 and out into Room 167 and hallway			

Description of Incident (What Happened)

A reaction was started at 7 pm on Saturday (11-01-2008) using a water reflux condenser with copper wire to secure the water hoses. At 8pm, all was secure and the chemist left for the night. The next morning at 8.15 am (11-02-2008) the chemist found some water on the floors in the hallway and a lot of water on the laboratory floors. A hose had popped off the condenser, resulting in the water leak onto floor of fume hood and out onto the lab floor. Clint Gregg (RSO) was called and informed about the water leak. The water was mopped/vacuumed up by the chemist with the help of Shawn Earll (Maintenance department).

Do You Know of any Other Witnesses? (Yes☐ No☐) No	Do You Know of any Injuries? (Yes☐ No☐) No
If Yes, List Names	

How Do You Think The Incident Occurred (Unsafe Condition Or Act, Root Cause)

Over tightening of the copper wire at the water hose connections led to the wire breaking sometime during the night. At that point, the hose came off from reflux condenser and water leaked

Do You Know Of any Other Similar Incidents Occurring In The Past? (Yes☐ No☐)

Yes, this is an incident that has happened infrequently over the years in organic chemistry labs.

How Do You Think This Could Have Been Prevented?

Using hose clamps instead of, or in addition to the copper wire could ensure the hose stays secured. We can/will also use self-contained recirculating chillers for overnight reactions (contains ~2 gallons of fluid).

11/28/08

aptuit

EH&S INCIDENT REPORT FORM

Report all work-related injuries and illnesses to the Facilities EH&S Department as soon as possible.

In addition, report any incidents that could have resulted in an injury (near-miss) or caused significant material damage.

The purpose of this report is to learn from the incident so that it does not happen again, not to assign blame.

Name: Hari K Pennaka	*Job Title: Senior Scientist*
Supervisor/Manager: John Goehl	*Department: Radiochemistry-API*
Type of Incident: Water leakage *Work-related injury* *Work-related illness* *Near-miss incident* *X Materials damage*	
Date/Time of the incident: 11/01/2008	*Location of the incident:Radiolab #166, B-2*
Narrative description of the incident: I started my reaction at 7 pm on Saturday (11-01-2008) using water reflux condenser with copper wire to tighten water hose joints and I was inspected the experiment at 8 pm, seems everything was under control and left it for overnight experiment. I left the place at 8 pm and came back next morning at 8.15 am (11-02-2008) and found some water on the floors in the hall way and lot of water on the laboratory floors. I called Mr.Clinton Gregg (RSO) and reported about the water leak accident. I cleaned up all the water in the hallway and laboratory with the help of Mr.Shawn Earll (Maintenance department).	
In your opinion, what was/were the root cause(s) of the incident? (e.g., condition or act that caused the incident) Over tightening of the copper wire at the water hose connections led to the wire breaking sometime during the night. At that point, the hose came off from reflux condenser and water leaked.	
What corrective action(s) were taken or should be taken to prevent a reoccurrence of the incident? Either using chillers (self contained cooling units) or employing hose clamps instead of copper wire should prevent this kind of water leakage accidents in the future.	
Report prepared by: Hari K. Pennaka	*Date:* 11-18-2008

Distribution: Facilities Environmental Health & Safety Department, Human Resources Office, Employee's Supervisor/Manager

Created by Sue Wohlford
Created on 11/17/2008 1:55:00 PM

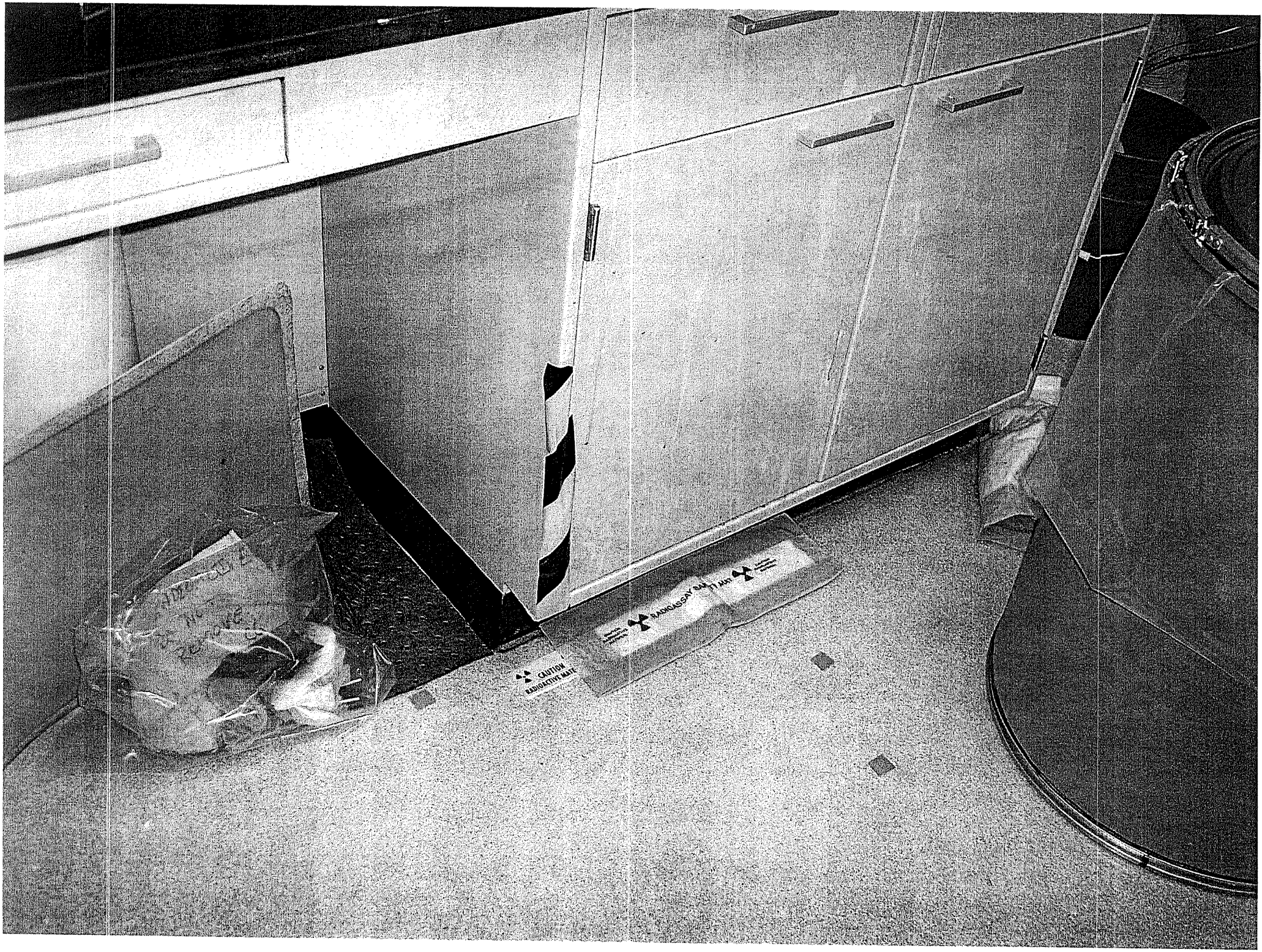
11/20/08

Incident in B3-298 on July 26, 2010

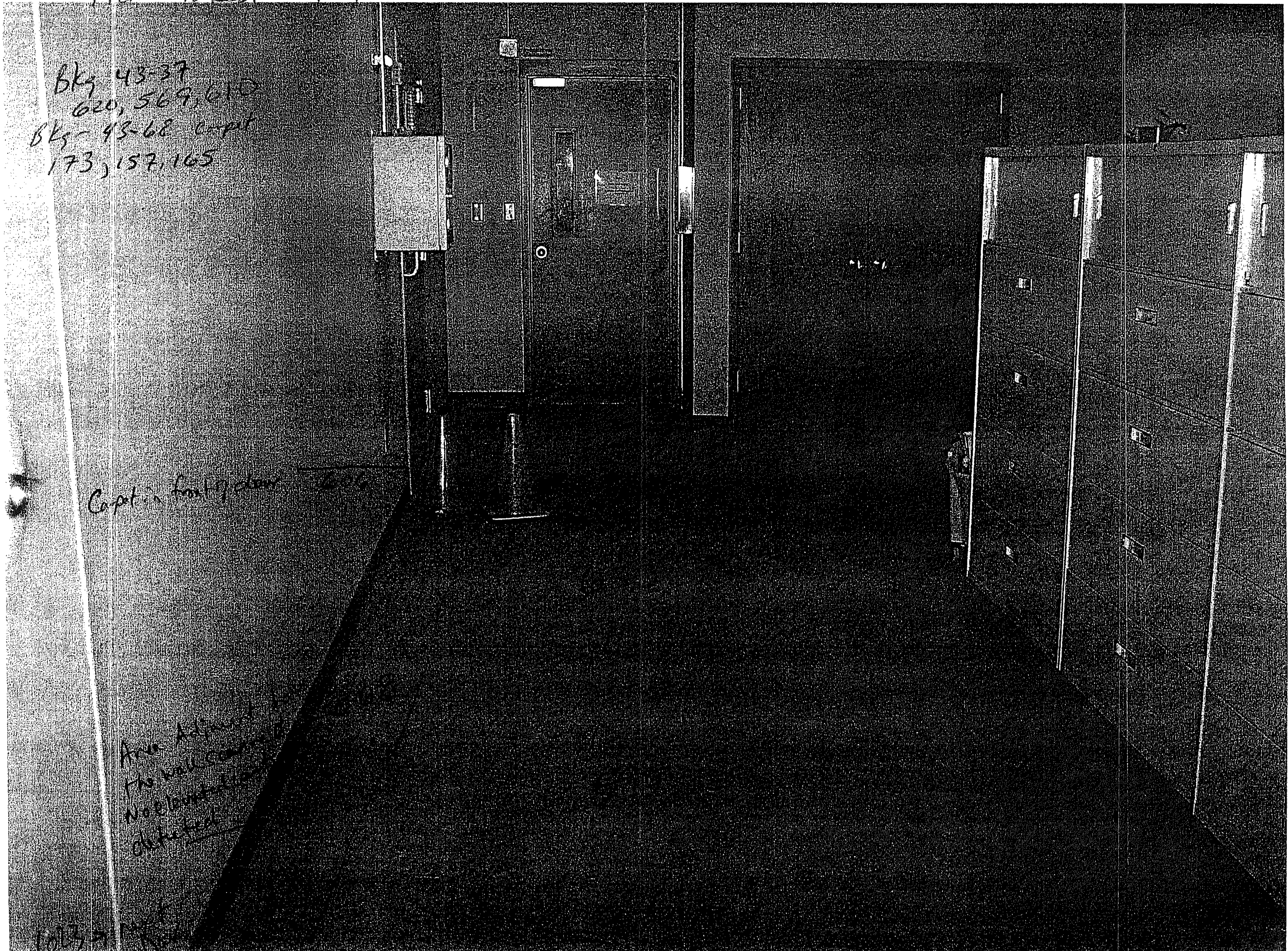
Clinton J. Gregg

From: Clinton J. Gregg
Sent: Monday, July 26, 2010 9:13 PM
To: pamela.barton@aptuit.com; Kevin Tarwater
Subject: B3-298

The wipes of B3-298 following the DI water leak showed that there is loose contaminaiton under the bench in B3-298 (7-8K dpm on wipe and assay of water absorbed by towels). Most of the water avoided this area, but water leaching back out is hot. I changed the absorbent pads before I left and most of the water had stopped. Nothing in the mop water or further out on the floor. The carpet on the other side of the wall showed a few spots, but no counts were detected. I will scan the area again once everything dries out. There were two fans left in the room overnight to assist in drying the area.


CAUTION
RADIOACTIVE MATE

Picture taken 7/20/10



Assay Definition-

Assay Description:

Assay Type: DPM (Dual)
Report Name: WIPE TEST
Output Data Path: C:\Packard\Tricarb\Results\CLINDT\WIPES\20100726_1511
Raw Results Path: C:\Packard\Tricarb\Results\CLINDT\WIPES\20100726_1511\20100726_1511.results
Assay File Name: C:\Packard\TriCarb\Assays\WIPES.lsa

Count Conditions-

Nuclide: 3H-14C
Quench Indicator: tSIE/AEC
External Std Terminator (sec): 0.5 2s%
Pre-Count Delay (min): 0.00
Quench Sets:
Low Energy: 3H
Mid Energy: 14C
Count Time (min): 1.00
Count Mode: Normal
Assay Count Cycles: 1 Repeat Sample Count: 1
#Vials/Sample: 1 Calculate % Reference: Off

Background Subtract: On - 1st Vial
Low CPM Threshold: Off
2 Sigma % Terminator: Off

Regions	LL	UL	Bkg Subtract
A	0.0	12.0	1st Vial
B	12.0	156.0	1st Vial
C	0.0	0.0	1st Vial

Count Corrections-

Static Controller: On Luminescence Correction: n/a
Colored Samples: Off Heterogeneity Monitor: n/a
Coincidence Time (nsec): 18 Delay Before Burst (nsec): 75

Half Life-

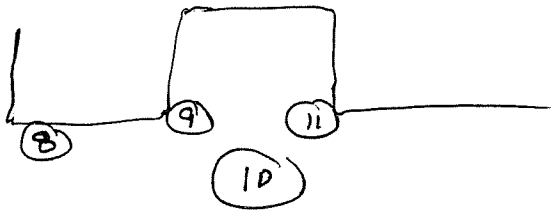
Half Life Correction: Off

Regions	Half Life	Units	Reference Date	Reference Time
A				
B				
C				

Cycle 1 Results

S#	Count Time	CPMA	CPMB	DPM1	DPM2	SIS	tSIE	MESSAGES
Missing vial 1.								
2	1.00	13	14	32	16	28.86	369.72	- Bkg mop water
3	1.00	4	7	9	8	25.02	361.41	- mop bucket 1
4	1.00	13	29	29	35	51.02	328.36	- mop bucket 2
5	1.00	846	6306	0	7809	56.00	322.71	- counts of water from bag
Missing vial 6.								
Missing vial 7.								
8	1.00	162	526	205	626	49.72	469.32	- wipe under ledge
9	1.00	62	173	92	206	44.29	441.63	-

10	1.00	51	133	82	157	44.33	433.12
11	1.00	1857	6792	2362	8188	45.51	393.96
Missing vial 12.							
Missing vial 13.							
14	1.00	13	14	24	16	35.93	517.65



Shaw® Shaw Environmental & Infrastructure, Inc.

By SCB Date 4/12/07 Subject Survey of Area Post Decon B3.298 Sheet No. ____ of ____

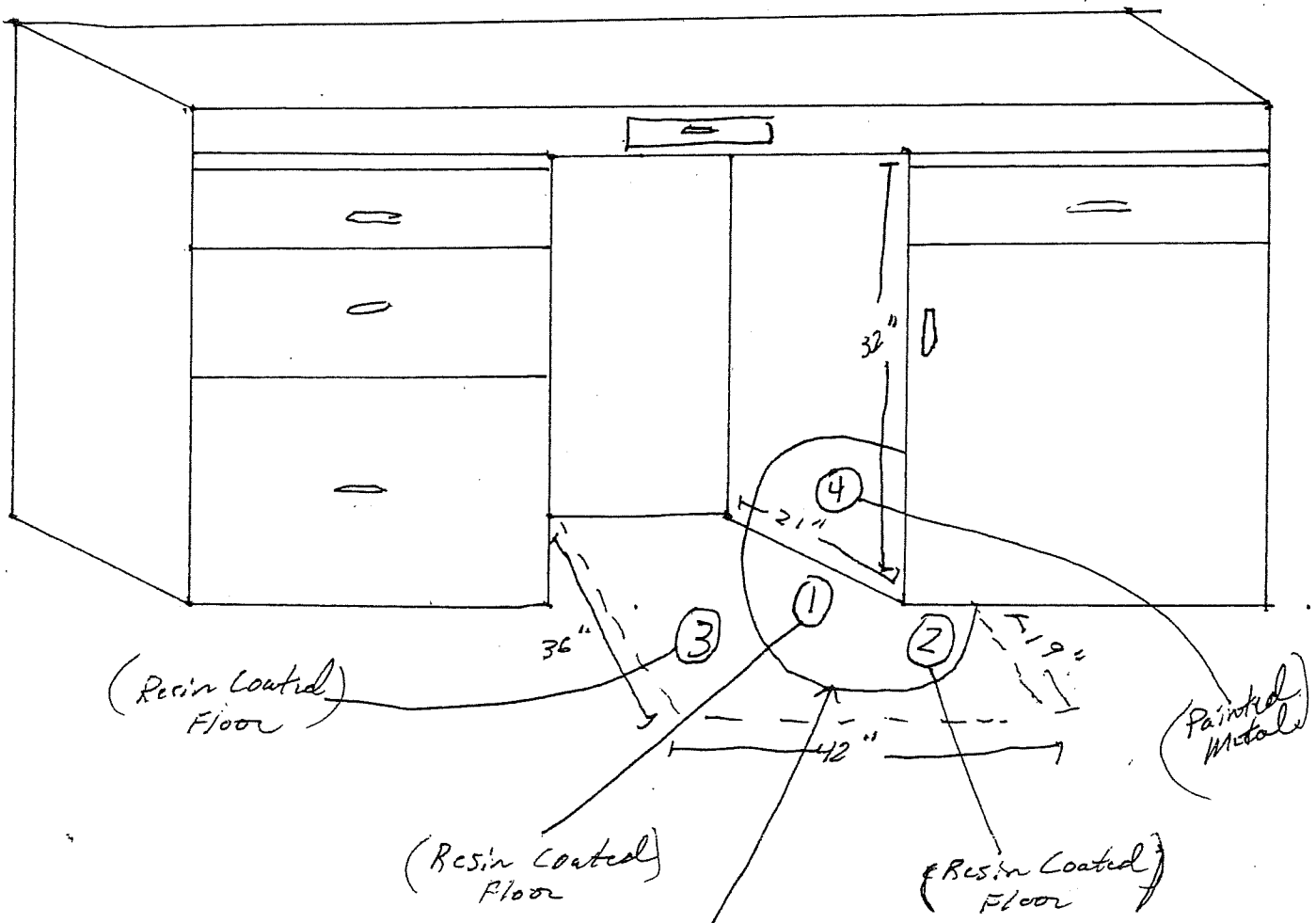
Chkd. By AM Date 4-12-07 Survey # 041207-1 Proj. No. 122089

.25 in. X .25 in.

43.68/PR190298
Material BKG:
Painted Metal: 120.70
Resin Coated Floor: 132.20

Post Decon Survey
South Wall Casework
and Floor

1) LSC BKG
Gross Static Counts
2) 14,795
3) 11,422
4) 1478
5) 14,587



Area inside solid line was above 200 cpm utilizing model 3/44-9.

Incident in B2 API on September 20, 2011

aptuit

Environmental Health and Safety
Incident Report

aptuit

Near Miss Incident/Condition Report

"It all about the people…
…Working together to make a better workplace and improving our lives"

Please fill out form and forward email to the following: kevin.tarwater@aptuit.com; clinton.gregg@aptuit.com; jeff.brinkmeyer@aptuit.com

Name of person making report:	Job Title:	Number of Years at Aptuit:
Clint Gregg	Radiation Safety Specialist II	15

Department:	Aptuit Site Location:	Time of Incident:	Date of near miss incident/condition:
EH&S	KCM	1600	

Near Miss type:
Incident
Condition Spill

General Location at Site: (Area/Lab or Room)
B2 outside B2-166

WHAT HAPPENED? Do your best to describe what happened or what condition is present.
Contamination found on the floor after moving a Cubic Yard box.

WHY DID IT HAPPEN? Thinking objectively describe why you think this happened.

Contamination on outside of lab trash or leaking trash container.

WHAT SHOULD BE DONE? Often we group these in categories. Please select any of the items from each of the categories that you feel may have contributed to the occurance.

Equipment	**Material**	**People**	**Environment** (fill in)
☐ Arrangement	☐ Placement	☐ Placement	
☐ Use of	☒ Handling	☐ Process	
☐ Maintenance	☐ Process	☐ Leadership	

Please describe.
Radioactive contamination found in the hallway outside of the radioactive laboratories after filling a CY box. This was most likely caused by a leaking container. CG shoes were disposed of. Use more caution when filling CY boxes and make sure that everything is in secondary containment.

EH&S Reviewer/Comments:	Date:
Clint Gregg	26 Sep 2011

Incidents in areas previously released from radiological controls

B2-119

B2-112

B2-119

John Stuhler /QKAN/Quintiles
12/08/2004 08:34 PM

To: Kevin Tarwater/QKAN/Quintiles@Quintiles, Mike Sturgeon/QKAN/Quintiles@Quintiles
cc: Randy Press/QKAN/Quintiles@Quintiles
bcc:
Subject: Notification of Radioactive Spill in B2-119

At approximately 4:30 p.m. on Wednesday, December 8, a radioactive spill ocurred during preparation of a suspension dose formulation in the B2-119 Radioisotope Lab. The formulation contained a total of 618 uCi ^{14}C-RA738. Most of the spillage was contained on the benchtop assay mat, but a portion was spilled on the floor with splashing on the adjacent cabinet doors. The spill areas were vigorously cleaned with a scrub pad and a variety of solvents, including Scrubbing Bubbles, Tergazyme, RS235 solution, and methylene chloride. After repeated cleaning, the spill area scanned <200 cpm with a survey meter. A total of 8 swipes were then taken (areas labeled with masking tape) and the LSC results will be available on Thursday, December 9. I will forward the LSC results to you, and take remedial action for any areas that contain >200 dpm.

Best Regards, John

LS-6500 Beckman

ID: DOSE SPILL 9 DEC 2004 10:09

USER: 5 COMMENT: RM#119

PRESET TIME :	5.00						
DATA CALC :	SL DPM	H#	:YES	SAMPLE REPEATS:	1	PRINTER	: STD
COUNT BLANK :	NO	IC#	: NO	REPLICATES :	1	RS232	: OFF
TWO PHASE :	NO	AQC	: NO	CYCLE REPEATS :	1	DISK	:EDIT
SCINTILLATOR:	LIQUID	LUMEX:	NO	LOW SAMPLE REJ:	0	RWM LIST	: OFF
LOW LEVEL :	NO	HALF LIFE CORRECTION DATE:				none	

ISOTOPE 1: 14C %ERROR: 0.00 FACTOR: 1.000000 BKG. SUB: 0

BACKGROUND QUENCH CURVE: Off COLOR QUENCH CORRECTION: On

Quench Limits Low:13.031 High:325.00

SAM NO	POS	TIME MIN	H#	14C CPM	14C %ERROR	14C DPM	14C EFF-1	LUMEX %	ELAPSED TIME	
1	53-1	5.00	49.6	26.20	17.47	**27.61**	94.89	0.25	5.61	Bkg
MISSING SAMPLE										
3	53-3	5.00	48.3	77.60	10.15	**81.73**	94.95	0.09	11.18	- Door 1
4	53-4	5.00	45.2	48.60	12.83	**51.12**	95.08	0.11	16.85	- Door 2
5	53-5	5.00	49.5	80.20	9.99	**84.51**	94.90	0.07	22.52	- Floor 1
6	53-6	5.00	47.5	152.00	7.25	**160.03**	94.98	0.03	28.19	- 2
7	53-7	5.00	45.3	48.00	12.91	**50.49**	95.08	0.11	33.77	- 3
8	53-8	5.00	45.9	44.20	13.45	**46.50**	95.05	0.12	39.33	- 4
9	53-9	5.00	45.7	38.80	14.36	**40.82**	95.06	0.10	44.90	- 5
10	53-10	5.00	46.1	52.20	12.38	**54.92**	95.04	0.09	50.45	- 6

Kevin, here is the LSC data for the rad. spill and re-swipe.

09 Decon Rm

John
x6708

LS 6500 Beckman

ID: DOSE SPILL 9 DEC 2004 13:46

USER: 5 COMMENT:RM#119

PRESET TIME :	5.00						
DATA CALC :	SL DPM	H#	:YES	SAMPLE REPEATS:	1	PRINTER	: STD
COUNT BLANK :	NO	IC#	: NO	REPLICATES :	1	RS232	: OFF
TWO PHASE :	NO	AQC	: NO	CYCLE REPEATS :	1	DISK	:EDIT
SCINTILLATOR:	LIQUID	LUMEX:	NO	LOW SAMPLE REJ:	0	RWM LIST	: OFF
LOW LEVEL :	NO	HALF LIFE CORRECTION DATE:				none	

ISOTOPE 1: 14C %ERROR: 0.00 FACTOR: 1.000000 BKG. SUB: 0

BACKGROUND QUENCH CURVE: Off COLOR QUENCH CORRECTION: On

Quench Limits Low:13.031 High:325.00

SAM NO	POS	TIME MIN	H#	14C CPM	14C %ERROR	14C DPM	14C EFF-1	LUMEX %	ELAPSED TIME	
1	46-1	5.00	51.7	27.00	17.21	28.48	94.80	0.35	5.62	Blq
MISSING SAMPLE										
3	46-3	5.00	41.1	41.60	13.87	43.67	95.25	2.28	11.24	-R1
4	46-4	5.00	42.1	91.60	9.35	96.21	95.21	0.87	16.82	-R2

09Dec04 Rmw

B2-112

March 15, 1996

SUBJECT: Radiation Safety Incident

Two times during the month of February, 1996, animal studies were done using Carbon-14 (^{14}C) Allervax Cedar. Allervax Cedar is a peptide. In the first study, approximately 60% of the ^{14}C-Allervax Cedar was recovered. Study parameters were adjusted and another study was done, to investigate the recovery of the 40%. During the second study it was realized that the animals were exhaling ^{14}C-Carbon Dioxide. These animals were in the autopsy room, and except for 4 animals no precautions were taken to capture the Carbon Dioxide (CO_2). Based on this, an investigation into the amount of airborne ^{14}C-CO_2 was done.

A worst case scenario was used to calculate potential airborne concentrations. Assumptions that were made to ensure a worst case scenario:
1. All 40 animals were in the room for the entire 6 hours. (The protocol called for 18 animals to be sacrificed in the first hour.
2. All the ^{14}C-CO_2 (30%) was generated in the first 6 hours. (Study numbers indicate that 18% is exhaled in the first 6 hours)
3. We know 30% is exhaled, but there is still 10% not accounted for. We assume this all to be exhaled ^{14}C-CO_2. (When we know at least 3% sticks to the syringe).

Using this worse case scenario, the associates in the area, if each person inhaled the total amount in the room, they would have had a dose of 12μCi in the 6 hour timeframe. The Annual Limit of Intake for ^{14}C-CO_2 per the Nuclear Regulatory Commission is 2000μCi/year. [10CFR20.1201(d), 10CFRPart 20 Appendix B]

Note: This was per study. And 2 studies were done. Therefore total potential dose could have been 24uCi ^{14}C-CO_2

Note:
There were 5 associates who actually worked on the study, but other associates did enter the room throughout the study. And based on the fact that other associates in the group might have to work on similar studies in the future it was decided that this information would be presented to all associates. This was done at 1:00 on Friday afternoon.

Possible corrective actions discussed by the group:
1. Do a mass balance study for peptide compounds before the other work is done.
2. Use isolators for the cages that would trap exhaled air.
3. Look at whether radiolabeled compound really needs to be used.

Conclusion 4-6 % Blow-by
Based on info 5-7-96.

Appendix C

Current Radioactive Material Use and Storage Areas

Aptuit LLC
Current Radioactive Material Use and Storage Areas

Area	Types, Quantities, & Forms of Radioactive Material Used or Stored	Timeframe of Use	Uses	Expected Contamination
B2-103A	C-14, H-3 in waste.	From 1995-2005 Incinerator From 2008 to present 103A has been used for rad waste accumulation.	Old incinerator room currently used for rad waste accumulation. Incinerator and incinerator stack are still present.	Elevated readings on the refractory lining of the incinerator are attributable to NORM. The incinerator and stack have been surveyed and the ash has been analyzed. Survey numbers 121306-01 & 121306-03. Survey 121306-01 is the incinerator survey. Direct readings on the refractory brick were elevated (up to 5000 dpm/100 cm2 total). Removable contamination surveys were performed in access port and roof under access port for incinerator stack (<30 dpm). The incinerator room was also surveyed in 1999 by GTS Duratek (Hoechst Marion Roussel, Inc., Kansas City, Missouri, Decontamination and Survey Report, Revison 0, November 1999, GTS Duratek). The floor was found to have a consistent activity of about 800 dpm/100 cm2 attributable to NORM. An ash sample from the burn chamber was collected and analyzed in 2006. All results were below the sample specific minimum detectable concentrations) of 0.078 picocuries per gram (pCi/g) H-3 and 18 pCi/g C-14. An additional ash sample was collected in 2012 from the bottom of the stack and was analyzed for H-3 (8.74 pCi/g) and C-14 (4.35 pCi/g).
B2 API Common	This is the office area adjacent to the API labs. No radioactive materials were used in this area, however a spill (C-14) from API migrated into this area.	2008 to 2012	Office area.	There was a water spill in API (Nov 2, 2008) that resulted in contamination of linoleum and carpet tiles in the API cubicle area. Linoleum was stripped and carpet tiles were removed and replaced. All areas were below Aptuit's release limits after decon.
B2-112	C-14 & H-3 contained in the exhaust HEPA system. B2-112 contains the high-efficiency particulate air (HEPA) filter system (supply and exhaust) that services the API radiosynthesis area. Worst case contamination levels were used to assess potential exposures during remediation activities.	2008 to 2012 The exhaust system is active and will remain so during some D&D efforts in the API area.	HEPA filter room that services B2 API. This area contains both the supply and exhaust filters.	The exhaust system prior to the exhaust HEPAs is contaminated but it has not been fully characterized. Contamination levels in the ductwork and stack beyond the HEPA filters have not been assessed.
B2-116	Low-levels of H-3 and C-14 in LSC cocktail.	2008 to 2012 This area will remain active for support of D&D.	Accumulation room for LSC vials & storage of floor monitor.	No contamination expected.

Area	Types, Quantities, & Forms of Radioactive Material Used or Stored	Timeframe of Use	Uses	Expected Contamination
B2-117	Low level H-3 & C-14 in samples and in instrument performance standards.	2008-2012 This area will remain active for support of D&D.	Liquid scintillation counting of HP samples.	No contamination expected.
B2-119	H-3, C-14 in samples. C-14 instrument check source.	This area will remain active for support of SO demo.	HP office/work area.	This lab was decontaminated in 1999 and was deconned and released with the LAR FSS in 2007. Some of the contaminated legacy ductwork originated in this area. No contamination above site release limits is expected.
B2-155	H-3 and C-14. Millicurie quantities in radiolabeled organic compounds.	2008-2012	This was a GMP lab for synthesis of radiolabeled compounds.	All materials & equipment in the B2 API labs are considered to be potentially contaminated and will be surveyed for release or reuse (shipped to another licensee) or disposed. Routine operational surveys for removable contamination reveal that there is low-level H-3 and C-14 surface contamination throughout the laboratory, but it is generally maintained below 2,000 dpm/100 cm^2 removable. Routine survey areas include floors, hood sashes, hood hand wheels and ledges, and miscellaneous equipment. Biased scoping surveys were performed on December 15, 2011. This survey included assessment of total and removable contamination levels on internal hood surfaces, hood ledges, floors, walls, tables, sinks, and ceiling tiles. Direct measurements were made with a with a Pancake Geiger-Mueller (PGM) detector. The highest average C-14 contamination levels (direct measurements) of 7.4E5 dpm/100 cm2 and 1.2E5 dpm/100 cm2 were found on internal hood surfaces and in sinks, respectively. The highest average removable levels of H-3 and C-14, 7.2E3 dpm/100 cm2 and 4.8E4 dpm/100 cm2, respectively, were found on internal hood surfaces. Similar removable contamination levels were found in the sinks. Average C-14 levels on hood surfaces, sinks, lab benches, floors, and overhead were areas above Aptuit's
B2-156	H-3 and C-14	2008-2012	Airlock for B2-156.	
B2-157	H-3 and C-14. Millicurie quantities in radiolabeled organic compounds.	2008-2012	This was a GMP lab for synthesis of radiolabeled compounds.	
B2-158	H-3 and C-14	2008-2012	Airlock for B2-158.	
B2-159	H-3 and C-14 in stock solutions stored in freezers.	2008-2012	Common area for GMP suites. Some materials were stored in freezers in this area (H-3 and C-14).	
B2-161	H-3 and C-14. Millicurie quantities in radiolabeled organic compounds.	2008-2012	This was a GMP lab for synthesis of radiolabeled compounds.	
B2-162	H-3 and C-14	2008-2012	Airlock for B2-161.	
B2-163	H-3 and C-14. Millicurie quantities in radiolabeled organic compounds.	2008-2012	This was a GMP lab for synthesis of radiolabeled compounds.	
B2-164	H-3 and C-14	2008-2012	Airlock for B2-163.	
B2-165	H-3, C-14. Millicurie to low curie quantities in stock solutions and radiolabeled organic compounds.	2008-2012	This was the radioanalytical QC lab.	
B2-166	H-3, C-14. Typical use 2 mCi to 1 Ci of C-14 in the form of carbonate or KCN as starting material.	2008-2012	Radiosynthesis of labeled organic compounds.	
B2-167	Incidental H-3 and C-14	2008-2012	Access/egress	
B2-167A	Incidental H-3 and C-14	2008-2012	Room added in access/egress. Room 167 was split to provide for better contamination control.	

Area	Types, Quantities, & Forms of Radioactive Material Used or Stored	Timeframe of Use	Uses	Expected Contamination
B2-170	Typical use 2 mCi to 1 Ci of C-14.	2008-2012	Nuclear Magnetic Resonance analysis of radiolabeled materials.	[illegible] acceptable surface contamination level for total activity. Only the walls had average C-14 contamination levels below Aptuit's limits. Average removable H-3 contamination levels on hood surfaces, sinks, and overhead areas exceeded the Aptuit acceptable surface contamination level. Average removable C-14 contamination levels on hood surfaces, sinks, lab benches, and overhead areas exceeded Aptuit's limits.
B3-298	C-14 in HPLC samples. Microcurie quantities. Some contamination on a section of a lab bench and floor.	prior to 2008	Analytical laboratory. A HPLC & hood were used for C-14 project.	There are two documented incidents in B3-298 that resulted in C-14 contamination or the further spread of contamination on a lab bench and a section of the floor. Fixed contamination levels of 100,000 dpm/100 cm2 were noted from the first spill. The second incident was a release of water into the contaminated area, which resulted in removable contamination levels of up to 8,000 dpm/100 cm2. These areas are marked as contaminated, and there is no known contamination outside of these areas. Routine monthly contamination surveys were performed in B3-298 prior to August of 2008. Since that time, the laboratory has not been used for radioactive material studies and has been moved to a semiannual frequency for contamination surveys. Results of routine surveys are consistently below the action limit of 200 dpm/100 cm2 for removable H-3 and C-14. Only contamination found is C-14 in spill area. Spill area: Max removable - 8,000 dpm/100 cm2 General area: Removable <200 dpm/100 cm2
Building B - Dock 5	H-3 and C-14 in packages	1995-2012	Shipping/receiving.	No contamination expected.

Aptuit LLC

Current Radioactive Material Use and Storage Areas

Area	Types, Quantities, & Forms of Radioactive Material Used or Stored	Timeframe of Use	Uses	Expected Contamination
Rad Waste Storage (The Hill)	H-3 and C-14 in waste and on contaminated equipment.	2006- 2012	Storage of waste and contaminated equipment.	Low-level contamination on the floor (<DCGLs).

Appendix D

Historical Radioactive Material Use and Storage Areas

Aptuit

Historical Radioactive Material Use and Storage Areas

Laboratory/Area	Notes	Status
A3-320	Listed as a "use area" in the QKAN Report of Monthly Radiation Contamination Swipe Sampling Report - November 2004. Interviews indicate that this area may have been listed as a "use" area due to the presence of X-ray diffraction equipment. There is no indication that rad materials were used in this lab.	Submitted for unrestricted release in the Aptuit CTS FSSR, February 2012
A3-323	Listed as a "use area" in the QKAN Report of Monthly Radiation Contamination Swipe Sampling Report - November 2004. X-ray defraction room only.	Submitted for unrestricted release in the Aptuit CTS FSSR, February 2012
A3-324	Listed as a "use area" in the QKAN Report of Monthly Radiation Contamination Swipe Sampling Report - November 2004. X-ray defraction room only.	Submitted for unrestricted release in the Aptuit CTS FSSR, February 2012
A3-327	Listed as a "use area" in the QKAN Report of Monthly Radiation Contamination Swipe Sampling Report - November 2004. Interviews indicate that this area may have been listed as a "use" area due to the presence of X-ray diffraction equipment. There is no indication that rad materials were used in this lab.	Submitted for unrestricted release in the Aptuit CTS FSSR, February 2012
A3-340	Listed as a "use area" in the QKAN Report of Monthly Radiation Contamination Swipe Sampling Report - November 2004. Numerous samples (15) were collected throughout the lab including hoods, sinks, scales. C-14 used from 1989-1999. Most material removed in 2000. Interviews indicated that rad use was only in refrigerator located by the doorway between 340 and 341. A characterization survey was performed in 2004 with no contamination found. Additional surveys were performed in April 2010. No contamination was found.	Submitted for unrestricted release in the Aptuit CTS FSSR, February 2012

Aptuit

Historical Radioactive Material Use and Storage Areas

Laboratory/Area	Notes	Status
A3-341	This lab has not been on the routine survey schdule since 2004. Interviews indicated that lab was used for FTIR or HPLC analysis (C-14) for about 2 years (maybe 1994-1996). Other interviews (Kindel) indicated C-14 use as late as 2004-2005. Areas involved included a prep area on a work bench and the location of the instrument (adjacent work bench). Additional surveys were performed in April 2010. No contamination was found.	Submitted for unrestricted release in the Aptuit CTS FSSR, February 2012
A3-348	Document storage center. Rad labeled animal samples (slices) were found stored here. All samples have been removed and the area surveyed.	Submitted for unrestricted release in the Aptuit CTS FSSR, February 2012
A3-367	C-14 former use. Final Status Survey (FSS) was performed by Shaw. FSSR report was issued May 2006.	Area was released from radiological controls in May 2006.
A3-394	Found daily survey record. C-14 1996. It's unclear if this is A3-394 or some other area. Area was added to impacted list for FSS.	Submitted for unrestricted release in the Aptuit CTS FSSR, February 2012
A Building Potentially contaminated legacy ducts (from A3-341)	Aptuit researched and labeled ducts. Ducts, stacks and fans have been traced & labeled. Surveys performed in November 2011 confirm that the legacy ducts are not contaminated.	Released
A building stacks	Surveys performed. Stacks not impacted.	Released
A building Dock 1	Radioactive materials were shipped/received at this dock. No uncontained materials handled here. Characterization surveys and final status surveys perfomed.	Submitted for unrestricted release in the Aptuit CTS FSSR, February 2012
A Mezzanine (loft)	C-14. Several pieces of rad labeled equipment (hot plate, motor & shaft, microscope) found in February 2009. Only the motor & shaft were found to be contaminated. ECDs (Ni-63) were stored there. The ECDs were leak tested (not leaking) and disposed. Characaterization and final status surveys performed.	Submitted for unrestricted release in the Aptuit CTS FSSR, February 2012
A building roof	Surveys performed. Roof not impacted.	Released

Laboratory/Area	Notes	Status
B2-119, 120, 122	A "3 room suite" consisting of Rooms 119, 120, and 122 was mentioned in the application for Amendment No. 8 as being radioactive materials use areas. Rooms 120 and 122 were not mentioned in any prior investigations as been potentially impacted. Room 119 is part of the SO decommissioning.	Scoping surveys performed in February 2013 confirm that Rooms 120 and 122 are not impacted. These rooms are part of the current B2-121, 122, and 134.
B2-179	Room was numbered wrong. Use area was actually B2-180. It has been corrected in the license.	Not impacted
B2-180	Possibly some C-14 use. Primary use was I-125. I-125 prep room using uCi amounts to label plates. Room was numbered wrong (179). Use area was actually B2-180 not B2-179. Work with I-125 completed in February 2010.	Submitted for unrestricted release in the Aptuit CTS FSSR, February 2012
B2-181	C-14, I-125. Plates set up & counted. Work with I-125 was completed in February 2010. All M&E from B2-180 that was used for I-125 work has been moved here.	Submitted for unrestricted release in the Aptuit CTS FSSR, February 2012
B2-182	Daily survey - H-3. Surveys were performed for H-3 between January 1996 and March 1999. There were 4 occassions between June 1998 and March 1999 when H-3 contamination was found (up to 946 dpm).	Submitted for unrestricted release in the Aptuit CTS FSSR, February 2012
B2-189	I-125 and maybe C-14 stored in freezer. It appears that the only "use" was storage of C-14 in the Deli case refrigerator. C-14 was not used in B2 (Liz Rombach).	Submitted for unrestricted release in the Aptuit CTS FSSR, February 2012
B2-194	C-14. Storage of API in low temperature freezer. Last removed in 2006. I-125 was also stored in the freezer (Liz Rombach).	Submitted for unrestricted release in the Aptuit CTS FSSR, February 2012
B2-195	Pipe chase. Vents from B2-119 marked RAM.	Submitted for unrestricted release in the Aptuit CTS FSSR, February 2012

Laboratory/Area	Notes	Status
B3 labs (250-270)	These labs were demo'd around 2001 and may not have been used for rad work. These may be the same labs listed below that had some indication of rad use (e.g. survey form) but no building number associated with them. B3-current labs 252, 270 encompass former labs 250, 251, 252, 253B, 254, 255, 266, 267, 270, 272, 273, and 275.	Submitted for unrestricted release in the Aptuit CTS FSSR, February 2012
B3-268	Listed as a "use area" in the QKAN Report of Monthly Radiation Contamination Swipe Sampling Report - November 2004. Submitted to the NRC with Amendment 27 as a "use" area. Former location of the LSC. A characterization survey was performed in 2004 with no contamination found.	Submitted for unrestricted release in the Aptuit CTS FSSR, February 2012
B3-268 (F)	Listed as a "use area" in the QKAN Report of Monthly Radiation Contamination Swipe Sampling Report - November 2004. Submitted to the NRC with Amendment 27 as a "use" area. This is a walkin freezer where rad materials are stored . The floor was found to be contaminated and it was painted (by Purdum). Floor stripped and surveyed.	Submitted for unrestricted release in the Aptuit CTS FSSR, February 2012

Laboratory/Area	Notes	Status
B3-274	C-14. HPLC & balance located in lab for one project. Both were moved to B2 API. The position of the contaminated balance in this lab is in question. Routine surveys are conducted on the west end of the lab; however work with radioactive materials was reportedly done on the east side as well. A hot refrigerator was also removed from 274. Based on interviews there was an attempt to de-post the area (early to mid 2000s), however it could not be de-posted due to contamination on the benchtop (Penny McCambell). There was a spill near prep-HPLC/marble table where balance was located. Detectable C-14 contamination (<1000 dpm/100 cm2) was found on bench tops of center island and the bench to the right as you enter the lab (Memo from Michael Carr, GTS Duratek dated 6/3/99). A compilation of "exceedances" for B3-274 indicate C-14 contamination up to 6000 dpm/100 cm2 on VBE and on the north wall at sink (300 dpm/100 cm2).	Submitted for unrestricted release in the Aptuit CTS FSSR, February 2012
B3-275	Former use indicated during interviews and mentioned in 1991 NRC inspection report. Daily survey indicated use with Ca-45 & I-125. Areas may have been demo'ed around 2001.	Submitted for unrestricted release in the Aptuit CTS FSSR, February 2012
B3-278	Former use indicated during interviews (Pam Barton) and mentioned in 1991 NRC inspection report. Fixed C-14 contamination (<1000 dpm/100 cm2) found on most bench tops (Memo from Michael Carr, GTS Duratek dated 6/3/99). Areas may have been demo'ed around 2001.	Submitted for unrestricted release in the Aptuit CTS FSSR, February 2012
B3-295	Some indication of rad use. Hood and bench tops had fixed C-14 contamination (up to 38,000 dpm/100 cm2). One area had low level (<200 dpm/100 cm2) H-3 contamination (Memo from Michael Carr, GTS Duratek dated 6/3/99).	Submitted for unrestricted release in the Aptuit CTS FSSR, February 2012
B3-297	Some indication of rad use.	Submitted for unrestricted release in the Aptuit CTS FSSR, February 2012

Laboratory/Area	Notes	Status
E-205	Former limited use of C-14. HPLC & balance moved to B2 API. From multiple interviews the only use was from sampling in a hood for three projects, the last of which, resulted in contamination of the hood (2005-2005). The hood was removed. No rad work since then.	Submitted for unrestricted release in the Aptuit CTS FSSR, February 2012
E 208 (warehouse)	Several C-14 samples found in warehouse. All items were in secondary containment. No loose contamination.	Submitted for unrestricted release in the Aptuit CTS FSSR, February 2012
E-222	Former use. One rad study was performed in this area in an isolation chamber. The internals of the chamber were contaminated and the chamber was disposed as radioactive waste. No other known uses in this area.	Submitted for unrestricted release in the Aptuit CTS FSSR, February 2012
E-250	There was a contaminated scale in this area but no other use reported according to interviews.	Submitted for unrestricted release in the Aptuit CTS FSSR, February 2012
E-253	Former use. Cheryl Fox. This is a clean room and has undergone numerous (hundreds) of cleanings since use of material. Chances of loose contamination are remote.	Submitted for unrestricted release in the Aptuit CTS FSSR, February 2012
E-260	Former use. Cheryl Fox. Use in this area has been called into question by Peggy Pierce. She does not recall any rad use in this room.	Submitted for unrestricted release in the Aptuit CTS FSSR, February 2012
Lab Animal Resources (LAR) - B2-111, 112, 114, 115, 116, 117, 119, 123, 124, 125, 126, 127, 128, 129, 130, 131, 132, 136, 137A, 137B, 140, 142,	The LAR comprised approximately 19,000 square feet on the second floor of B Building (B2). Work with radioisotopes ceased in LAR in October 2006 and surveys were performed October 30 through December 15, 2006 as part of Final Status Survey (FSS) activities conducted at the site. The results of the release surveys in LAR are presented in the FSS Report (Final Status Survey Report, LAR and L Building, Aptuit, Incorporated, Kansas City, Missouri, prepared by Shaw Environmental, Inc., January, 2007).	Released for unrestricted use via FSSR, January 2007.

Laboratory/Area	Notes	Status
143, 148, 150A, 150B, 153, 155, 156, 158, 159, 160, 161, 162, 163, 164, 165, 166, 167, 168, 169, 170, 171		
L Building - L3-321 ,L3-322, L3-323, L3-324, L3-325, L3-326A, L3-326B, L3-327, L4-419, L4-420, L4-421a, L4-422a, L4-423, L4-424, L4-425, L5-520, L5-521, L5-522, L5-523, L5-524, L5-525, L5-526a, L5-527, L5-528	Lab L4-422 - FSSR May 2005 – FSSR January 2007 Lab L5-526 – FSSR June 2006 L Building	Released for unrestricted use via FSSR, January 2007 and from the License via Amendment 25 to the NRC license.

Appendix E

Aptuit Decommissioning Work Instructions

1. PURPOSE

This procedure describes methods and techniques to be employed when performing surface contamination surveys for Aptuit, LLC (Aptuit) decommissioning activities.

2. APPLICABILITY

This procedure applies to decommissioning activities being conducted at Aptuit by Shaw Environmental, Inc. (Shaw) personnel and its subcontractors.

3. REFERENCES

3.1 Aptuit Radiation Safety Program Manual, March 2008

3.2 Manufacturers' operating manuals

3.3 Instruction manual for Packard Tri-Carb 2900 TR Liquid Scintillation Analyzer.

4. DEFINITIONS

TERM/ACRONYM	DEFINITION
^{14}C	carbon-14
FSS	final status survey
IPA	instrument performance assessment
MDC	minimum detectable concentration
PHP	Project Health Physicist
PPE	personal protective equipment
QC	quality control
SS	Site Supervisor
ST	Survey Technician
^{3}H	tritium

5. RESPONSIBILITIES

5.1 Project Health Physicist

The Project Health Physicist (PHP) is responsible for the maintenance and management of this procedure.

5.2 Site Supervisor/Survey Coordinator

The Site Supervisor (SS) will be responsible for the field oversight of the Survey Technicians (ST) performing this procedure. A Shaw Health Physicist or Radiological Control Technician will be designated for this position. The SS/SC is responsible for the supervision of data collection activities, including surveys and samples. Specific responsibilities include:

- Selecting proper equipment for the performance of defined data collection activities
- Ensuring properly calibrated and tested equipment is available for the performance of survey/sampling tasks
- Ensuring the proper establishment of reference and sample grids
- Determining locations for biased sample collection and direct measurement
- Reviewing collected data for accuracy and verifying the completion of data collection for each survey unit.

5.3 Survey Technicians

STs will be responsible for the field execution of this procedure and for addressing any issues or suggested modifications with the SS or PHP.

The ST is responsible for the proper execution of survey and sampling activities. Specific responsibilities include:

- Ensuring all portable instrumentation is properly calibrated and checked prior to use
- Performing all data collection activities in full compliance with the established protocols
- Properly documenting all survey/sampling activities.

6. EQUIPMENT AND MATERIALS

- Preprinted survey unit and laboratory survey maps and data forms (plan view of area, items or equipment to be surveyed)
- Paper liquid scintillation smears
- Metal or plastic laboratory tweezers
- Properly prepared liquid scintillation vials containing 17 milliliters of scintillation cocktail
- Gloves, safety glasses
- Ludlum Model 2360 scaler/ratemeter with a Model 43-37 gas proportional probe with 0.8 milligram per square centimeter window for floor monitoring or functional equivalent
- Ludlum Model 2360 scaler/ratemeter with a Model 43-68 probe with 0.4 milligram per square centimeter window or functional equivalent
- Ludlum Model 3 ratemeter with Model 44-9 PGM or functional equivalent
- Packard TriCarb 2900 TR liquid scintillation counter (or equivalent).

7. PREREQUISITES

- Ensure that all instrumentation is properly calibrated and operating properly in accordance with Aptuit Work Instruction WI-002 and manufacturer procedures.
- Ensure STs have proper personal protective equipment (PPE) for area to be surveyed based on area postings and site control requirements.
- Ensure the job hazard analysis has been conducted for the survey/sampling activities and that all workers are properly briefed on the hazards anticipated.
- Review previous surveys of the survey unit, if available, to determine radiological conditions within the survey unit prior to entry.
- STs will be instructed regarding the quality control (QC) measure/sample requirements prior to performing any survey or sampling activity.
- STs will be instructed on the potential radiological hazards that may be present in the survey units.

NOTE: Minimum PPE for performance of survey/sampling activities will be latex or nitrile gloves, and safety glasses.

8. INSTRUCTIONS

8.1 Scan Surveys

The scan survey may include materials and equipment, floors, countertops, wall surfaces, fume hoods and exhaust system components.

This survey will be performed as follows:

- Verify the instrument has been calibrated and set up in accordance with Aptuit Work Instruction WI-002 and manufacturer's technical manual prior to use.
- With the instrument in operation, at the rate required to meet the calculated beta scan minimum detectable concentration (MDC), and at a height of no greater than 1 centimeter, move the detector over the surfaces across the area to be surveyed. Using the audible response of the instrument, locate the area of maximum count rate for each area and/or grid surveyed and document the instrument reading at that location on the survey map.
- For final status surveys (FSS), any location where the detector reading is twice the material background will be flagged with a small piece of masking tape marked with the word "SCAN," the meter reading in counts per minute, the background reading in counts per minute, and the initials of the person performing the survey. The anomalous reading will also be noted on field paperwork.

8.2 Direct Measurement Surveys

- Verify that the required instrument/detector combination has been calibrated and set up in accordance with Aptuit Work Instruction WI-002 and manufacturer's technical manual prior to use.
- Place the detector directly on the surface to be surveyed at the desired location. With the instrument operating in "Scaler" mode, take a measurement at the selected sample point for

count time determined during instrument setup required to meet static MDC requirements for the parameter being measured. MDCs will be no greater than 50 percent of the applicable derived concentration guideline level. Document the direct surface contamination reading measured at the location on the survey data forms.

8.3 Wipe Surveys

Wipe sampling for removable contamination will be conducted during decommissioning activities. Samples will be taken and then transported to the on-site laboratory for analysis in accordance with Aptuit Work Instruction WI-003. The sample method for beta contamination smears will be a paper smear technique.

- Survey/Sampling Technician will change into new gloves as needed.
- Obtain prepared scintillation vials with 17 milliliters of scintillation cocktail added to each vial by the on-site laboratory.

  Note: Project requirements may dictate another other sample media and configurations for special cases. In any case, the volume used in the prep blank, laboratory control sample, and spikes should be the same as that used for the samples.
- Remove a single smear and wipe the smear over an area of approximately 100 square centimeters (wipe a square area of approximately 4 inches by 4 inches or an "S" pattern approximately 16 inches long).
- Once the wipe is performed, quickly place smear into an individual prepped scintillation vial.
- The lid of the scintillation vial containing the smear will be marked with a unique number identifying the sample location. The vials will be transported to the laboratory for counting and activity determination.

8.4 Quality Control Measurements/Samples

QC measurements and samples will be performed/collected in a manner consistent with the work plans. The survey/sampling technician performing each survey will be given instruction regarding the QC sample requirements for the sampling activity being conducted. For FSS direct measurements, replicate samples are used to measure operator and/or instrument precision and provide an estimate of precision for the operator and procedure used to perform the measurement. For the FSS, replicates to measure operator precision will be performed using the same instrument at the same location. One replicate direct reading will be performed for every 20 direct readings taken. For contamination smears, sampling precision will be checked through recounting of smears, and one smear will be recounted for every 20 smears collected. Relative percent difference values shall be less than 20 for direct readings and less than 30 for smears.

An automatic instrument performance assessment (IPA) will be performed each day of liquid scintillation counter operation. IPA monitors the system background, efficiencies for both tritium (^{3}H) and carbon-14 (^{14}C), Figure of Merit (E^2/B) and Chi-squared values for both ^{3}H and ^{14}C. IPA is performed using ^{14}C and ^{3}H quenched standards and a background standard. Instrument operation must be within pre-established limits.

For FSS samples, QC samples consisting of background and $^{3}H/^{14}C$ spikes will be counted with each liquid scintillation counter sample batch. Relative bias will be determined by comparing the

results obtained from the $^{3}H/^{14}C$ spike sample run with the sample batch. Bias measurements should be within plus or minus 20 percent.

8.5 Waste Management

Waste streams associated with survey and sampling activities include used PPE (gloves) and liquid scintillation cocktail. If not suspected of being contaminated, PPE items will be disposed as trash. If contamination is suspect based on survey data, PPE will be bagged as potentially radioactive waste and turned over to the Aptuit Radiation Safety Officer for disposition. Scintillation cocktail waste will be managed by Aptuit personnel.

8.6 Documentation of Surveys and Wipe Samples

The SS is responsible to see that, once a survey is completed, all survey data forms and field paperwork is reviewed.

9. ATTACHMENTS

None

10. FORMS

Survey Forms

11. REVISION HISTORY AND APPROVAL

Rev Level	Rev Date	Rev Description	Approver
0	8/7/12	Initial Issue	_____ Project Health Physicist _____ Site Supervisor

1. PURPOSE

This Work Instruction (WI) describes the requirements for pre-operational inspection and routine verification of operability prior to the use of radiation survey instruments at Aptuit, LLC for the detection of carbon-14 (^{14}C).

2. SCOPE

This WI provides standard practices and operating procedures for the instruments listed in Table 1 and equivalent instruments. This document provides the minimum required steps and quality checks that all employees and subcontractors are to follow when operating these instruments. Proper control, calibration, and daily checks of these instruments ensure that operating parameters demonstrate compliance with applicable data quality requirements and/or regulations. Also provided in this WI are instructions for the documentation of instrument performance and survey data. Use of these detectors is for performance of surveys during decommissioning activities at Aptuit, LLC.

Table 1: Portable Instruments

DETECTORS	DETECTOR TYPE	TYPICAL METERS		USE
Ludlum 43-68	126 cm^2 Gas-flow proportional	Ludlum 2360	Ludlum 2221	Scanning and static measurements of beta surface contamination
Ludlum 43-37	584 cm^2 Gas-flow proportional	Ludlum 2360	Ludlum 2224	Scanning for beta surface contamination
Ludlum 44-9	Geiger-Mueller Pancake	Ludlum 3	Ludlum 12	Scanning for beta surface contamination

cm^2 – Square centimeter

3. REFERENCES

3.1 Aptuit Radiation Safety Program Manual, March 2008

3.2 Manufacturers' operating manuals

3.3 U.S. Nuclear Regulatory Commission, 2003, ***Consolidated NMSS Decommissioning Guidance: Characterization, Survey, and Determination of Radiological Criteria***, NUREG 1757, Vol. 2, September.

4. DEFINITIONS

TERM/ACRONYM	DEFINITION
Background Radiation	Radiation that occurs naturally in the environment. Background radiation consists of cosmic radiation from outer space, or radioactive elements in geological media, building material, or other natural sources, including radon and its decay products in air and global fallout as it exists in the environment from the testing of nuclear explosive devices or from past nuclear accidents such as Chernobyl that contribute to background radiation and are not under the control of the licensee. "Background" radiation does not include radiation from source, byproduct, or special nuclear material regulated by the Nuclear Regulatory Commission.
Beta Radiation	Beta particles (β) emitted by some radionuclides while undergoing radioactive decay. With few exceptions, beta-emitting radionuclides also emit photons (gamma or x-ray) during decay. Beta particles cannot penetrate human skin but do pose a hazard to the skin and lenses of the eye.
Ionizing Radiation	Alpha particles, beta particles, gamma rays, neutrons, energetic electrons or protons, and other particles capable of producing ions when interacting with matter.

5. RESPONSIBILITIES

Project Health Physicist

The Project Health Physicist is responsible for the maintenance and management of this procedure, including selection of appropriate instrumentation to meet the data quality objectives of the project.

Site Supervisor/Survey Coordinator

The Site Supervisor (SS)/Survey Coordinator is responsible for the oversight of the Survey Technicians (ST) operating these instruments. The SS is also responsible for making sure STs are following this procedure as described herein.

Survey Technicians

The STs are responsible for compliance with this work instruction, recognizing instrumentation problems and notifying the SS or Project Health Physicist of malfunctioning instruments. STs shall

understand project investigation levels and release criteria and know how to compare instrument response to the applicable investigation levels or release criteria.

6. PROCEDURE

6.1 Ratemeter Pre-Operational Requirements

Instruments are calibrated and operated in accordance with manufacturers' instructions. Instruments are set up and function checked each day of use in accordance with this work instruction.

6.1.1 Calibration Verification

All portable radiological instruments shall have an approved, current calibration label. Calibration verification shall be performed prior to the use of the instrument.

6.1.2 Physical Check

A physical check of radiological instruments is an inspection of the general physical condition of each instrument and detector. A physical check shall be performed prior to using a radiological instrument.

The physical check should include inspecting the instrument for loose or damaged knobs, buttons, cables, and connectors; broken/damaged meter, movements/displays; dented or corroded instrument cases; punctured/deformed probe/probe windows, cables, etc.; and any other physical impairments that may affect the proper operation of the instrument or detector. Any instrument or detector having a questionable physical condition shall not be used until the condition is properly corrected.

The instrument, cable, and detector as calibrated should be kept together as a unit. Do not swap components. However, cables of equal length may be replaced if defective without affecting the calibration of the instrument.

6.1.3 Battery Check

A battery check is performed to help ensure that sufficient voltage is being supplied to the detector and instrument circuitry for proper operation. This check shall be performed in accordance with the instrument's technical manual.

6.1.4 High Voltage Check

The high voltage (HV) is adjusted during instrument calibration; additional adjustment for normal operation is not required. However, an HV check is required prior to each use in accordance with the specific instrument technical manual. For some instruments, an HV check in the field is not possible. An instrument with suspected HV problems shall be immediately reported to the SS.

6.1.5 Response Source Check

A response source check is performed to ensure that the instrument will accurately respond to a known source of radiation. Obtain a check source of the proper size, type, and activity for the instrument/detector being used and perform the response source check as follows:

1. Determine the background radiation level. It must be low enough to allow a measurable response to the check source being used. Careful monitoring of changing background levels is necessary to obtain accurate instrument readings.

2. Begin with the instrument on the highest range/scale and energize the audible device, if applicable.
3. Slowly move the detector towards the check source and check the instrument for an increase in audible and/or visual response.
4. Change the range/scale of the instrument as appropriate to obtain a readable indication and to check each of the meter ranges/scales. If an appreciable response cannot be obtained (even in the lowest range), evaluate instrument performance by comparison to previous source check data for the instrument. If no previous source check data are available, comparison should be made to the data associated with similar instruments in use. Notify the SS of any instrument/detector response problems. Document the response on the Ratemeter Daily Instrument Check Sheet. Plot the response on the Control Graph at the bottom of the Ratemeter Daily Instrument Check Sheet.
5. The SS or designee shall set up the control graph on the Ratemeter Daily Instrument Check Sheet such that lines indicate when an instrument is outside of the +/- 20 percent variability.
6. Instruments with day-to-day responses that vary by more than 20 percent under identical conditions shall be removed from service. Notifying the SS of such a condition is required.

A ratemeter-type instrument and detector used to perform measurements for the documentation of a release survey must meet the requirements of Section 6.2 for scaler-type instruments.

Ratemeter instrument inspections, performance verifications, and corrective actions shall be recorded on the Ratemeter Daily Instrument Check Sheet prior to use.

6.2 Surface Contamination Survey Instruments

Ludlum Model 2360 or Model 2224 meters with either Ludlum 43-68 or Ludlum 43-37 detectors will be prepared for use in accordance with the following steps. Also applicable are Ludlum Model 3 or Model 12 meters with a Ludlum 44-9 detector.

6.2.1 Surface Contamination Survey Instrument Pre-Operational Requirements

Prior to the use of these instruments and detectors, the following inspections/operational verifications shall be performed in addition to those required in Section 6.1 for ratemeter-type instruments (i.e., calibration verification, physical check, battery check, HV check).

6.2.2 Background Measurement (Initial Project Setup)

1. Select the desired counting time. The selected time must be consistently used to perform all source and sample counting operations. The counting time directly influences the Minimum Detectable Concentration (MDC) obtained for the instrument. Although the counting time must be long enough to obtain the desired MDC, it must be short enough to be practical. The background measurements should be performed in conjunction with the MDC calculations.
2. Perform the background measurement for the selected time period (t_b) and record the total counts measured on the Scaler Instrumentation Setup Form.
3. Repeat the background measurement 10 times. Record the total counts observed for each measurement..

4. Calculate the average background counts ($\overline{C_b}$) and the standard deviation (SD_b):

$$\overline{C_b} = \frac{\sum_{i=1}^{N} C_{b_i}}{N} \qquad SD_b = \sqrt{\frac{\sum_{i=1}^{N} (C_{b_i} - \overline{C_b})^2}{N - 1}}$$

Where:

$\sum_{i=1}^{N}$	=	Summation of item 1,2,3…N
$\overline{C_b}$	=	Average number of background counts
SD_b	=	Standard deviation of the background counts
N	=	Number of measurements
C_{b_i}	=	Background counts 1, 2, 3 … N.

5. Record the average background ($\overline{C_b}$), background count time (t_b), and the standard deviation (SD_b) on the Scaler Instrumentation Setup Form.

6. Divide $\overline{C_b}$ by t_b to determine the average background count rate in cpm ($\dot{C}_b$), and record the result on the Scaler Instrumentation Setup Form.

Background is checked at the beginning and end of each workday the instrument is used. Acceptable background response is assessed using the following equation:

$$C_b = \overline{C_b} \pm 3SD_b$$

Where:

$\overline{C_b}$	=	Average background counts
SD_b	=	Standard deviation of the average background counts.

If the background measurement is satisfactory, continue. If the background measurement does not meet this criterion, immediately notify the SS. Record the background measurement on the Scaler Daily Instrument Check Sheet.

6.2.3 Source Response (Initial Project Setup)

Determine the detector source response with a source of known activity of a nuclide with energy decay products similar to those of the nuclide to be monitored, as follows:

1. Correct the source activity for radioactive decay (when necessary) as follows:

$$A = A_o e^{-\lambda T} \quad Where: \lambda = \frac{0.693}{t_{\frac{1}{2}}}$$

Where:

A	=	Present source activity
A_o	=	Source activity at initial assay
λ	=	Decay constant for the source isotope
T	=	Time elapsed since initial source assay
$t_{1/2}$	=	Source isotope half-life.

NOTE: Time units must be consistent (days, hrs., mins., etc.)

2. Count the source for the same time period (t_s) selected during the background measurements (see Section 6.2.2, step 2).

$$\overline{C}_g = \frac{\sum_{i=1}^{N} C_{g_i}}{N} \qquad \overline{C}_n = \overline{C}_g - \overline{C}_b$$

$$SD_g = \sqrt{\frac{\sum_{i=1}^{N} (C_{g_i} - \overline{C}_g)^2}{N - 1}} \qquad SD_n = \sqrt{(SD_g)^2 + (SD_b)^2}$$

At project setup or as otherwise directed by the project-specific work plans or instructions, or the SS, count the source 10 times and calculate the average net counts ($\overline{C_n}$), the standard deviation of the average gross counts (SD_g), and the standard deviation of the average net source counts (SD_n):

Where:

C_{g_i}	=	Gross Source Counts (total counts observed including background) 1 through N
$\overline{C_b}$	=	Average background counts
$\overline{C_g}$	=	Average gross counts
$\overline{C_n}$	=	Average net counts
SD_n	=	Standard deviation of the average net counts
SD_g	=	Standard deviation of the average gross counts
N	=	Number of measurements
SD_b	=	Standard deviation of the average background counts
$\sum_{i=1}^{N}$	=	Summation of item 1,2,3…N.

Record the gross counts (C_{g_i}, where i =1 to N), $\overline{C_n}$, and the standard deviations (SD_n and SD_g) on the Scaler Instrumentation Setup Form.

3. Divide $\overline{C_n}$ by t_s to determine the average net count rate ($\dot{C}_n$) and record the rate on the Scaler Instrumentation Setup Form.

Source response is checked at the beginning and end of each workday the instrument is used. Acceptable source response is assessed using the following equation:

$$C_g - C_b = C_n = \overline{C_n} \pm 3SD_n$$

Where:

$\overline{C_n}$ = Average net counts

C_n = Net Source Count

C_b = Daily Background counts

SD_n = Standard deviation of the average net counts

$$SD_n = \sqrt{(SD_g)^2 + (SD_b)^2}$$

If the source measurement is satisfactory, continue. If the source measurement does not meet this criterion, immediately notify the SS. Record the source measurement on the Scaler Daily Instrument Check Sheet.

6.2.4 Instrument Efficiency

Record the 2 pi instrument efficiency (ε_i) from the instrument Calibration Certificate on the Scaler Instrumentation Setup Form.

6.2.5 Calculation of Minimum Detectable Concentrations

The calculated MDC is determined to ensure that the detector being used will detect the presence of activity at or above the allowable limit under a given set of counting conditions. The MDC is the concentration that a specific instrument and technique can be expected to detect 95 percent of the time under actual conditions of use. MDC is based on the estimated detector efficiency, sample quantity, and the counting time.

The MDC of each instrument shall be determined upon initial setup of the counting system and as needed following modification, calibration, repair, or replacement (i.e., new detector, cables, calibration, etc.). An MDC may need to be determined on specific materials that exhibit a different background than at initial setup. The PHP shall be contacted to determine if an MDC determination is necessary for specific materials.

For scanning building surfaces, the MDC_{scan} should be determined using the following equation (using a value recommended in Appendix A of U.S. Nuclear Regulatory Commission, NUREG-1757, Vol. 2, "Consolidated NMSS Decommissioning Guidance," for the index sensitivity d' of 1.38, which is for 95 percent detection of a concentration equal to MDC_{scan} with a 60 percent false positive). The background collection times shall be at least 1 minute, to ensure consistent data collection.

1. Calculate the MDC_{scan} in disintegrations per minute (dpm)/100 square centimeters (cm^2):

$$MDC_{scan}\left(building\ \ surfaces\right)=\frac{1.38\sqrt{C_{bscan}}*60}{\sqrt{p}*\varepsilon_i*\varepsilon_s*t_{scan}*\left(A/100\,cm^2\right)}$$

Where:

1.38	=	Index of sensitivity d'
$\overline{C_{bscan}}$	=	Average background counts in time interval t_{scan}
p	=	Surveyor efficiency (0.5)
ε_i	=	Instrument Efficiency for the emitted radiation
ε_s	=	Source Efficiency in emissions/disintegration (0.25 for ^{14}C)
t_{scan}	=	Sample count time, time interval of the observation while the probe passes over the source in seconds.
A	=	Active area of probe in cm^2.

2. Record the calculated MDC_{scan} on the Scaler Instrumentation Setup Form.
3. For static measurements of surface concentrations by either direct measurement or by a smear sample, the MDC_{static} should be determined using the equation from NUREG-1507. The sample collection times should be the same as the selected background times in Section 6.4.1, step 2, if practical. The SS shall consult with the PHP for all other conditions.
4. Calculate the MDC_{static} in dpm/$100cm^2$:

$$MDC_{static}=\frac{3+4.65\sqrt{C_{bstatic}}}{K\left(t_{static}\right)}=\frac{3+4.65\sqrt{C_{bstatic}}}{\varepsilon_i*\varepsilon_s*(A/100cm^2)*t_{static}}$$

Where:

$\overline{C_{bstatic}}$	=	Average background counts during time interval t_{static}
t_{static}	=	Sample counting time, time interval in min. the probe is in direct contact with the surface or smear
K	=	$\varepsilon i*\varepsilon s*(A/100)$ A calibration constant (best estimate) to convert counts/min to dpm/100 cm^2.
A	=	Probe's sensitive area, in cm^2
ε_i	=	Instrument Efficiency for the emitted radiation
ε_s	=	Source Efficiency in emissions/disintegration (0.25 for ^{14}C).

5. Record the calculated MDC_{static} on the Scaler Instrumentation Setup Form.

The calculated MDC_{static} should be less than 50 percent of the appropriate derived concentration guideline level, and while there is no specific recommendation of MDC_{scan}, it should be no more than 50 percent of the appropriate derived concentration guideline level if possible. If the desired MDC

cannot be attained, inspect the instrument for equipment problems (contaminated detector or sample holder, loose cables/connectors, etc.) and notify the PHP. If no equipment problems are found, parameters such as sample quantity, count time, or background radiation levels may have to be adjusted appropriately to obtain an acceptable MDC. If reasonable adjustment of these parameters (as directed by the Radiation Safety Officer) does not result in an acceptable MDC, a more suitable instrument/detector shall be used.

Static counts are reported in dpm/100 cm^2.

7. FORMS

Ratemeter Daily Instrument Check Sheet

Scaler Instrumentation Setup Form

Scaler Daily Instrument Check Sheet

8. REVISION HISTORY AND APPROVAL

Rev Level	Rev Date	Rev Description	Approver
0	8/7/12	Initial Issue	_____ Project Health Physicist _____ Site Supervisor

APTUIT WORK INSTRUCTION	
TITLE: LIQUID SCINTILLATION COUNTER PROCEDURE FOR BETA RADIATION SCREENING OF SURFACE WIPE SAMPLES	**No:** Aptuit WI - 003 **Date:** August 28, 2012 **Page:** 1 of 4

UNCONTROLLED
WHEN REPRODUCED

1. PURPOSE

The purpose of this work Instruction is to describe the methods and procedure for use of the liquid scintillation counter for counting samples at Aptuit, LLC (Aptuit).

2. APPLICABILITY

This procedure is applicable to any Shaw Environmental, Inc. (Shaw) individual involved in the use of the liquid scintillation counter at Aptuit.

3. REFERENCES

3.1 Instruction Manual for Packard Tri-Carb 2900 TR Liquid Scintillation Analyzer

3.2 Aptuit Radiation Safety Program Manual, March 2008

4. DEFINITIONS

TERM/ACRONYM	DEFINITION
Batch	Samples received per shipment date per project
IPA	Instrument Performance Assessment
LSA	Liquid scintillation analyzer
NIST	National Institute of Standards and Technology
SNC	System normalization and calibration
SS	Site Supervisor

5. RESPONSIBILITIES

5.1 Project Health Physicist

The Project Health Physicist is responsible for the maintenance and management of this procedure.

5.2 Site Supervisor/Survey Coordinator

The Site Supervisor (SS)/Survey Coordinator will be responsible for the field oversight of the Survey Technicians performing this procedure. The SS is also responsible for ensuring workers are following this procedure as described herein.

5.3 Survey Technicians

Survey Technicians will be responsible for the field execution of this procedure and for addressing any issues or suggested modifications with the SS or Project Health Physicist.

6. SCOPE

The liquid scintillation instrument consists of opposing photomultiplier tubes, a sample elevator, computer, software, and a printer. This standard operating procedure provides an outline of the procedure for acquiring and analyzing samples for beta radiation using a liquid scintillation analyzer (LSA). This should be combined with the instrument manual and hands-on training for project-specific analysis. The specific LSA used in this laboratory is a Packard Tri-Carb 2900 TR.

Wipe assays are routinely performed to monitor surface contamination for low energy beta emitters. This procedure is applicable to the direct counting of paper wipes in Fisher ScintiSafe Plus scintillation cocktail by LSA.

7. PRINCIPLE

When a beta particle from a wipe is emitted and passes through the liquid scintillation cocktail, a light pulse is emitted by the cocktail. This light emission is detected by the photomultiplier tubes and is registered as a count.

Contamination of a surface can be in many forms, including water-soluble or organic-soluble materials. If water soluble compounds are expected, it may be advisable to add a small amount of water (1-2 percent) to commercially available cocktails designed to accept water-soluble samples. If the contaminant is water-soluble, the water solubilizes it from the surface of the solid support and ensures good contact with the scintillation cocktail. Since a scintillation cocktail is a mixture of organic solvents, there is a good chance that an organic contaminant will also be soluble in the counting solution. Results are reported as disintegrations per minute per wipe.

8. APPARATUS

- National Institute of Standards and Technology (NIST) traceable standards
- Packard Tri-Carb 2900 TR
- Sample Cassettes.

9. LSA COUNTING METHODOLOGY

Counting protocols for the 2900 TR are stored on the instrument computer. Established protocols are defined for the isotope of interest and associated with counting flags. Each individual protocol has parameters, counting options, and data options that are defined and stored when created. The analyst configures the protocols to meet the data quality objectives of each associated analytical procedure or a client specific request.

10. CALIBRATION/INSTRUMENT PERFORMANCE CHECKS

SNC (system normalization and calibration) protocol plug/Instrument Performance Assessment (IPA) standards consist of a purchased set of three NIST traceable sealed quenched standards that are maintained in a sample cassette in the instrument. These standards are run every 24 hours (or prior to instrument use) to monitor instrument background, counting efficiencies, figure of merit (E^2/B), and Chi square values for the tritium and carbon-14 quenched standards. All IPA data are stored on the computer's hard drive for future review. To initialize the SNC count program, the moveable flag on the SNC cassette is pushed to the left position. The F2-Start/Stop key on the computer instrument status page starts the counter.

Blank – Place a clean paper wipe into 17 milliliters of the ScintiSafe cocktail.

11. PROCEDURE

11.1 Sample Collection

Wipe samples are taken and placed directly into 20 milliliters scintillation vials containing 17 milliliters of ScintiSafe cocktail and taken to the laboratory for analysis.

Note: Project requirements may dictate another other sample media and configurations for special cases. In any case, the volume used in the prep blank, laboratory control sample, and spikes should be the same as that used for the samples.

11.2 Sample Preparation

Wear gloves when handling vials to prevent fingerprints. Invert samples until mixed well (should not have any visible emulsion).

Wipe each vial with anti-static wipe and place in counter cassette with appropriate protocol plug.

Load cassettes into sample racks in the following order for counting:

- Blank
- Sample Batch
- QC Samples
- End.

12. CALCULATIONS

Calculations are performed by LSA reporting template.

13. REPORTING

Enter data from instrument printout into appropriate LSA reporting template. All data are reviewed by SS or designee. Results are reported as disintegrations per minute per wipe.

14. QUALITY CONTROL

Minimum detectable concentration is determined each day during the SNC protocol.

15. ATTACHMENTS

None

16. FORMS

None

17. REVISION HISTORY AND APPROVAL

Rev Level	Rev Date	Rev Description	Approver
0	3/15/12	Initial Issue	_____ Project Health Physicist _____ Site Supervisor

1. PURPOSE

This procedure describes methods and techniques to be employed when performing general decontamination and decommissioning (D&D) activities at the Aptuit, LLC (Aptuit) facility.

2. APPLICABILITY

This procedure applies to decommissioning activities being conducted at Aptuit by Shaw Environmental, Inc. (Shaw) personnel and its subcontractors.

3. REFERENCES

3.1 Aptuit Work Instruction-001, Surface Contamination Surveys for Decommissioning Activities at Aptuit, LLC

3.2 Aptuit Work Instruction-005, Control of Radiological Work for Decommissioning Activities at Aptuit, LLC

3.3 Aptuit Work Instruction-007, Radiological Characterization for Decommissioning Activities at Aptuit, LLC

3.4 Aptuit Radiation Safety Program Manual, March 2008

4. DEFINITIONS

TERM/ACRONYM	DEFINITION
ACM	asbestos containing material
ALARA	as low as reasonably achievable
API	Active Pharmaceutical Ingredients
CFH	chemical fume hood
DCGL	derived concentration guideline level
D&D	decontamination and demolition
DP	decommissioning plan
FT	field technician
HASP	health and safety plan

TERM/ACRONYM	DEFINITION
HEPA	high efficiency particulate air
HP	health physics
LOTO	lockout/tag out
PHP	project health physicist
PPE	personal protective equipment
SO	Scientific Operations
SS	site supervisor

5. RESPONSIBILITIES

5.1 Project Health Physicist

The Project Health Physicist (PHP) is responsible for the maintenance and management of this procedure.

5.2 Site Supervisor

The Site Supervisor (SS) will be responsible for the field oversight of the personnel performing this procedure. Specific responsibilities include:

- Ensuring that the proper tools and equipment are available for the performance of D&D tasks
- Ensuring that the proper personal protective equipment (PPE) is available for the performance of D&D tasks
- Reviewing this procedure with all personnel that will be performing the work prior to beginning the tasks
- Periodically observing the performance of the D&D tasks to ensure that they are being performed according to this procedure
- Reviewing completed tasks to ensure that all objectives and requirements have been met.

5.3 Field Technicians

Field Technicians (FTs) will be responsible for the field execution of this procedure and for addressing any issues or suggested modifications with the SS.

The FT is responsible for the proper execution of D&D activities. Specific responsibilities include:

- Inspecting all tools and equipment prior to use to ensure that they are in good working condition
- Inspecting all PPE prior to use to ensure that it is in good working condition

- Performing all D&D activities in full compliance with this procedure, the procedures referenced in Section 3, the project Decommissioning Plan (DP), the project health and safety plan (HASP), and the Aptuit Radiation Safety Program Manual.

6. EQUIPMENT AND MATERIALS

- High efficiency particulate air (HEPA) vacuum cleaner
- Mercury vapor analyzer (Jerome 431-X or other make/model)
- Radiation detection instruments (see Aptuit WI-002)
- Record/log sheets (e.g., survey forms, checklists, sample collection logs, field activity daily logs)
- Hand tools, including wrenches, screw drivers, hammers, pry bars, etc.
- Plastic sheeting
- Power tools, including drills, saws, etc.
- Waste packaging
- Ladders
- Manlift
- Crane
- PPE.

7. PREREQUISITES

- Prior to being assigned to perform D&D work for the first time, FTs will receive project and site-specific radiation awareness training to include radiation safety requirements of the license. This training will be documented.
- A daily briefing will be conducted prior to start of work to review specific work steps/tasks, to update any work requirements/conditions as applicable, and to review safety hazards and control methods. This meeting will be documented. Documentation may be on the Job Safety Analysis/Tailgate Safety Meeting form.
- Prior to D&D activities, the contents of the Scientific Operations (SO) laboratories, including laboratory equipment and chemicals, will be removed and the areas will be made available to perform decommissioning work.
- The Health Physics (HP) Support Area, which includes rooms B2-116, B2-117, and B2-119, will be designated to house D&D base operations, tools, instrumentation, and equipment.

Ladders and other large D&D equipment may be kept in other rooms designated as D&D support areas.

- Utility disconnections will be performed, as necessary, and all energized sources will be properly locked out/tagged out (LOTO) in accordance with 29 CFR 1910.147. Utility disconnects to be conducted prior to the commencement of decommissioning fieldwork may include, but are not limited to, water, gas, air, and electrical power. All utilities will be verified to have been physically disconnected and/or properly LOTO prior to commencement of D&D activities.
- Prior to initiating any component disassembly or removal activities, physical barriers will be established to limit access to work areas. In addition, signage and/or caution tape will be placed around the work sites to provide a warning of the activities taking place.
- Verification that all project staff are trained/qualified commensurate with assignments in accordance with this procedure will be obtained.
- Ensure FTs have proper PPE for activities being performed based on area postings and site control requirements.
- Ensure the job hazard analysis has been conducted for the D&D activities and that all workers are properly briefed on the hazards anticipated.
- FTs will be instructed on the potential radiological hazards that may be present in the work areas.
- Lab benches and other work surfaces will be wiped down with an appropriate cleaner prior to initiating demolition activities.

NOTE: Minimum PPE for performance of D&D activities will be hard hat, steel-toed boots, and safety glasses.

8. INSTRUCTIONS

8.1 Storage Cabinets and Freezers

Storage cabinets and freezers in the Active Pharmaceutical Ingredients (API) area will be surveyed to characterize for waste disposal. The disposal will be performed as follows:

- The storage cabinet and freezer surfaces will be surveyed for radiological contamination as specified in Aptuit WI-001.
- Storage cabinets and freezers that are not radiologically contaminated above Aptuit's acceptable surface contamination levels (i.e., release criteria) will be disposed of as construction debris.
- Storage cabinets and freezers that do not meet the free release criteria (i.e., >acceptable surface contamination levels) will be loaded into the radiological waste container.
- Storage cabinets and freezers may be transported to the appropriate waste container using hand trucks or carts.
- The work area will be cleaned with a HEPA vacuum after the storage cabinet and freezer removal has been completed.

8.2 Wall Cabinetry

All wall cabinetry in the API area will be removed and characterized for waste disposal. The removal and disposal will be performed as follows:

- Cabinets will be removed from the walls by loosening and removing wall mounting hardware, typically found in the interior of the cabinets, with hand or power tools.
- The cabinet surfaces will be surveyed for radiological contamination as specified in Aptuit WI-001.
- Cabinets that do not meet the release criteria will be loaded into the radiological waste container for disposal.
- Cabinets that are not radiologically contaminated above the release criteria will be disposed of as construction debris.
- The cabinets may be transported to the appropriate waste container using hand trucks or carts.
- The work area will be cleaned with a HEPA vacuum after the wall cabinetry removal has been completed.

8.3 Bench Tops and Tables

The bench tops and tables in the API area will be removed and characterized for waste disposal. The removal and disposal will be performed as follows:

- Any bench tops or table tops that are determined to be asbestos containing material (ACM) will be removed by a Missouri registered asbestos contractor. All required controls and PPE will be utilized during the handling of ACM. The ACM will be managed to prevent nonfriable materials from being damaged and made friable.
- The ACM and ACM-related materials, including PPE used during the handling of ACM, will be consolidated to the extent possible.
- Bench tops and tables may be transported to the appropriate waste container using hand trucks or carts.
- ACM bench tops and table tops will be surveyed for radiological contamination as specified in Aptuit WI-001.
- ACM bench tops and table tops with radiological contamination above the release criteria will be properly packaged in accordance with federal and state regulations and disposed of as mixed waste.
- ACM bench tops and table tops that are not radiologically contaminated above the free release criteria will be packaged and disposed of in a permitted landfill in accordance with Missouri ACM disposal rules.
- Non-ACM bench tops and tables will be surveyed for radiological contamination as specified in Aptuit WI-001.

- Non-ACM bench tops and table tops with radiological contamination above the release criteria will be decontaminated or properly packaged and disposed of as radiological waste.
- Non-ACM bench tops and table tops that are not radiologically contaminated above the free release criteria will be disposed of as construction debris.
- The work area will be cleaned with a HEPA vacuum after the bench top and table top removal has been completed.

8.4 Sink Trap and Strainer Removal

The p-traps associated with the sinks in the chemical fume hoods (CFH) will be removed and characterized for waste disposal. In addition, p-traps and strainers associated with laboratory bench tops will also be removed and characterized. The p-traps and strainers will be dismantled as follows:

- Prior to beginning work, plastic sheeting will be placed on the floor and on the bottom of any cabinets in the area of the traps or any required pipe disconnections. The plastic sheeting is intended to protect the floor from any leaked or spilled liquids or debris.
- Personnel will utilize appropriate PPE, including safety-toed shoes, Tyvek® suits, safety glasses or face shields, and nitrile gloves at a minimum. Any traps/strainers found to have mercury vapor readings greater than 0.01 milligrams per cubic meter, which is 1/10 of the U.S. Occupational Safety and Health Administration ceiling level, will be removed using Level C PPE with the appropriate mercury vapor cartridge.
- The sink trap openings will be measured for mercury vapor using a mercury vapor analyzer. The mercury vapor measurements will be recorded.
- The sink trap openings will be measured for radiological contamination as specified in Aptuit WI-001 and WI-007 and the radiological survey measurements will be recorded on radiological survey forms.
- The traps and strainers will be removed at mechanical joints where possible. Where the pipe is welded or rusted together, or otherwise cannot be mechanically disassembled, the traps and strainers may be removed using a pipe cutter or reciprocating saw. Hearing protection will be used while operating power tools.
- The liquid contents of the traps will be poured into U.S. Department of Transportation-approved plastic buckets with lids.
- Once removed, the traps/strainers will be measured a final time for mercury vapor and the value recorded. Traps/strainers that exhibit mercury contamination and any associated solid residues will be segregated as hazardous waste. If only radiological contamination is detected, the trap/strainer and any associated solid residues will be segregated as radioactive waste. The solids residues will be removed from non-mercury, non-radiologically contaminated sink traps/strainers and placed in appropriate containers. Sink traps/strainers that do not exhibit mercury and meet radiological release criteria will be disposed as construction debris.
- All sink trap and strainer components will be surveyed as specified in Aptuit WI-001 to ensure that radiological release criteria are met. Wipe samples will be collected from the

openings of the sink traps. Sink traps and strainers that do not meet radiological release criteria will be segregated and managed as radioactive waste.

- After the final determination of mercury and radiologically contaminated and non-contaminated residues described above is made, trap liquid residues will be combined with like liquids as characterized. All liquid wastes from mercury-only contaminated traps will be combined, containerized appropriately, and labeled as pending analysis. All radiological contamination-only liquid waste will be combined and containerized appropriately for disposal. Liquid collected from traps that are not found to be mercury or radiologically contaminated will be combined and containerized for disposal.
- The work area will be cleaned with a HEPA vacuum after the sink trap/strainer removal has been completed.

8.5 Utility Service Line Removal

The utility service lines in the API area, including the vacuum lines, water lines, and gas lines, as well as a vacuum line remaining in B2-119, will be characterized and removed, as necessary. Most of the lines are made of galvanized steel, carbon steel, or copper and range in diameter from ¾" to 2". The lines will be removed as follows:

The first step will include performing a survey of the exterior of the lines as specified in Aptuit WI-001.

Any detected removable radiological contamination will be removed with a cleaning agent and water-wetted rags.

After confirming that the system has been properly LOTO, the lines from the fume hoods in the API area to the header will be cut and removed.

The cut lines will be surveyed for waste characterization.

After the feeder lines are removed, wipe samples of the interior of the header line will be collected through the openings.

If the header line is found to be radiologically contaminated, it will be removed and disposed of as radioactive waste.

If the header line is not found to be contaminated, then the openings will be capped and the header will be left in place and returned to service.

The vacuum line in B2-119 will be characterized and either left in place or disposed appropriately.

Utility service lines that are removed and meet the release criteria may be recycled.

The work area will be cleaned with a HEPA vacuum after the line removal has been completed.

8.6 Chemical Fume Hood Removal

CFHs will be removed as part of decommissioning activities. The CFHs will be removed as follows:

CFHs with known radioactive contamination will be delineated and surveyed as specified in Aptuit WI-001 and WI-007 before and after any decontamination attempts.

A visual inspection of the CFHs will be conducted.

If debris or visual contamination is observed, including pooled liquids, oily smears, etc., it is left to the discretion of the worker to decontaminate the area.

A HEPA vacuum may be used to remove debris.

Exterior and accessible interior surfaces of the CFH may be wiped with rags with a detergent-water mixture. If residues remain after the initial cleaning, the affected surfaces may be cleaned again using more vigorous techniques or cleaning agents until visibly clean (as is practicable).

Upon completion of the initial inspection and any decontamination, the following activities will be conducted for each CFH:

- All utilities will be verified to be LOTO and disconnected.
- Yellow caution tape and signs will be posted outside the doors leading to rooms where work is being performed to warn personnel of the activities being performed.
- Plastic sheeting will be placed on the floor in the vicinity to collect any debris and protect the floor.
- Any ACM components (transite panels, benchtop) of the CFH will be thoroughly examined for breaks, which will be secured by covering exposed edges with duct tape.
- Sink traps associated with the CFH will be removed as described in Section 8.4.
- All asbestos abatement will be completed as described in Section 8.3 for any CFHs that contain ACM.
- The CFH may be disassembled, as necessary, so that the pieces are small enough to be transported to the waste container. The CFH will be disassembled using hand tools or power tools to remove the screws or bolts that hold the pieces together.
- The pieces of the CFH may be transported to the appropriate waste container using a hand truck or cart or hand carried if small and light enough.
- The CFH pieces will be surveyed and sampled for surface contamination as specified in Aptuit WI-001 to determine if the radiological release criteria are met.
- CFH pieces with contamination levels in excess of the release criteria will be placed in the radiological waste container and disposed of as radiological waste. It is anticipated that most, if not all, of the CFHs will be disposed of as radiological waste.
- CFH pieces that meet the free release criteria may be disposed of as construction debris.
- The work area will be cleaned with a HEPA vacuum after the chemical fume hood removal has been completed.

8.7 Exhaust Duct Removal

Aptuit will disconnect and remove exhaust ductwork from CFHs and snorkel exhausts. Ductwork will be characterized as described in WI-007 prior to removal. In addition, impacted legacy ductwork will be investigated and removed, as necessary. Disconnection and removal will proceed as follows:

- Yellow caution tape and signs will be posted outside the doors leading to rooms where work is being performed to warn personnel of the activities being performed.
- Plastic sheeting will be placed on the floor below the ductwork to collect any debris and protect the floor.
- The upper side of any adjacent ceiling tiles may be HEPA vacuumed of loose debris and dust as it is removed to allow work on the ducting.
- Personnel will utilize appropriate PPE, including safety-toed shoes, eye protection, Tyvek suits, and nitrile gloves, at a minimum. Task-specific health and safety requirements specified in the job safety analysis will be briefed prior to each shift.
- If radiological contamination exceeds the action level specified in the radiological controls procedure (WI-005), a fixative to prevent removable radiological contamination from becoming airborne may be sprayed on the interior surfaces of the duct sections prior to removing each section.
- Ductwork will be removed from the closest point of amenable disconnection near the laboratory wall face to the CFH. Snorkel exhaust ductwork will be removed from the point of connection to the laboratory equipment to the joint at the main exhaust duct.
- All removed ductwork will be surveyed and sampled as specified in Aptuit WI-001 to ensure that radiological release criteria are met.
- Any ductwork with suspect internal contamination will have the ends wrapped and taped and will be segregated as suspect radioactive waste.
- Sections of ductwork of a manageable length will be disassembled at mechanical joints by removing bolts/screws using wrenches or screwdrivers or cut with an electric saw.
- Personnel on multiple stepladders or manlift, as necessary, will be utilized to safely lower the ductwork sections to the floor in a controlled manner. In addition, temporary supports may be created to support and secure the duct, as necessary, to ensure a safe disassembly.
- The sections will be wrapped in plastic sheeting and packaged with duct tape.
- Ductwork sections that do not meet the release criteria will be placed in the radiological waste container for disposal.
- Ductwork that does meet the release criteria may be disposed of as construction debris.
- The work area will be cleaned with a HEPA vacuum after the ductwork removal has been completed.

8.8 Exterior and Rooftop Exhaust Components

As part of decommissioning activities, the exterior components of the API exhaust system will be removed, surveyed for radiological contamination, and disposed of appropriately. The exterior API exhaust system components include a HEPA filter system, ductwork, two fans, and a 30” diameter metal stack. In addition, select B Building rooftop fan assemblies and associated exhaust duct and stacks will be surveyed for radiological contamination, removed as necessary, and disposed of appropriately.

Disassembly and removal of the exterior and rooftop exhaust components will include the following tasks:

- Prior to beginning decommissioning work on the roof, the structural capacity of the roof will be evaluated by a structural engineer through review of as-built drawings and/or visual inspection. The structural engineer will confirm that the load capacity of the roof where the decommissioning activities are going to be performed is adequate for the weight of the work crew and their equipment.
- All crew members working in proximity of roof edge or roof openings will be trained and equipped in use of mandatory fall protection harness usage and application thereof for all roof operations conducted during the decommissioning.
- Yellow caution tape and warning signs will be posted around all work areas prior to beginning any decommissioning activities. In addition, temporary fencing will be placed around areas where any crane or overhead operations will occur.
- Prior to beginning any crane or overhead work, the work areas will be inspected for any overhead or ground level hazards. All identified hazards will be discussed by the D&D team responsible for performing the work and a hazard abatement plan will be established and adhered to by the team.
- The HEPA filters for the API exhaust system are assumed to be radiologically contaminated above the release criteria based on previous survey results of the interior of the HEPA housing. The HEPA housing is equipped with a bag-in/bag-out containment system. The HEPA filters will be removed utilizing the bag-in/bag-out system and placed in the radiological waste container for disposal.
- The HEPA filter housing is assumed to be radiologically contaminated above the release criteria based on previous survey results and will either be decontaminated or disposed of as radiological waste. The HEPA filter housing will be disassembled with hand tools or power tools, as necessary, so that the pieces are small enough to be transported to the decontamination area or the radiological waste container. Open ends of the housing will be covered with plastic sheeting.
- The duct connecting the HEPA system, fans, and stack will be disassembled, removed, and surveyed for radiological contamination. The duct may be disassembled using hand or power tools. If radiological contamination exceeds the action level specified in the radiological controls procedure (WI-005), a fixative to prevent removable radiological contamination from becoming airborne may be sprayed on the interior surfaces of the duct sections prior to removing each section.
- All removed ductwork will be surveyed and sampled as specified in Aptuit WI-001 to ensure that radiological release criteria are met. Any ductwork with suspect internal contamination will have the ends wrapped and taped and will be segregated as suspect radioactive waste.
- Sections of ductwork of a manageable length will be disassembled at mechanical joints by removing bolts/screws using wrenches or screwdrivers or cut with an electric saw.
- The sections will be wrapped in plastic sheeting and packaged with duct tape.
- The sections will be lowered to the ground one section at a time using a crane or ropes.

- Ductwork sections that do not meet the release criteria will be placed in the radiological waste container for disposal.
- Ductwork that does meet the release criteria may be disposed of as construction debris.
- The fans and stack associated with the API exhaust system will be removed and surveyed for radiological contamination.
- The fans may be removed with a crane or may be disassembled into components small enough to be handled by hand using carts or with a forklift.
- The stack will be removed using a crane. The open ends of the fans and stacks will be covered with plastic sheeting.
- If the fans and stack sections do not meet the radiological release criteria, they will be placed in the radiological waste container for disposal.
- If the fans and stack sections meet the release criteria, they may be disposed of as construction debris.
- Five fan assemblies located on the rooftop of B Building will be surveyed for radiological contamination and removed if found to be contaminated. The fan assemblies to be surveyed are designated BR-EF 21A, BR-EF 21B, BR-EF 23, BR-EF 24, and BR-EF 26. The fan assemblies may be removed using a crane. All openings on the fan assemblies will be blanked or sealed prior to moving them. Trained and qualified personnel will perform the rigging and crane operation procedures.
- Fan assemblies identified as radiologically contaminated will be placed in the radiological waste container for disposal.
- Fan assemblies that meet the radiological release criteria may be disposed of as construction debris.
- The rooftop stacks associated with the BR-EF 21A, BR-EF 21B, BR-EF 23, BR-EF 24, or BR-EF 26 exhaust fans that are determined to be radiologically contaminated, as described above, will be removed. The stacks will be lowered to ground level with a crane. Trained and qualified personnel will perform the rigging and crane operation procedures.
- Once on the ground, the stacks will be cut into smaller sections and surveyed for radiological contamination. The open ends of the stack sections will be covered with plastic sheeting.
- Stack sections that do not meet the radiological release criteria will be placed in the radiological waste container for disposal.
- Stack sections that meet the release criteria may be disposed of as construction debris.

8.9 Incinerator Removal

The incinerator in room B2-103A, along with the associated ductwork, filter, and stack, will be removed and disposed of appropriately. The incinerator will be removed as follows:

- The exterior and interior surfaces of the incinerator will be surveyed for waste characterization purposes.

- Any removable radiological contamination detected on the exterior will be removed using a cleaning agent and water-wetted rags.
- The ductwork, filter, and filter housing will be removed, characterized, and disposed of appropriately.
- The angle iron securing the stack to the side of B Building will be disconnected or cut and the stack will be lowered to the ground using a crane.
- Once on the ground, the stack will be cut into smaller sections, characterized, and disposed of appropriately, either as radiological waste or construction debris.
- Prepare the incinerator by blanking or sealing all openings in the incinerator and the attached pipe, instruments, and equipment.
- Remove a section of the south wall of B2-103A to provide access to move the incinerator out of the building. The walls of B2-103A are constructed of concrete block with brick veneer.
- Survey the wall section planned for removal to determine if the wall materials can be disposed of as nonhazardous construction waste or if they require disposal as radiological waste.
- The wall section will then be removed using a concrete saw and/or an electric or pneumatic jackhammer. Dust suppression will be implemented, as necessary.
- The wall waste will be disposed appropriately, as indicated by the prior survey results.
- After a hole in the wall has been created, the incinerator will be slid out of B2-103A using a heavy duty forklift, crane lift, or other equipment with a rated capacity to safely handle the load.
- Once removed, the incinerator will be wrapped in plastic sheeting, loaded onto a trailer with a crane and prepared for transportation to the appropriate disposal site.
- After the incinerator has been removed, the floor area under where it had been located will be cleaned with a HEPA vacuum.
- The floor area will then be surveyed to determine if there is any residual radiological contamination on the floor.
- Any detected removable contamination will be removed with a cleaning agent and water-wetted rags.
- Any detected fixed radiological contamination will be cut out and disposed of as radiological waste.

8.10 Laboratory B3-298

Laboratory B3-298 will be decommissioned as follows:

- After all of the equipment and materials have been removed from B3-298, the surfaces in the room, including bench tops, cabinets, floor, and walls, will be cleaned with a HEPA vacuum.
- The surfaces will then be surveyed for radiological contamination as specified in Aptuit WI-001.
- If any removable radiological contamination is detected, it will be removed using a cleaning agent and water-wetted rags.
- Any surfaces with fixed radiological contamination above the release criteria will be removed, packaged, and placed in the radiological waste container for disposal.

8.11 Waste Storage Building

The waste storage building will be decommissioned as follows:

- After all of the equipment and materials have been removed from the waste storage building, the surfaces in the room, including shelves, floor, and walls, will be cleaned with a HEPA vacuum.
- The surfaces will then be surveyed for radiological contamination as specified in Aptuit WI-001.
- If any removable radiological contamination above the release criteria is detected, it will be removed using a cleaning agent and water-wetted rags. Brushes may be used if more vigorous cleaning is required to remove the contamination.
- The cleaning items will be placed in a closed-top bucket or drum suitable for radiological waste, which will then be placed in a radiological waste container for disposal.
- Any surfaces with fixed radiological contamination above the release criteria will be removed, packaged, and placed in a radiological waste container for disposal.

8.12 Walls, Floors, Drains

The walls, floors, and drains of the SO area will be decommissioned as follows:

- After the rooms have been cleared of equipment, hoods, bench tops, tables, and cabinets, the building surfaces, including walls, floors, and drain openings will be cleaned with a HEPA vacuum, if they have not already been cleaned with a HEPA vacuum.
- A visual inspection and radiological survey will be performed on building surfaces including walls, floors, and drain openings. The visual inspection will be conducted to identify any visible contamination (e.g., oily smears, etc.).
- If debris or residues are observed, a HEPA vacuum may be tried again to remove any remaining debris. In addition, rags wetted with water or a cleaning agent may be used to remove any residues until visibly clean. Brushes may be used if more vigorous cleaning is required to remove the residue.

- Radiological characterization surveys will consist of scanning and bias measurements of gross beta activity and wipe sampling to determine removable contamination levels. The survey locations, methods, and findings will be documented. Survey results will be used to determine if remedial actions are needed to meet release criteria (i.e., activity below derived concentration guideline level (DCGL) and as low as reasonably achievable [ALARA]).
- Surfaces that are found to meet the radiological release criteria will be left in place.
- Surface areas that exceed the release criteria will be removed by cutting out the contaminated areas with the appropriate saw or tool. The removed surfaces will be properly packaged and placed in a radiological waste container for disposal.

8.13 HP Support Areas

The final spaces to be decommissioned are the HP support areas, which include rooms B2-116, B2-117, and B2-119. The HP support areas will be decommissioned as follows:

- After the HP support areas have been cleared of equipment, bench tops, tables, and cabinets, the building surfaces, including walls, floors, and drain openings will be cleaned with a HEPA vacuum.
- A visual inspection and radiological survey will be performed on building surfaces including walls, floors, and drain openings. The visual inspection will be conducted to identify any visible contamination (e.g., oily smears, etc.).
- If debris or residues are observed, a HEPA vacuum may be tried again to remove any remaining debris. In addition, rags wetted with water or a cleaning agent may be used to remove any residues until visibly clean. Brushes may be used if more vigorous cleaning is required to remove the residue.
- Radiological surveys will consist of scanning and bias measurements of gross beta activity and wipe sampling to determine removable contamination levels. The survey locations, methods, and findings will be documented. Survey results will be used to determine if remedial actions are needed to meet release criteria (i.e., activity below DCGL and ALARA).
- Surfaces that are found to meet the radiological release criteria will be left in place.
- Surface areas that exceed the release criteria will be removed by cutting out the contaminated areas with the appropriate saw or tool. The removed surfaces will be properly packaged and placed in the radiological waste container for disposal.

9. ATTACHMENTS

None

10. FORMS

None

11. REVISION HISTORY AND APPROVAL

Rev Level	Rev Date	Rev Description	Approver
0	8/7/12	Initial Issue	_____ Project Health Physicist _____ Site Supervisor

1. PURPOSE

This procedure provides information necessary to control radiological work during Aptuit, LLC (Aptuit) decommissioning activities. Control of work involving radioactive materials shall be accomplished by establishing radiological standards and responsibilities, using radiological protection personnel to monitor performance of radiological work, training workers in radiation hazards, and providing personnel with Work Instructions (WI)s and/or Radiation Work Permits (RWPs). RWPs shall include the radiological protection measures and controls necessary for safe and compliant completion of the job.

2. APPLICABILITY

This procedure applies to decommissioning activities being conducted at Aptuit by all decommissioning personnel.

3. REFERENCES

3.1 Aptuit Radiation Safety Program Manual, March 2008

3.2 U.S. Nuclear Regulatory Commission (NRC), 1993, *Air Sampling in the Workplace*, NUREG-1400, September.

4. DEFINITIONS

TERM/ACRONYM	DEFINITION
ALARA	As Low As Reasonably Achievable
ALI	annual limits on intake
API	Active Pharmaceutical Ingredients
Ci	Curie
^{14}C	carbon-14
CA	Contamination Areas
D&D	decontamination and demolition

TERM/ACRONYM	DEFINITION
^{3}H	tritium
HEPA	high efficiency particulate air
mrem	millirem
PHP	Project Health Physicist
PPE	personal protective equipment
QC	quality control
RCT	Radiological Control Technician
RSO	Radiation Safety Officer
RSPM	Radiation Safety Program Manual
RWPs	Radiation Work Permits
SS	Site Supervisor
SS/SC	Site Supervisor/Survey Coordinator
ST	Survey Technician

5. RESPONSIBILITIES

5.1 Project Health Physicist

The Project Health Physicist (PHP) is responsible for the maintenance and management of this procedure and for determination of action levels.

5.2 Site Supervisor/Survey Coordinator (SS/SC)

The Site Supervisor (SS) will be responsible for the field oversight of the Survey Technicians (ST) involved with decommissioning activities. A Shaw Health Physicist or Radiological Control Technician (RCT) will be designated for this position. The SS/SC is responsible for the supervision of the following:

- Proper donning and doffing of personal protective equipment (PPE)
- Proper entry and exit of personnel from Contamination Areas (CA)
- Selecting and ensuring properly calibrated and tested equipment is available for the performance of survey/sampling tasks
- Ensuring proper training has been provided prior to start of work
- The implementation of use of personnel monitoring, as applicable

- Establishment of Radiation Work Permits (RWP) as necessary
- Reviewing collected data for accuracy
- Establishment of methods to ensure contamination control
- Use of proper postings in designated areas

5.3 Survey Technicians

STs are responsible for the proper execution of survey and sampling activities. Specific responsibilities include:

- Ensuring all portable instrumentation is properly calibrated and checked prior to use
- Performing all data collection activities in full compliance with the established protocols
- Properly documenting all survey/sampling activities.

6. METHODS TO CONTROL RADIOLOGICAL WORK

6.1 Contamination Control Program

Contamination control methods may include pre-cleaning of accessible surfaces, use of a high efficiency particulate air (HEPA) vacuum to remove visible dust, use of plastic sheeting to protect adjacent surfaces as necessary, use of foam or fixatives to prevent the spread of contamination, establishment of contamination control zones, and use of step-off pads at access/egress areas.

6.2 Radiation Work Permits (RWPs)

- RWPs will be utilized to control access to restricted areas including Contamination Areas.
- RWPs will be based on evaluation of individual decommissioning tasks and the hazards applicable to those tasks
- RWPs will be reviewed and approved by the Radiation Safety Officer (RSO) or his designee.
- RWPs will be managed and evaluated by the RSO throughout the decommissioning project
- The RSO or designee will review all procedures in the RWP with individuals performing decommissioning tasks
- Acknowledgement of the understanding of the RWP and agreement to abide with its conditions will be documented on the applicable entry log form

6.3 ALARA

As Low As Reasonably Achievable (ALARA), when used to describe exposures to radiation workers, means that every reasonable effort has been made to maintain exposures to radiation workers as far below the dose limits specified in the regulations as is practical, consistent with the purpose for which the licensed activity is undertaken.

Techniques that will be used on this project to minimize radiation exposure (even though exposures are well below the regulatory limits) include the following:

- Project and site-specific radiation awareness training

- Pre-cleaning exposed surfaces that are potentially contaminated
- Use of PPE as appropriate
- Radiological surveys for exposure and contamination control
- Radiological surveys for uncontrolled release of equipment and areas
- Use of HEPA vacuum to control dust
- Use of containment systems to control contamination
- Use of radiation work permits, as needed, to control radiological work.

6.4 Work Planning

The objectives of the radiological planning of work shall be to ensure that the worker's radiation exposures are maintained ALARA, to minimize the creation and spread of surface contamination, to minimize the creation and spread of airborne radioactive material, and to minimize the creation of radioactive waste.

6.5 Personal Protective Equipment (PPE)

STs shall have proper personal protective equipment (PPE) for the area to be entered based on area postings and site control requirements. The minimum PPE for performance of work in Contamination Areas will be latex or nitrile gloves, shoe covers and safety glasses. PPE may be upgraded as conditions warrant (see Section 6.11, Action Levels).

Proper donning and doffing of PPE is required. Proper methods will be reviewed prior to initial entry. The RSO will perform regular review of radiological conditions encountered during decommissioning activities. If contamination levels exceed those anticipated, the RSO will evaluate the need for additional protective measures.

6.6 Training

- All personnel involved with decommissioning must have training and qualifications commensurate with their assignments. Minimum training for workers performing decommissioning activities include current Radiation Worker Training (RWT). Training topics that must be included (but are not limited) in RWT are:
    - Radiological Fundamentals
    - Biological Effects
    - Radiation Detection and Measurement
    - Principles of Radiation Protection
    - Regulatory Requirements
- In addition, all personnel involved with decommissioning will receive project and site-specific radiation awareness training to include radiation safety requirements of the license. This training will be documented.

6.7 Personnel Monitoring

Although personnel external dosimetry, personal air samplers, and other personal measurements (e.g., bioassay monitoring) are not required during decommissioning activities based on potential exposures, Aptuit may, at its discretion, employ certain monitoring methods to acquire data as needed. The RSO will perform regular review of radiological conditions encountered at the site to determine if any necessary actions are required. Surveys for removable contamination will be performed during routine operations and special operations, as determined necessary by the RSO.

6.8 Workplace Air Sampling and Respiratory Protection

Based on the evaluation of maximum potential exposures (see Section X of the Decommissioning Plan), it is unlikely that an individual could have an intake of radioactive material in excess of 1 percent of the applicable annual limits on intake (ALIs), or a total effective dose equivalent in excess of 1 percent of the occupational dose limit. Therefore, the use of respiratory protection is not warranted. Based on this evaluation, there is also no requirement for individual monitoring of occupational dose as established in 10 CFR 20.1502(a)(1) and (b)(1). Although the assessment of potential airborne hazards did not identify the need for air sampling, monitoring or sampling for airborne radioactive material hazards may be conducted when contamination levels exceed the action levels in Section 6.11, as directed by the RSO, when opening contaminated systems or when performing aggressive decontamination or demolition activities.

6.9 Internal Exposure Determination

The evaluation of maximum potential exposures demonstrates that monitoring of internal dose is not required. However, the RSO will determine if decommissioning personnel will participate in the bioassay program based on survey results, activities being performed, and control methods used when contamination levels exceed the action levels in Section 6.11. The general guidelines for internal dose monitoring from the Radiation Safety Program Manual RSPM are found in Table 4-1.

Bioassay for 3H and 14C is by urinalysis. Scheduling of bioassay tests will be coordinated through the RSO. In addition, appropriate bioassay may be performed whenever an internal exposure to radioactive materials is suspected.

Records of all monitored individual exposures are maintained by the RSO.

6.10 Radiological Areas and Postings

- Radiological areas shall be posted as applicable by the RSO. Typical postings may be:
    - **Radioactive Materials Area** - Any area or room where quantities of radioactive materials in excess of 10 times the 10 CFR 20, Appendix C quantities are used or stored, or any area designated by the RSO.
    - **Contamination Area (CA)** - An area, accessible to individuals, in which removable surface contamination levels on equipment or solid surface materials are equal to or exceed 1000 dpm/100 cm^2.
- **Entry/Exit from a CA** – proper entry and exit requirements will be stated in the applicable Radiation Work Permit (RWP). The RWP will be generated by the SS/SC and reviewed with individuals prior to entry into a CA.

6.11 Action Levels

Action levels that require consideration for an upgrade in radiological controls, such as additional PPE (i.e. respirator use, Tyvek overalls, etc.), air monitoring, etc., have been determined for building surfaces and exhaust system components based on an assessment of the radiological hazards involved with decommissioning activities. After a review of the radioactive contaminants of concern, a review of facility operational and characterization surveys, the facility radioactive material inventory, and exhaust stack release data, the most significant potential for dose to the worker during decommissioning activities was determined to be internal exposure during removal of the Active Pharmaceutical Ingredients (API) exhaust system (hoods, ducts, and HEPA housing).

Action levels for ^{3}H and ^{14}C were calculated for both building surfaces and exhaust system components. The activity of each radionuclide that could result in a potential intake that would result in an internal dose of 5 millirem (10 mrem total) was calculated following the methods in NUREG-1400 (NRC, 1993) [1]. These activities were then divided by the building surface area (floors and walls) of the API laboratories and the API exhaust duct work to determine action levels for building surfaces and exhaust system components, respectively. These action levels are given below.

[1] A release fraction of 0.01 (nonvolatile powders), a confinement factor of 1 (uncontained material), and a dispersibility factor of 10 (adding energy to the system) were used in calculating the intake potential.

Decommissioning Action Levels

Action	^{3}H (dpm/100 cm^2)	^{14}C (dpm/100 cm^2)
Release of materials & equipment	≤1000 removable	≤1000 removable ≤5000 average ≤15000 maximum
Aptuit DCGLs	3.7E4 removable (^{3}H & ^{14}C combined)	3.7E5 total 3.7E4 removable (^{3}H & ^{14}C combined)
NRC Screening DCGLs[2]	1.2E8	3.7E6
Consideration of additional radiological controls – building surfaces	>3 e10	>6E8
Consideration of additional radiological controls – exhaust system	>5e10	>1E9

[2]Included for comparison. These building surface screening levels represent surface concentrations of individual radionuclides that would be deemed in compliance with the 25 mrem/y unrestricted release dose limit in 10 CFR 20.1402.

7. SEALED SOURCES

All sealed sources will have documentation showing that all necessary leak tests have been performed at appropriate intervals

8. ATTACHMENTS

None

9. FORMS

Radiation Work Permit

10. REVISION HISTORY AND APPROVAL

Rev Level	Rev Date	Rev Description	Approver
0	8/7/12	Initial Issue	_____ Project Health Physicist _____ Site Supervisor

1. PURPOSE

This procedure describes methods and techniques to be employed for management of decontamination and decommissioning (D&D) waste for Aptuit, LLC (Aptuit) decommissioning activities.

2. APPLICABILITY

This procedure applies to decommissioning activities being conducted at Aptuit.

3. REFERENCES

3.1 Aptuit Radiation Safety Program Manual, June 2011

4. DEFINITIONS

TERM/ACRONYM	DEFINITION
D&D	Decontamination & Decommissioning
FTs	Field Technicians
HASP	Health and safety plan
HP	health physics
LOTO	locked out/tagged out
PHP	Project Health Physicist
PPE	personal protective equipment
RPP	radiation protection plan
RSO	Radiation Safety Officer
RSPM	Aptuit Radiation Safety Program Manual
SO	Scientific Operations
SS	Site Supervisor

5. RESPONSIBILITIES

5.1 Project Health Physicist

The Project Health Physicist (PHP) is responsible for the maintenance and management of this procedure.

5.2 Site Supervisor

The Site Supervisor (SS) will be responsible for the field oversight of the personnel performing this procedure. Specific responsibilities include:

- Reviewing this procedure with all personnel that will be performing the work prior to beginning the tasks
- Ensuring that all generated waste is properly handled, packaged, stored and processed, as necessary
- Ensuring that the proper tools and equipment are available for the performance of D&D tasks
- Ensuring that the proper PPE is available for the performance of D&D tasks
- Periodically observing the performance of the D&D tasks to ensure that they are being performed according to this procedure
- Reviewing completed tasks to ensure that all objectives and requirements have been met.

5.3 Field Technicians

Field Technicians (FTs) will be responsible for the field execution of this procedure and for addressing any issues or suggested modifications with the SS.

The FT is responsible for the proper execution of D&D activities. Specific responsibilities include:

- Collecting waste in a proper manner so as to limit contamination of personnel and areas
- Inspecting all tools and equipment prior to use to ensure that they are in good working condition
- Inspecting all PPE prior to use to ensure that it is in good working condition
- Performing all D&D activities in full compliance with this procedure and the health and safety plan (HASP) and radiation protection plan (RPP).

6. PROPER HANDLING OF WASTE STREAMS GENERATED DURING D&D ACTIVITIES

6.1 Remediation-Derived Waste

- All remediation-derived waste (RDW) will be placed in appropriate containers that conform to federal and state regulations.
- Waste containers will be properly labeled and inventoried on site. If necessary, temporary accumulation areas will be established in accordance with applicable regulatory requirements.
- Nonhazardous waste will be disposed as construction debris in a local, licensed landfill.
- Aptuit will prepare manifests for all hazardous waste.
- A licensed hazardous waste disposal subcontractor will be utilized for the transportation and disposal of all hazardous waste generated during the D&D activities.

- All secondary RDW (e.g. PPE, wash rags, plastic, etc.) will be assumed to have contaminant concentrations consistent with the waste streams being generated for any given activity.

Decommissioning RDW will generally include but not be limited to the following:

- Regulated components – ceiling tiles, floor tiles, as well as any other items or surfaces not meeting radiological release criteria
- Rinse water
- Cleaning materials (e.g. wipes, brushes, rags, etc.)
- PPE
- Other wastes associated with D&D activities.

6.1.1 Asbestos-Containing Material

- All ACM will be packaged and labeled in accordance with federal and state regulations by a fully licensed and permitted contractor.
- The ACM will be wetted and packaged to prevent nonfriable materials from being damaged and made friable.
- The ACM and ACM-related materials, including PPE used during the handling of ACM, will be consolidated to the extent possible.
- The properly containerized ACM materials will be moved to a temporary, on-site storage location.
- The asbestos abatement subcontractor, upon Aptuit's approval, will dispose of nonradioactive ACM waste at a landfill licensed to accept ACM.
- Any ACM that does not meet radiological release criteria will be segregated from nonimpacted ACM and disposed as radioactive mixed waste.

6.1.2 Sink Traps and Associated Wastes

- All water and other contents of the traps will be placed in appropriate containers and samples collected for waste disposal purposes. The water samples will be analyzed for RCRA metals and semivolatile organic compounds.
- The contaminated sink traps and fittings will be placed into appropriate containers by Aptuit and disposed as radioactive waste. Management of the sanitary sink trap RDW will include the following:
    - Contents of the sink traps will be accumulated, and ultimately, a composite sample for characterization will be obtained for off-site analysis.
    - Trap contents and rinse water will be sampled and characterized, as necessary, to determine disposal requirements. The analytical data will be of sufficient quantity and quality to accurately determine constituent concentrations in RDW. Secondary wastes will be characterized based on analytical data obtained from the corresponding waste stream.

- Samples of sink trap liquids will be collected by thoroughly mixing the waste container and bailing out the required volumes with a stainless-steel or Teflon® bailer.
- Samples of the sink trap liquid will be analyzed for RCRA metals and semivolatile organic compounds. The results of the analyses will be compared to the hazardous waste characteristic levels for toxicity identified in 40 CFR 261.
- Any liquid or solid trap contents that are potentially radioactive will be sampled and analyzed for 3H and 14C. All radionuclide results will be reviewed by the RSO prior to disposition of wastes.
- The removed sink traps and fittings will be monitored for mercury vapor and radioactive contamination. If neither is detected, the sections will disposed of as non-regulated construction debris. Any sections with positive indication of mercury contamination will be segregated and managed as hazardous waste. Additionally, pipe sections with radiological contamination exceeding release criteria in addition to the mercury contamination will be managed as mixed waste. Trap sections with no mercury contamination that exceed radiological release criteria will be managed as radioactive waste.

6.1.3 Radioactive Waste

- All known or suspected radioactive waste will be packaged and labeled at the point of generation.
- Prior to packaging, all required survey data will be obtained to support proper management and characterization for impending disposition.
- All radioactive material will be handled and managed in accordance with Aptuit's radioactive materials license.
- All potentially contaminated waste media generated during the project that cannot be adequately characterized by field survey (e.g. liquids, vacuum contents, drain solids, filter media, etc.) or by the on-site laboratory will be analyzed by an off-site laboratory.

6.1.3.1. The following basic criteria related to acceptance for shallow land burial will be followed:

- Any medium that is potentially or known to be hazardous shall not be commingled with radioactive wastes.
- Packages shall contain no standing water or excessive moisture.
- All clean industrial trash shall always be segregated unless potentially contaminated.
- No chemical containers or pressurized aerosol cans will be included.

7. WASTE MINIMIZATION

The generation of radioactive waste will be minimized by employing work practices such as:

- Restricting material entering contamination areas to those needed for performance of work

- Restricting quantities of hazardous materials (paints, solvents, chemicals, etc.) entering contamination areas
- Surveying potentially contaminated material to separate uncontaminated from contaminated materials

8. WASTE STORAGE AND HANDLING

- Radioactive waste shall be stored in a manner which prevents inadvertent spread and minimizes personnel exposure, as applicable.
- Radioactive waste will be stored in a designated radioactive materials storage area The access controls instituted shall be based on the types and amounts of material present and routine radiological surveys.

9. EMERGENCY RESPONSE

Emergency procedures are contained in the Aptuit RSPM.

10. RADIOACTIVE WASTE SHIPPING

All shipments of radioactive waste will be shipped in accordance with 49 CFR 173, Subpart I.

11. ATTACHMENTS

None

12. FORMS

Survey Forms

13. REVISION HISTORY AND APPROVAL

Rev Level	Rev Date	Rev Description	Approver
0 1	8/7/12 2/18/13	Initial Issue Correct formatting in Section 6.1.2	_____ Project Health Physicist _____ Site Supervisor

APTUIT WORK INSTRUCTION	
TITLE: RADIOLOGICAL CHARACTERIZATION OF SYSTEMS, SURFACES AND EQUIPMENT FOR DECOMMISSIONING ACTIVITIES AT APTUIT, LLC.	**No:** Aptuit WI-007 **Date:** August 28, 2012 **Page:** 1 of 7

UNCONTROLLED
WHEN REPRODUCED

1. PURPOSE

This procedure describes methods and techniques to be employed when characterizing the radiological impact of activities performed at Aptuit LLC, Kansas City, MO (Aptuit). Characterization surveys include building surfaces, air exhaust, vacuum, and drainage systems, overhead areas, and environmental media. Characterization surveys/sampling will be performed to:

- Provide sufficient characterization data to enable a determination on the scope of decontamination and decommissioning (D&D) activities that are warranted to make the site suitable for unrestricted use.
- Provide data for remediation alternatives and waste characterization.
- Provide data for establishing radiological controls.
- Provide input into the final status survey design, and, in some cases provide data to meet final status survey (FSS) requirements.

2. APPLICABILITY

This procedure applies to facilities, equipment, systems, and environmental media that are subject to decommissioning activities being conducted at Aptuit.

3. REFERENCES

Aptuit Radiation Safety Program Manual, March 2008

Manufacturers' operating manuals

4. DEFINITIONS

TERM/ACRONYM	DEFINITION
ALARA	as low as reasonably achievable
D&D	decontamination and decommissioning
DQOs	data quality objectives
FSS	final status survey
HEPA	High efficiency particulate air
LSC	liquid scintillation counter
PHP	Project Health Physicist
PPE	personal protective equipment

TERM/ACRONYM	DEFINITION
QC	quality control
SS	Site Supervisor
SS/SC	Site Supervisor/Survey Coordinator
ST	Survey Technician

5. RESPONSIBILITIES

5.1 Project Health Physicist

The Project Health Physicist (PHP) is responsible for the maintenance and management of this procedure.

5.2 Site Supervisor/Survey Coordinator (SS/SC)

The Site Supervisor (SS) will be responsible for the field oversight of the Survey Technicians (ST) performing this procedure. A Shaw Health Physicist or Radiological Control Technician will be designated for this position. The SS/SC is responsible for the supervision of data collection activities, including surveys and samples. Specific responsibilities include:

- Selecting proper equipment for the performance of defined data collection activities.
- Ensuring properly calibrated and tested equipment is available for the performance of survey/sampling tasks.
- Ensuring that the proper personal protective equipment (PPE) is available for the performance of Characterization tasks.
- Reviewing this procedure with all personnel that will be performing the work prior to beginning the tasks.
- Periodically observing the performance of the Characterization tasks to ensure that they are being performed according to this procedure.
- Determining locations for biased sample collection and direct measurement.
- Reviewing collected data for accuracy and verifying the completion of data collection.

5.3 Survey Technicians

STs will be responsible for the field execution of this procedure and for addressing any issues or suggested modifications with the SS or PHP.

The ST is responsible for the proper execution of survey and sampling activities. Specific responsibilities include:

- Ensuring all portable instrumentation is properly calibrated and checked prior to use
- Performing all data collection activities in full compliance with the established protocols

- Properly documenting all survey/sampling activities.

6. EQUIPMENT AND MATERIALS

- High efficiency particulate air (HEPA) vacuum
- Paper liquid scintillation smears
- Cotton swabs
- Metal or plastic laboratory tweezers
- Properly prepared liquid scintillation vials containing 7 milliliters of scintillation cocktail
- Mercury vapor analyzer (Jerome 431-X or other make/model)
- Radiation detection instruments (see Aptuit WI-002)
- Record/log sheets (e.g., survey forms, checklists, sample collection logs, field activity daily logs)
- Tin snips
- Plastic sheeting
- Power tools, including drills, saws, etc.
- Ladders
- PPE.
- Gallon size zip lock bags / metal colander
- Soil sample container
- Hand trowel or shovel
- Mild soap

7. PREREQUISITES

- Ensure that all instrumentation is properly calibrated and operating properly in accordance with Aptuit Work Instruction WI-002 and manufacturer procedures.
- Survey and sampling activities should be of a quality to meet the data quality objectives (DQOs) of the FSS.
- Ensure STs have proper PPE for area to be surveyed/sampled based on area postings and site control requirements.
- Ensure the job hazard analysis has been conducted for the survey/sampling activities and that all workers are properly briefed on the hazards anticipated.
- Review previous surveys of the survey unit, if available, to determine radiological conditions within the survey unit prior to entry.

- STs will be instructed on the potential radiological hazards that may be present in the survey units.

NOTE: Minimum PPE for performance of survey/sampling activities will be latex or nitrile gloves, steel toed boots, a Tyvek™ lab coat and safety glasses.

8. INSTRUCTIONS

8.1 General

The characterization survey includes:

- Performing scans of potentially contaminated building surfaces for surface contamination including expansion joints, stress cracks, and wall/floor interfaces.
- Performing systematic direct measurements and smears.
- Performing judgmental direct measurements and smears on building surfaces and in exhaust systems, drains and traps, and overhead areas.
- Performing judgmental direct measurements and smears of areas of elevated activity.
- Sampling potentially impacted environmental media (e.g., surface soil).
- Documenting survey and sampling locations and results.

8.2 Building Surfaces

The characterization survey of building surfaces includes:

- Surface scans of designated and adjacent areas to identify locations which may indicate residual contamination.
- Systematic measurements and sampling are performed throughout the designated areas. The number and spacing of the measurement locations must be such that sufficient data points to evaluate the radiological condition of the property are generated.
- Judgmental measurements and samples are collected at representative "hot spot" locations, identified by surface scans.
- Judgmental measurements and samples are collected in areas most likely to be contaminated (e.g., in front of hoods, areas where spills have occurred, etc.).

Perform surveys in accordance with Aptuit Work Instruction WI-001. Characterization surveys to be used in the determination of final status shall meet the FSS design.

8.3 Exhaust Systems

All of the existing exhaust systems associated with the Aptuit Scientific Operations will be removed. In order to be removed safely and disposed of properly, each section removed from the system will be characterized for radiological contamination.

These sections will be characterized as follows:

- Exhaust systems that are not able to be surveyed from the ground will be accessed by a ST via a step ladder.

- Survey the existing opening using the appropriate PPE per Aptuit WI-005 and following the survey procedure from Aptuit WI-001. If the scanning survey, direct measurement, or wipe sample exceeds the action level in Aptuit WI-005, stop work and institute the appropriate radiological controls as directed by the RSO before continuing the characterization survey.
- After the conditions of the existing opening have been assessed, create a small hole in the exhaust system no greater than 5 feet from the opening or previous survey point using a power drill. Using a cotton swab on a stick, wipe the inside of the newly created hole and count the swab in the liquid scintillation counter (LSC) per Aptuit WI-003.
- If there is indication that the action level may be exceeded, stop work and institute the appropriate radiological controls as directed by the RSO.
- Once the exhaust system has been assessed, create 10 inch by 10 inch opening in the side of the system using tin snips (manual or pneumatic) and perform a survey of the inside of the exhaust system, per Aptuit WI-001.
- For characterization and as low as reasonably achievable (ALARA) purposes, the highest readings observed at either end of the section to be removed will be applied to the entire section.

It is assumed that the majority of the contamination will have been contained within the exhaust system prior to the HEPA filter and housing. Each section prior to the HEPA housing and each section past the housing will be surveyed in this manner until a section falls below the Aptuit equipment release limit.

After this point has been reached, sections may be removed as regular construction debris although each section will still be characterized by surveying each opening prior to being released.

8.4 Drains and Traps

Based on site engineering drawings, no holding tanks exist between the lab drains, including lab and sanitary sinks, eyewash drains and floor drains, and the site pH treatment building. Samples have been collected and analyzed for radioactive contamination from the pH treatment building bi-monthly since 2011. Because of this, it is not deemed necessary to scope the entire drain system. Rather, the drains will be characterized by performing scanning, static and wipe surveys per Aptuit WI-001.

The drains will be accessed by using the dismantling techniques in the Aptuit WI-004 section 8.4.

If a drain is deemed to be contaminated above the Aptuit free release limit, it will be removed to a point 5 feet beyond the last identified area of contamination and then resurveyed until no contamination above the Aptuit free release limit is found.

8.5 Overhead Areas

In areas where it is deemed necessary to characterize above 6 feet, these steps will be followed:

- Prior to the survey, plastic sheeting will be placed below the area to be surveyed to prevent the potential spread of contamination.
- Wall areas above 6 feet and overhead areas will be accessed via step ladder. The ST performing the survey will stand no higher than the second highest ladder step. If this cannot be accomplished, a taller ladder will be acquired before proceeding with the survey.

- In the case of a ceiling or exposed pipe/system, the ladder will be placed as close to the area to be surveyed as possible. Once this is accomplished, a survey will be performed according to Aptuit WI-001.
- In the case of a ceiling tile, the ladder will be placed adjacent to the tile to be surveyed. A scanning survey will be performed around the edges of the tile to determine if there is any indication of contamination above the release criteria. If there is indication that the release criteria will be exceeded, work will stop and appropriate PPE will be obtained.
- After the initial scanning survey, the tile will be lifted out of place and set above the other ceiling tiles. A visual inspection of the tile and surrounding tiles will be performed.
- If there is a noticeable amount of debris above or on the tile, it may be vacuumed using a HEPA vacuum.
- After the tile has been inspected, it will be handed to another ST to be placed on the plastic sheeting.
- Once the tile has been placed on the plastic sheet, a survey will be performed per Aptuit WI-001.
- After the tile has been surveyed, it will be replaced as it was found initially.

8.6 Surface Soil Sampling

In areas where it is deemed necessary to characterize soil, the appropriate steps are as follows:

- Soil sample locations shall be identified on a map showing systematic and bias sample locations and identification numbers.
- Composite samples will be collected using a trowel or a hand shovel to take a representative sample to 6 inches in depth. The sample will then be placed in a metal bowl or new gallon sized zip lock bag to composite.
- After compositing, the soil sample will be placed in the appropriate lab container for analysis. Each container will be labeled using a permanent marker to include the sample identification number; sample time, date, and sample analysis.
- To prevent cross contamination between soil samples, sampling tools shall be decontaminated using soap and water. In addition, gloves will also be changed between each sample location.
- The outside of soil sample containers will be cleaned of any residual soil, and radiologically surveyed prior to analysis.

9. ATTACHMENTS

None

10. FORMS

Survey Forms

11. REVISION HISTORY AND APPROVAL

Rev Level	Rev Date	Rev Description	Approver
0	8/07/12	Initial Issue	_____ Project Health Physicist _____ Site Supervisor

APTUIT WORK INSTRUCTION	
TITLE: BIOASSAY	**No:** Aptuit WI-008 **Date:** August 28, 2012 **Page:** 1

UNCONTROLLED
WHEN REPRODUCED

1. PURPOSE

This procedures describes the process to monitor permissible levels of tritium H^3 and C^{14} in the body on a weekly basis of employees handling radioactive materials.

2. APPLICABILITY

This procedure applies to decommissioning activities being conducted at Aptuit by all decommissioning personnel.

3. REFERENCES

3.1 Aptuit Radiation Protection Plan Manual, March, 2008

4. ATTACHEMENTS

Aptuit – Radiation Protection Plan Manual, Number 7002, Urinalysis.

5. DEFINITIONS

TERM/ACRONYM	DEFINITION
C^{14}	carbon-14
H^3	tritium

6. REVISION HISTORY AND APPROVAL

Rev Level	Rev Date	Rev Description	Approver
0	8/7/12	Initial Issue	_____ Project Health Physicist _____ Site Supervisor

Revised By:

Approved:

RSO

1.0 PURPOSE

This Standard Operating Procedure (SOP) describes the process to monitor permissible levels of tritium (H^3) and C^{14} in the body on a weekly basis of employees handling radioactive materials.

2.0 REFERENCES

Nuclear Regulatory Commission Federal Guidance Report 11

Nuclear Regulatory Commissions Regulatory Guide 8.9 "Acceptable Concepts, Models, Equations, and Assumptions for a Bioassay Program."

3.0 RESPONSIBILITY

3.1 It is the responsibility of each employee that comes in contact, or has potential contact with radioactive material to submit a sample for testing. All personnel working in B2 radio-laboratories shall submit urinalysis samples for any week they are working in the laboratories handling greater than ALI (Allowable limit for Intake) quantities.

3.2 It is the responsibility of the Radiation Safety Officer or assistant to perform the actual testing.

4.0 PROCEDURE

4.1 Requirements

4.1.1 Urine specimens are to be submitted by all laboratory technical staff and ancillary personnel by 3 p. m. on the last working day of the week. Specimen cups are located in the rest rooms. Samples may also be given by employees when an exposure is suspected due to abnormal or infrequent operations.

4.1.2 A minimum of 10 mL is required for the sample.

4.1.3 After submitting the sample, the individual should write his/her name or initials and the date/time of sample, and place in the designated area for pick up inside the restroom.

4.2 Testing

4.2.1 Using an Eppendorff pipet, take 1 mL of water and inject into a 10-ml vial with 6 mL of scintillation cocktail. Repeat three times to determine which is the lowest reading for the background sample.

4.2.2 Take a 1 mL aliquot of each individual's urine and inject it into a vial containing 6 mL of cocktail. Label the cap of the scintillation vial with the individual's initials. Labeling the tray is also sufficient.

4.2.3 Using the "Urinalysis" program on the scintillation counter, count each sample for 0.5 minutes for a quick survey to determine if any exposures are suspect or additional samples will be necessary.

4.3 Results-Local Control Levels and Maintenance of ALARA program

4.3.1 If any individual's urine shows > 124,000 dpm H^3 or 3800 dpm C^{14} above background, give the individual 5 fresh scintillation vials for another Friday sample, then 2 Saturday and 2 Sunday samples. A sample is also required on Monday.

4.3.2 If any individual's urine shows > 62,000 dpm H^3 or 1900 dpm C^{14} above the background sample, that individual will have to submit an afternoon Monday sample, as well as the morning sample.

4.3.3 If an individual's bioassay data shows levels exceeding 100 dpm/ml the cause of the exposure shall be investigated. The minimum items investigated shall be the hood operation, type and quantity of material used. Do not allow any individual back in the lab until their urine sample is below the limits in 4.3.2 without prior approval of the Director of API.

4.3.4 Count each additional sample for 60 minutes to obtain more accurate survey data.

4.4 Documentation

4.4.1 Results of exposures will be evaluated using the following equation for the appropriate isotope.

C^{14} Exposure={Urine dpm/ml}* {1400 ml/day}*{2.087X10^{-6} mrem/pCi}*{1pCi/2.22 dpm}

H^3 Exposure={Urine dpm/ml}* {1400 ml/day}*{6.4X10^{-8} mrem/pCi}}*{1pCi/2.22 dpm}

Definition of Terms

Urine-dpm/ml from EPPS bioassay readings

1400 ml/day reference ICRP-23 reference man. *1000 ml/day for adult female.*

C^{14} 2.087X10^{-6} mrem/pCi-FRG report 11 Page 122 for Inhalation tables. (5.64X10^{-10} Sv/Bq). Assumes carbon exposure from organic; see FRG11 for monoxide and dioxide conversion factors.

H^3 $6.4X10^{-8}$ mrem/pCi-FRG report 11 Page 122 for Inhalation tables. ($1.73X10^{-11}$ Sv/Bq)

4.4.2 Exposures from means other than inhalation will be evaluated using the CINDY program and FRG 11.

4.4.3 A weekly exposure is then calculated and recorded on the form.

4.4.4 A running weekly exposure will be generated. This will be added to the exposure received on film badges and added to the quarterly and yearly exposure for tracking purposes. If an individual does not submit a sample for a given week, he/she will have a exposure estimate for that week. The dose estimate will be based on prior exposure for the type of work and isotopes being handled.

4.4.5 Active files and completed files are kept in the file cabinet by the Assistant Radiation Safety Officer's desk.

4.5 Additional information and NRC Guidelines

4.5.1 C^{14} Evaluation and Investigation Levels

a) C^{14} Evaluation Levels= ALI * 0.02= 2mCi *0.02=.04mCi OR $6.34X10^4$ dpm/ml OR an exposure of 83.48 mrem.

b) C^{14} Investigation Levels=ALI *0.1=2mCi *0.1=0.2 mCi OR $3.17X10^5$ dpm/ml OR an exposure of 417.4 mrem.

4.5.2 H^3 Evaluation and Investigation Levels

a) H^3 Evaluation Levels=ALI *0.02= 80 mCi * 0.02=1.6 mCi OR $2.54X10^6$ dpm/ml OR an exposure of 102.4 mrem.

b) H^3 Investigation Levels=ALI *0.1=80 mCi * 0.1=8 mCi OR $1.27X10^7$ dpm/ml OR an exposure of 512 mrem.

APTUIT WORK INSTRUCTION	
TITLE: BAG-IN / BAG-OUT OPERATING AND MAINTENANCE GUIDE.	**No:** Aptuit WI-009 **Date:** August 28, 2012 **Page:** 1 of 1

UNCONTROLLED
WHEN REPRODUCED

1. PURPOSE

This procedure describes the bag-in / bag-out operating and maintenance guide for bag-in / bag-out Containment Housings.

2. APPLICABILITY

This procedure applies to facilities, equipment, systems, and environmental media that are subject to decommissioning activities being conducted at Aptuit.

3. REFERENCES

Aptuit Radiation Safety Program Manual, March 2008

Manufacturers' operating manual.

4. ATTACHMENTS

Barnebey Sutcliffe: Bag-in / Bag-out Operating and Maintenance Guide

5. REVISION HISTORY AND APPROVAL

Rev Level	Rev Date	Rev Description	Approver
0	8/7/12	Initial Issue	_____ Project Health Physicist _____ Site Supervisor

BAG-IN/BAG-OUT OPERATING AND MAINTENANCE GUIDE

Bag-In/Bag-Out Containment Housings

For containment of hazardous chemicals, biological, and radioactive contaminants.

Applies to:
CM/CMP Series For Gasketed Filters
KE/KEP Series For Fluid Seal Filters

CAUTION

NOTICE TO READER:

This manual is only an operating and maintenance guide. Thorough on-site safety reviews must be conducted before attempting any action discussed herein.

This manual is to be used by the reader as an assistance guide and an operational framework when installing and exchanging filters in the Bag-In/Bag-Out Housings: Model CM and Model KE. Since system designs and environments vary, procedures in this manual must be adapted for particular and appropriate on-site need. It is written and presented with the understanding that operators and maintenance personnel participating in the use and maintenance of the equipment are properly trained and equipped to perform assigned functions in a safe manner.

IMPORTANT

TO ACHIEVE MAXIMUM PROTECTION, IT IS IMPERATIVE THAT THE READER IS COMPLETELY FAMILIAR WITH THE METHODS DESCRIBED HEREIN AND REVIEWS PROCEDURES WITH ON-SITE SAFETY PERSONNEL OR AN OUTSIDE CONSULTING GROUP BEFORE PERFORMING ANY FILTER EXCHANGE.

Depending upon the nature of the contaminants in the environment, it may be necessary for the operator to wear specialized protective clothing or utilize other personal protective devices when installing or exchanging filters. The operator must therefore be familiar with all of the on-site safety policies and procedures. Change-out methods require study and skilled practice.

This manual does not address system installation, nor does it address the suitability of a product for particular usage. If you have any questions concerning any of the guidelines or procedures in this operating guide, please contact Barnebey Sutcliffe by using the contact information on the bottom of the final page.

1. CONTAINMENT HOUSINGS

The Bag-In/Bag-Out contaminant filtration system, if properly selected and operated, provides protection from hazardous air contaminants, e.g., biological, radiological or chemical. For maximum protection with containment housings, correct filter element installation and filter element exchange procedures must be followed.

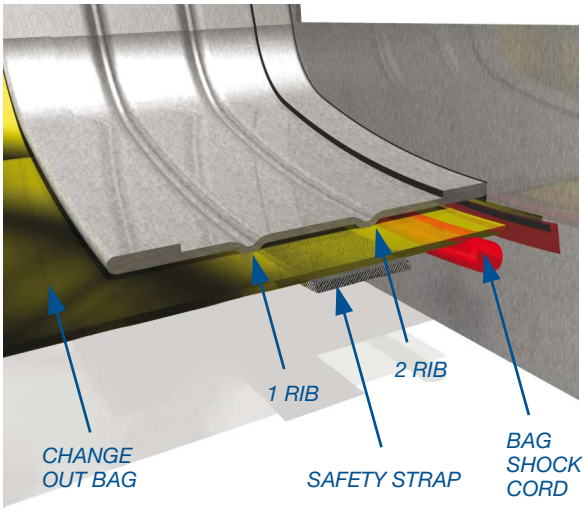
It is imperative that the operator be thoroughly familiar with Bag-In/Bag-Out Containment Housings and that appropriate adaptations are implemented on-site before proceeding with filter element installation or filter element exchange. It is also important for the operator to practice the bag sealing method on a new piece of 8-mil PVC before working directly with the change-out bag.

Filtration system housings are available in a variety of models that are designed to meet specific needs. Because of the system needs and the environments in which they operate vary, a schedule for the frequency of filter exchange is site-specific. Safeguards should be established on-site to ensure that filter exchanges occur as part of regularly scheduled maintenance.

The Bag-In/Bag-Out housing system consists of a series of modular sections. A typical system consists of a combination 2-inch, 4-inch or 6-inch prefilters and a standard 11½-inch deep HEPA filter and/or an activated carbon adsorber. Activated carbon adsorbers are provided in 12-inch, 16-inch, and 18-inch depths and chosen based on the application.

An all-welded construction of the housings ensures an air tight enclosure. Both the front and rear panels are of single-piece construction. This reduces the number of welds and the potential for leakage. All discontinuities in weld are free of burrs and sharp edges. All welds and welders are qualified in accordance with Section IX of the ASME BPV code.

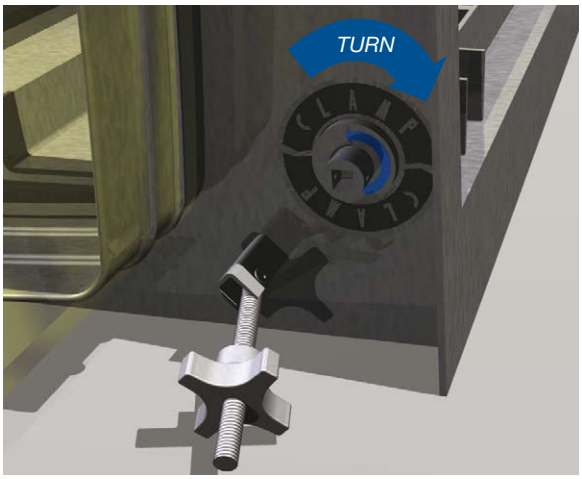
Collar Design



Filters are accessed through a bag-in/bag-out porthole. A collar around each porthole provides a means of securing the change-out bag. The collar is hemmed to prevent damage to the change-out bag during the sealing operation. Two parallel ribs are located on the outside perimeter of the collar. These ribs help in securing the straps during filter change-out. The door is sealed against the front of the housing, and secured by four swing-bolt latches with threaded aluminum knobs.

2. FILTER LOCKING MECHANISM – MODEL CM

In the Barnebey Sutcliffe CM SERIES filter systems, a positive clamped gasket provides the seal between the filter gasket and the sealing surface of the housing. The filter-locking mechanism consists of a drive screw, travel nut, and spring-loaded pressure bar. Filters are secured in place with a top and bottom locking mechanism that is spring-loaded. These mechanisms maintain constant pressure between the filters and the frame. This pressure compensates for any relaxation of gasket material that may occur. The clamping

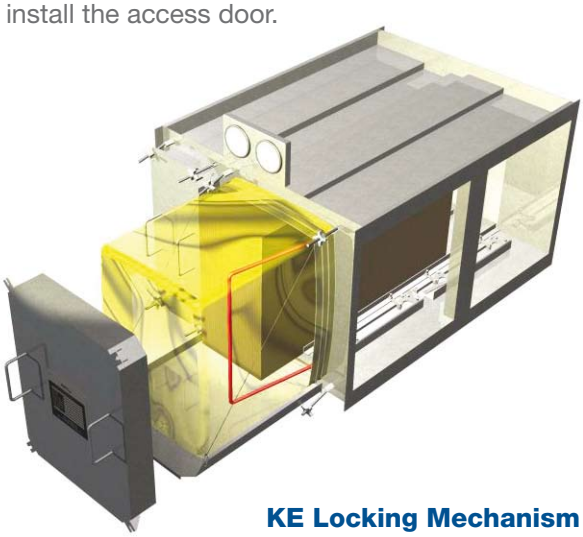


CM Locking Mechanism

mechanism actuators penetrate the housing wall by means of a leak-tight packing gland. Using a standard 3/8 inch drive ratchet operates the actuators.

3. FILTER LOCKING MECHANISM – MODEL KE

KE SERIES filters are secured in place with a locking arm. The filter elements used in the KE SERIES housings feature a liquid-filled channel on one side of the integral frame. This channel, which is filled at the factory with sealing fluid, mates to the knife-edge in the housing. Four metal retracting clips are required and attached to the filter to facilitate filter removal. When the locking arm is pushed or pulled, the locking mechanism respectively directs the filter into the correct location. This design also incorporates the unique safety feature that requires the filter to be properly installed in order to properly install the access door.



KE Locking Mechanism

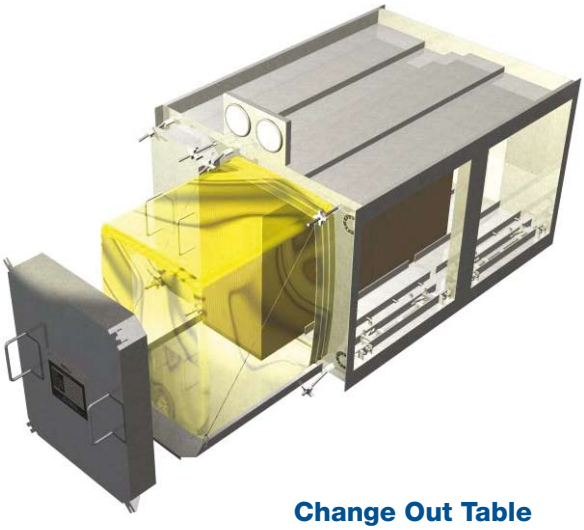
4. CHANGE-OUT BAGS AND TABLE

Change-Out Bags

The Bag-In/Bag-Out containment housing utilizes a heavy-gauge, 8-mil PVC change-out bag with an elastic retainer cord. The cord is hemmed into the mouth of the bag for a positive fit when stretched over the collar of the porthole. Special sleeves with gloves are formed into each bag. These sleeves assist in the handling of filters and stump removal of the old bag generated during the change-out procedure. Safety and cinch straps can be purchased with each change-out kit for additional safety. Filter installation and exchanging are handled through the bag as described in this guide.

Change-Out Table

An optional change-out table is available from Barnebey Sutcliffe to assist the operator with filter exchanging. It is held in place and supported by the swing-bolt latches used to secure the access door. The change-out table is positioned to help prevent the filter from dropping and ripping the bag. The operator should check the system to see if an optional change-out table has been incorporated. If not, the operator should use an appropriate support during filter installation and exchanging for ease of maintenance.



Change Out Table

5. RECEIVING INSPECTION

NOTE: ALL EQUIPMENT MUST BE IMMEDIATELY INSPECTED UPON RECEIPT FROM THE CARRIER. ANY DAMAGE MUST BE REPORTED TO THE CARRIER IMMEDIATELY AND ACKNOWLEDGED IN WRITING TO PRESERVE ANY CLAIM.

Inspect all equipment for damage and ensure that all received material agrees with shipping documents.

Pay particular attention to:

- Housings – for dents, bent flanges, or gasket damage
- Filters – for gasket damage, or damage to the media or filter frames
- Auxiliary or optional equipment for any damage

After inspection, keep the filter(s) in their respective shipping carton until they have been transported to the proper housing location. Unpack the filter(s) according to the filter manufacturer's instructions that are normally provided on the shipping carton. HEPA filters are especially fragile; be certain not to cause any damage to the filter media or gaskets during unpacking and installation.

6. MATERIALS AND TOOLS NEEDED

Assemble required materials and tools:

- Correct quantity and size of new adsorbers or filters
- Correct quantity and size of new change-out bags (see REPLACEMENT PARTS)
- Support for the adsorbers or filter installation or exchange, either from optional Barnebey Sutcliffe change-out table (see CHANGE OUT BAGS & TABLE) or locally provided support
- Standard 3/8-inch drive ratchet*
- Silicone grease for CM Series*

* Not provided

7. INITIAL FILTER INSTALLATION – MODEL CM

***NOTE:** The following chapters include specific filter installation procedures for Model CM and Model KE containment housings.*

Before proceeding with filter installation, ensure that the housing has been anchored as required. Confirm the inlet and outlet flanges have been properly welded, gasketed, bolted, and then tested for leaks.

***WARNING:** BEFORE BEGINNING PROCEDURE, MAKE SAFETY PROVISIONS TO STOP AIRFLOW AND LOCK OUT, TAG, AND TRY SYSTEM IN ACCORDANCE WITH APPLICABLE PLANT SAFETY DIRECTIVES.*

Step 1 – Remove the housing access door by loosening the aluminum knobs and swing knobs away from door hold-down clips. Remove door by pulling the door toward you.

Step 2 – Turn each filter-locking mechanism with a 3/8 inch drive ratchet in a clockwise direction, alternating top to bottom until it reaches its full open position. Full open position occurs when the travel nuts contact the guide blocks and the ratchet no longer turns. Do not apply excess pressure when opening or severe damage will result to clamping mechanism.

Step 3 – Evenly coat the entire face of the new filter gasket with silicone grease. This prevents the filter gaskets from sticking to the housing sealing surface and will help achieve and maintain good filter-to-housing seal.

Step 4 – Position the filter element(s) into the housing opening (with gasket facing the sealing surface) while ensuring that the filter element(s) being installed is (are) in the correct orientation. Install filters; particulate filter(s) will have pleats vertical and the carbon adsorber(s) will have horizontal panels. Slide filter element(s) into the housing while taking precaution not to damage the gasket. Use the pressure bars of the locking mechanism as a guide by butting the nongasket side of the filter element(s) to the bars, and gently but firmly, pushing the filter element(s) until it touches the back of the housing or adjacent filter element(s). Repeat until all filters are installed (see section on MULTIPLE FILTERS).

Step 5 – Seal and lock the filter(s) in place by alternately rotating each locking mechanism. With a 3/8-drive ratchet, rotate one locking mechanism counter-clockwise two turns. Then turn the other locking mechanism counter-clockwise two turns. Alternate the procedure until completely tightened. When completely tightened, the 1/4-inch gasket will be compressed to approximately 1/8 of an inch. Do not overtighten or filter damage will result and could damage the clamping mechanism.

Step 6 – Place the change-out bag over the collar. Ensure that the elastic cord of the bag is located between the second rib of the collar and the housing frame. For added safety, attach the safety strap around the change-out bag, between the two ribs and draw the strap tight.

Step 7 – Gather the bag near the collar until the slack of the bag around the lip is almost gone. Leave only enough slack in the bag around the collar so that the remaining bulk of the bag may be stored inside the collar when the door is replaced. At the point where the gather in the bag occurs, wrap the cinch strap around the bag. Tighten the cinch strap so that the gather will not unravel. Roll or fold the remainder of the bag so it will not interfere with the access door seal when it is replaced. Failure to do this could result in bags being drawn into the housings or improper door sealing.

Step 8 – Replace the access door. Confirm that the bag is neatly tucked inside of the collar of the porthole. Tighten the aluminum knobs alternately until the door is securely sealed.

***CAUTION:** BE SURE TO INSTALL MULTIPLE FILTERS AS NEEDED BEFORE PLACING THE HOUSING "ON STREAM" (see section on MULTIPLE FILTERS).*

***NOTE:** REPEAT STEPS 1 THRU 8 FOR EACH BANK AND EACH TIER OF THE SYSTEM.*

Step 9 – Once the steps are complete for each unit and tier, the unit is ready for operation.

8. INITIAL FILTER INSTALLATION PROCEDURES – MODEL KE

***WARNING:** BEFORE BEGINNING PROCEDURE, MAKE SAFETY PROVISIONS TO STOP AIRFLOW AND LOCK OUT, TAG, AND TRY SYSTEM IN ACCORDANCE WITH APPLICABLE PLANT SAFETY DIRECTIVES.*

Step 1 – Remove the housing access door by loosening the aluminum knobs and swing knobs away from door hold-down clips. Remove door by pulling the door toward you.

Step 2 – Unlatch and swing the locking arm toward you. This action actuates the clamping angles attached to the locking mechanism by moving the locking mechanism away from the knife-edge. This allows adequate room for the operator to slide the filter elements in place.

Step 3 – Slide the filter element(s) into the housing while ensuring that the filter element(s) being installed is (are) in the correct orientation, e.g., fluid seal channel facing the knife-edge of the frame. For correct orientation, refer to page 2, section 3. Confirm that all four retracting clips are overlapping the locking mechanism angles. Gently, but firmly, push the filter element(s) until it touches the back of the housing or an adjacent filter element.

Step 4 – After pushing the filter element(s) into place, move the locking arm slowly inward toward the filter and latch. This action will seat the fluid-filled channel onto the knife-edge. CAUTION: If the filter incurs resistance prior to the knife-edge penetrating the channel it will be necessary for the operator to back the filter element(s) away from the knife-edge and continue to push on the side of the filter element and repeat. NOTE: The locking arm position will prevent the door from being replaced if the filter element is not properly seated.

Step 5 – Place the change-out bag over the collar. Ensure that the elastic cord of the bag is located between the second rib of the collar and the housing frame. For added safety attach the safety strap around the change-out bag, between the two ribs, and draw the strap tight.

Step 6 – Gather the bag near the collar until the slack of the bag around the lip is almost gone. Leave only enough slack in the bag around the collar so that the remaining bulk of the bag may be stored inside the collar when the door is replaced. At the point where the gather in the bag occurs, wrap the cinch strap around the bag. Tighten the cinch strap so that the gather will not unravel. Roll or fold the remainder of the bag so it will not interfere with the access door seal when it is replaced. Failure to do this could result in bags being drawn into the housings or improper door sealing.

Step 7 – Replace the access door. Confirm that the bag is neatly tucked inside of the collar of the porthole. Tighten the aluminum knobs alternately until the door is sealed securely.

Step 8 – Once the steps are complete for each unit and tier, the unit is ready for operation.

***CAUTION:** BE SURE TO INSTALL MULTIPLE FILTERS AS NEEDED BEFORE PLACING THE HOUSING "ON STREAM" (see section on MULTIPLE FILTERS).*

***NOTE:** REPEAT STEPS 1 THRU 7 FOR EACH BANK AND EACH TIER OF THE SYSTEM.*

9. PREFILTER INSTALLATION FOR MODELS CMP & KEP

***WARNING:** BEFORE BEGINNING PROCEDURE, MAKE SAFETY PROVISIONS TO STOP AIRFLOW AND LOCK OUT, TAG, AND TRY SYSTEM IN ACCORDANCE WITH APPLICABLE PLANT SAFETY DIRECTIVES.*

Step 1 – Remove the housing access door by loosening the aluminum knobs and swing knobs away from door hold-down clips. Remove door by pulling the door toward you. Install filters with pleats in a vertical position.

Step 2 – Place the change-out bag over the collar. Ensure that the elastic cord of the bag is located between the second rib of the collar and the housing frame. For added safety, attach the safety strap around the change-out bag between the two ribs and draw the strap tight.

***NOTE:** Failure to do this could result in bags being drawn into the housings or improper door sealing.*

Step 3 – Gather the bag near the collar until the slack of the bag around the lip is almost gone. Leave only enough slack in the bag around the collar so that the remaining bulk of the bag may be stored inside the collar when the door is replaced. At the point where the gather in the bag occurs, wrap the cinch strap around the bag. Tighten the cinch strap so that the gather will not unravel. Roll or fold the remainder of the bag so it will not interfere with the access door seal when it is replaced.

Step 4 – Replace the access door. Confirm that the bag is neatly tucked inside of the collar of the porthole. Tighten the aluminum knobs alternately until the door is securely sealed.

Step 5 – Once the steps are complete for each unit and tier, the unit is ready for testing.

CAUTION: *BE SURE TO INSTALL MULTIPLE FILTERS AS NEEDED BEFORE PLACING THE HOUSING "ON STREAM" (see section on MULTIPLE FILTERS).*

NOTE: *REPEAT STEPS 1 THRU 4 FOR EACH BANK AND EACH TIER OF THE SYSTEM.*

TESTING

After the assembly has been completed and to ensure proper installation, the filter/adsorber bank should be tested. This test should be performed in accordance with site testing procedures.

10. FILTER EXCHANGE – SINGLE FILTER

WARNING: *BEFORE BEGINNING PROCEDURE, MAKE SAFETY PROVISIONS TO STOP AIRFLOW AND LOCK OUT, TAG, AND TRY SYSTEM IN ACCORDANCE WITH APPLICABLE PLANT SAFETY DIRECTIVES.*

NOTE: Barnebey Sutcliffe recommends that the operator use the band method of sealing the change-out bag.

PRELIMINARY STEPS

Step 1 – Confirm correct sizes and quantities of filters and change-out bags are available to be used in the filter exchange. See Filter/Adsorber Change-Out Bags (page 12) for the appropriate size bag.

Step 2 – Provide a heavy-duty, appropriate support or table to support the filter elements. Locate the support approximately 20 inches in front of the housing and a few inches below the bottom of the appropriate door.

An optional change-out table is available from Barnebey Sutcliffe. Refer to Change-Out Table, page 3 of this manual, for details on the change-out table.

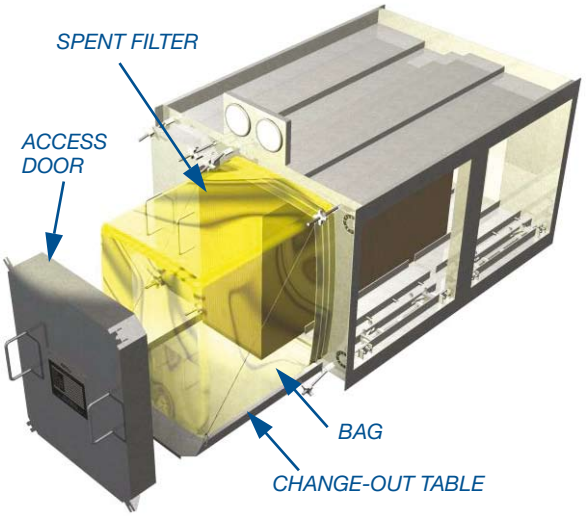
Assemble required materials and tools:

- Correct quantity and size of new adsorbers or filters
- Correct quantity and size of new change-out bags (see REPLACEMENT PARTS)
- Support for the adsorbers or filter installation or exchange, either from optional Barnebey Sutcliffe change-out table (see CHANGE OUT BAGS & TABLE), or locally provided support
- Standard 3/8-inch drive ratchet*
- Silicone grease for CM Series*

*Not provided

Step 3 – Make provisions to stop the airflow to the housing and lock out prior to starting this procedure. Open the breather valve if provided. This will release the vacuum and equalize pressure to ambient conditions.

Step 4 – Remove the access door. Remove the cinch strap. Place the optional change-out table or suitable support in front of the opening. Unroll the previously installed bag. Spread the bag over the support or table. Leave the breather valve opened, if provided with the housing assembly.

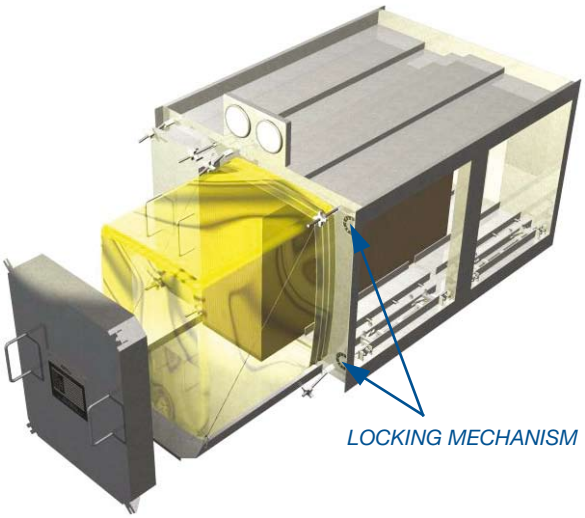


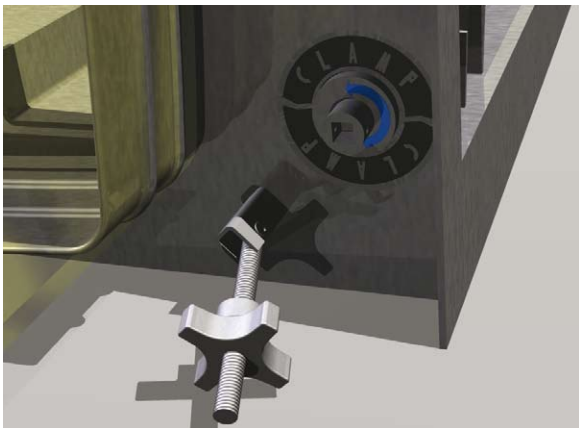
Step 5 – Disengage the filter element from the sealing surface by rotating the locking mechanism clockwise using a 3/8-inch ratchet for the CM design OR by unlatching and swinging the locking arm toward you for the KE design (see diagram on next page).

Step 6 – Place hands and arms in the sleeves provided in the change-out bag and push the change-out bag inward toward the filter. Firmly grip the filter. Slide the used filter from the housing and into the extended bag. Be careful not to damage or tear the plastic bag. Manipulate the filter to the back of the bag to ensure a maximum of slack in the bag between the filter and the housing collar.

CAUTION: *FOR ACTIVATED CARBON FILTERS DUE TO THE WEIGHT (120 TO 240 LBS.) AND THE AWKWARDNESS OF THE LOAD, THE OPERATOR SHOULD BE ASSISTED WHILE HANDLING THE FILTER(S).*

CM DESIGN: Disengage the filter element by rotating the locking mechanism.



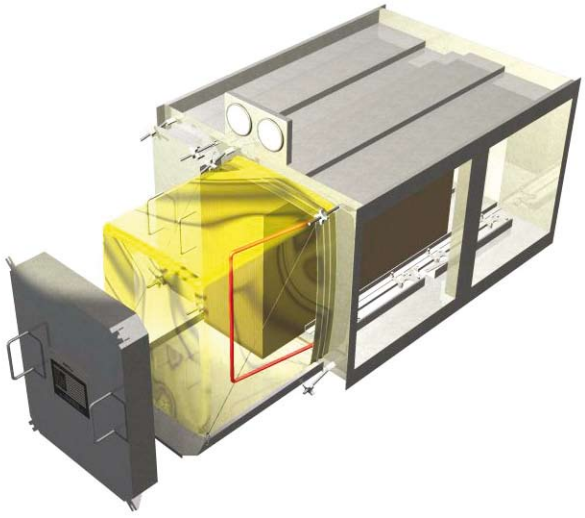


CM Locking Mechanism

Step 7 – Gather the excess material of the bag together at a midpoint between the filter and collar. Pinchoff the bag at this point by making two parallel seals approximately 6 to 7 inches apart and seal using two plastic ties provided with the kit. Cinch tightly to hold the bag in the gathered position. Locate the ties about 4 inches apart and the bands about 1 inch away from the plastic ties. (Refer to BAND SEALING METHOD of this manual). With both bands securing the bag gather, open the cutting tool and make a single cut between the two stainless bands. Tape over each seal end with duct tape for added security. Remove the newly sealed filter.

***NOTE:** FOLLOW ON-SITE DISPOSAL PROCEDURES FOR FILTERS OR CONTACT BARNEBEY SUTCLIFFE FOR FILTER DISPOSAL ASSISTANCE.*

KE DESIGN: Disengage the filter element by swinging out the locking arm.



Step 8 – The remaining part of the old change-out bag now forms a diaphragm, also referred to as a "stump". Remove the safety strap and set aside (it will be used in the final closure step). Pull/slide the shock cord of the diaphragm until it is located between the two ribs in the collar. The first rib should remain covered. For multiple filter systems, refer to FILTER EXCHANGE for further instructions before proceeding with installation of new filters.

Step 9 – Use caution handling the new filter. Check to ensure that the dimensions of the new filter are correct.

***CAUTION:** FOR ACTIVATED CARBON FILTERS DUE TO THE WEIGHT (BETWEEN 120 TO 240 LBS.) AND THE AWKWARDNESS OF THE LOAD, THE OPERATOR SHOULD BE ASSISTED WHILE HANDLING THE FILTER(S).*

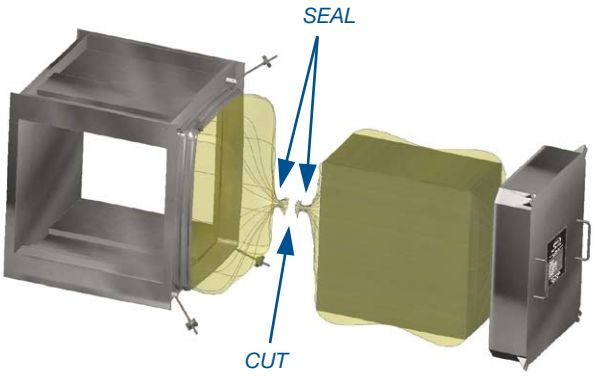
Check for dents or bent flanges. Check for gasket damage. Check for filter media damage. Look for tears in paper media (particulate filters) and dents or fractures in screen material of carbon adsorbers. Evenly coat the entire face of the new filter gasket with silicone grease. This prevents the filter gasket from sticking to the housing sealing surface and will help achieve and maintain good filter-to-housing seal. Place the new filter inside a new bag on the outside support, in front of the collar and with the sleeve hanging down. Make sure that the gasket is facing the seal face.

ALWAYS ENSURE THAT THE FILTERS ARE PROPERLY ORIENTED IN THE BAG PRIOR TO PROCEEDING. THE CORRECT ORIENTATION FOR PARTICULATE FILTERS IS WITH PLEATS IN THE VERTICAL POSITION. WHEN INSTALLING CARBON FILTERS, THE BEDS WILL BE HORIZONTAL (PARALLEL TO THE FLOOR).

Slip the open end of the bag over the stump until the elastic cord rests between the front of the housing and the second rib. Ensure complete confinement of the diaphragm or that stump is inside the new bag.

Step 10 – Withdraw the stump from the collar until it lies loosely inside the new bag. Install the safety strap between the two ribs and draw tight for added safety. Pull the stump into the sleeve of the new bag. Cut off the sleeve with the stump inside using the same process outlined in Step 7 for added security.

NOTE: THE INSTRUCTIONS FOR STEP 11 ARE SPECIFIC FOR EITHER A CM SERIES OR KE SERIES HOUSING. BE SURE TO FOLLOW APPROPRIATE STEPS FOR YOUR MODEL. STEP 11A IS FOR CM SERIES AND 11B IS FOR KE SERIES.



LOCATION OF SEALS AND CUT

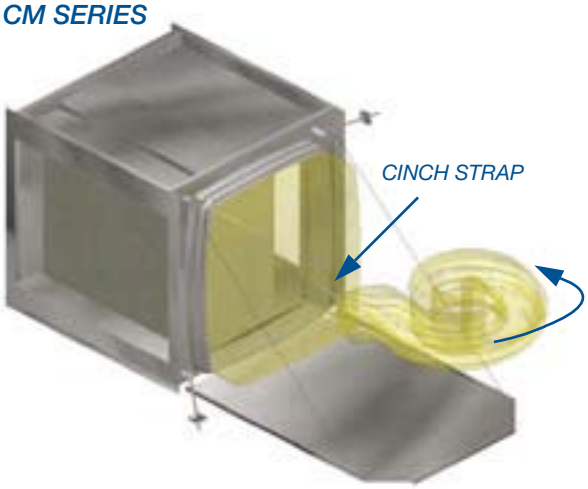
Step 11A – CM SERIES
Position the filter element(s) into the housing opening (with gasket facing the sealing surface) while ensuring that the filter element(s) being installed is (are) in the correct orientation.

ALWAYS ENSURE THAT THE FILTERS ARE PROPERLY ORIENTED IN THE BAG PRIOR TO PROCEEDING. THE CORRECT ORIENTATION FOR PARTICULATE FILTERS IS WITH PLEATS IN THE VERTICAL POSITION. WHEN INSTALLING CARBON FILTERS, THE BEDS WILL BE HORIZONTAL (PARALLEL TO THE FLOOR).

Slide filter element(s) into the housing while taking precaution not to damage the gasket. Use the pressure bars of the clamping mechanism as a guide by butting the nongasket side of the filter element(s) to the bars, and gently but firmly, pushing the filter element(s) until it touches the back of the housing or adjacent filter element(s). For multiple filters, see FILTER EXCHANGE in manual.

Slide the filter into the housing until it stops. Lock the filter into place by alternately rotating each clamping mechanism. With a 3/8-inch drive ratchet, first rotate one mechanism counter-clockwise two turns. Then turn the other mechanism two turns. Alternate procedures until completely tightened.

CM SERIES



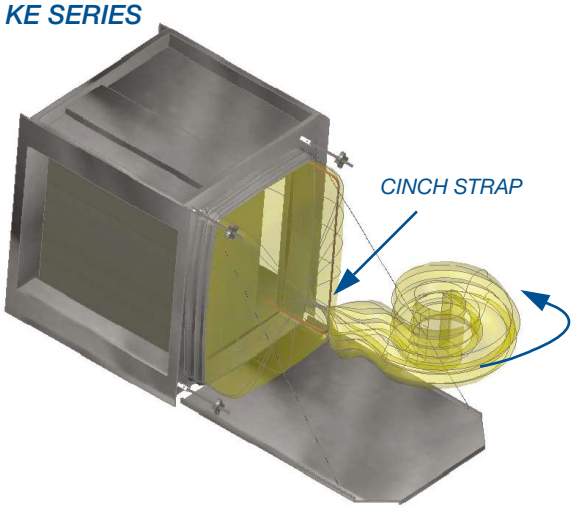
Roll the remainder of the bag so that it will not interfere with the access door seal when it is replaced. Gather the bag near the collar until the slack of the bag around the lip is almost gone. Leave only enough slack in the bag around the collar so that the remaining bulk of the bag may be stored inside the collar when the door is replaced. At the point where the gather in the bag occurs, wrap the cinch strap around the bag. Tighten the cinch strap so that the gather will not unravel. Roll or fold the remainder of the bag so that it will not interfere with the access door seal when it is replaced.

Step 11B – KE SERIES

Slide the filter element(s) into the housing while ensuring that the filter element(s) being installed is (are) in the correct orientation, e.g., fluid seal channel facing the knife-edge of the frame.

ALWAYS ENSURE THAT THE FILTERS ARE PROPERLY ORIENTED IN THE BAG PRIOR TO PROCEEDING. THE CORRECT ORIENTATION FOR PARTICULATE FILTERS IS WITH PLEATS IN THE VERTICAL POSITION. WHEN INSTALLING CARBON FILTERS, THE BEDS WILL BE HORIZONTAL (PARALLEL TO THE FLOOR).

KE SERIES



Install HEPA according to manufacturer's instructions. Confirm that all four clips are overlapping the locking mechanism angles. Gently, but firmly, push the filter element(s) until it touches the back of the housing or an adjacent filter element. For multiple filters, see FILTER EXCHANGE in this manual.

Slowly move the filter-locking arm inward toward the filter, and latch. This action will seat the fluid channel onto the knife-edge. Gather the bag near the collar until the slack of the bag around the lip is almost gone. Leave only enough slack in the bag around the collar so that the remaining bulk of the bag may be stored inside the collar when the door is replaced. At the point where the gather in the bag occurs, wrap the cinch strap around the bag. Tighten the cinch strap so that the gather will not unravel. Roll or fold the remainder of the bag so that it will not interfere with the access door seal when it is replaced.

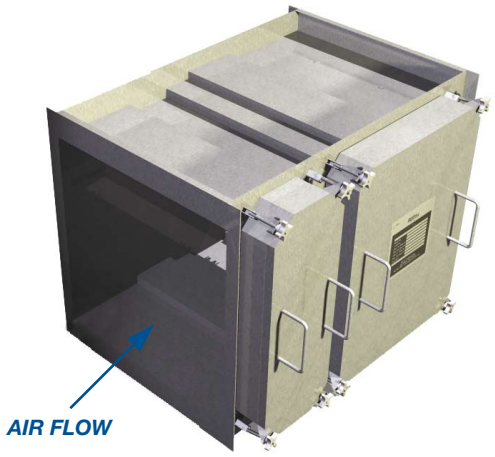
Step 12 – Replace the access door. Tighten access door knobs, ensuring evenly distributed pressure around the sealing edge. Close the breather valve. Once all of the filters in the system have been changed, follow start-up procedures established by the site procedures.

***NOTE:** FOR OLDER HOUSINGS WITH GASKET PAD INSIDE OF THE DOOR, IT IS RECOMMENDED THAT THE GASKET BE REPLACED PRIOR TO CLOSING. TO ORDER, CALL THE BARNEBEY SUTCLIFFE SALES DEPARTMENT. BE SURE TO NOTE THE HOUSING SERIAL NUMBER AND WHICH DOOR REQUIRES THE NEW GASKET.*

Step 13 – Leak-test the system to verify filter efficiency and proper installation.

11. FILTER EXCHANGE – MULTIPLE FILTERS

Multiple filters as defined in this manual refers to systems that hold more than one filter in each door. The operator should follow the same basic procedures for multiple filters as for single-filter change-out. All contaminated filters must be removed separately before new filters are installed in the housing. This is typical for each tier and each bank. One filter or adsorber per



bag is the recommended practice. The following additional steps will need to be followed for each respective filter per opening.

Once the new filter is installed, twist the excess bag material, squeezing air out of the bag, and make two parallel seals in the gathered material between the collar and the new bag sleeve creating a diaphragm/stump. Cut between the two seals using the same steps described in Step 5 of PRELIMINARY STEPS. Place the cut-off bag with the spent filters for proper disposal.

REPEAT STEPS 7 AND 8 OF THE FILTER CHANGE PROCEDURE; HOWEVER, DO NOT INSTALL SAFETY STRAP UNTIL THE FINAL STUMP OF THE FINAL FILTER HAS BEEN REMOVED.

Repeat these steps until all filters per opening are installed and perform the above steps for each new filter bag to create a new diaphragm/stump. Once the final filter has been installed, seal filter in place following Step 9 of the filter change-out procedure. Draw the final stump into the sleeve and either seal and remove the sleeve or store inside the collar until the next filter change-out. Install the safety strap and cinch the straps.

TO REMOVE ADDITIONAL FILTERS, a filter removal rod must be used by the operator.

Horizontal airflow housing incorporates the rod in the bottom and top of the housing.

PULL THE FILTER PULL ROD TOWARD YOU. This will pull the filters toward you and make them accessible at the door for ease of removal.

Refer to FILTER/ADSORBER CHANGE-OUT BAGS chart (page 12) for the correct quantity of bags required for multiple change-outs.

12. FILTER PACKAGING – BAND SEALING

The band-sealing method is a process utilizing two stainless steel bands to cinch the change-out bag together. The banding method provides an effective method for sealing the change-out bag and protecting the environment and operator from contamination.

The operator should practice the banding process before directly working with a change-out bag. With practice, the operator will be able to perform the procedure correctly and obtain an air-tight-seal.

Banding kit consists of:

1) Stainless Steel Bands – two required for each cut
2) Banding Tool
3) Ratchet Device
4) Plastic Ties – two required for each cut
5) Cutting Tool
6) Allen Wrench

The operator should use the Banding Kit and follow the procedure listed below to ensure proper sealing:

1) Remove the filter from the housing and place into the bag. On a firm shelf, manually gather the bag in two sections between the filter and the housing.

2) At the two manually gathered sections, use two plastic ties to cinch the bag tightly in order to hold the bag in the gathered position. Recommended distance between the ties is approximately 7 to 9 inches. This space is necessary since the double metal bands will be located between the plastic ties.

3) The stainless steel bands need to be formed into the shape of a “C” and looped around the bag between the two plastic ties.

4) At one end of the band is a buckle with a threaded insert. Please note that the threaded insert will need to be on the outside of the loop.

5) Insert the end of the band through the buckle and into the hole at the front of the banding tool. The banding tool should be held so that the word “Top” is visible and the cutting handle is on the left side.

6) The ratchet device will need to be inserted into the hole on the right side of the banding tool. Push the band through until it reaches the slot in the ratchet.

7) Operate the ratchet, winding the band tighter. Continue this step until the ratchet resists further winding.

8) Use the Allen wrench to set the threaded insert in the buckle. Tighten down the threaded insert.

9) To sever the band, push the cutting handle downward and forward toward the bag. Once severed, bend the severed end back into the buckle to prevent bag damage.

10) Repeat steps 2 through 9 for the additional band that should be placed approximately ½-inch away from the first band.

11) Before cutting the bag, experiment with the knife. Open the blade to the widest position and use the successive squeezes of the handles until the blades close.

12) Open the cutting tool (blade) and position it midway between the stainless steel bands. Please note that cutting too close to the band may damage the knife. To separate the dirty filter from the system, cut between the stainless steel bands. Refer to the FILTER EXCHANGE sections of this manual for additional disposal instructions.

13. MAINTENANCE & PARTS

MODELS CM & KE CONTAINMENT HOUSINGS HAVE BEEN DESIGNED FOR MINIMAL MAINTENANCE. FILTER REMOVAL AND FILTER INSTALLATION FOR MAINTENANCE SHOULD FOLLOW THE GUIDELINES IN THIS MANUAL.

REPLACEMENT PARTS

Replacement parts are available through Barnebey Sutcliffe. Most commonly ordered replacement parts are access door knobs, change-out bags, prefilters, particulate filters, carbon adsorbers, and swing bolt assemblies.

Replacement Parts

Part Number	Description	Quantity Calculation
1033367	Access Door Hand Knobs	4 per access door
1033237	Swing Bolt Assembly	4 per access door
1033489	Prefilter Access Door Gasket	7 feet per access door
1033489	12"-Deep Access Door Gasket	9 feet per access door
1033489	16-18"-Deep Access Door Gasket	10 feet per access door
1034780	Band Sealing Kit	
Refer to table on next page for Change-out bag Part #s (P/N)	Change-Out Bag	Refer to table on next page for appropriate quantities
Refer to unit name Plate for filter P/N	Prefilter	Number of filters high X number of filters wide
Refer to unit name Plate for filter P/N	HEPA filter	Number of filters high X number of filters wide
Refer to unit name Plate for filter P/N	Carbon adsorber	Number of filters high X number of filters wide

Filter/Adsorber Change-Out Bags

Bag Part #	Filter/Adsorber (H x W x D)	Cell Type	Bag Size
SP2515	24" x 24" x 2"	Prefilters	70C x 96
	24" x 24" x 4"		
	24" x 24" x 6"		
SP2006	24" x 24" x 11 ½"	HEPA Filters	90C x 96
SP8476	24" x 24" x 16"	Adsorbers	104C x 96
	24" x 24" x 18"		

Arrangement	Number of Cells	Total Number of Cells	Number of Bags Required
1H x 1W	1	1	1
1H x 2W	2	2	3
1H x 3W	3	3	5
1H x 4W	4	4	6
1H x 5W	5	5	8
1H x 6W	6	6	10
2H x 1W	1	2	2
2H x 2W	2	4	6
2H x 3W	3	6	10
2H x 4W	4	8	12
2H x 5W	5	10	16
2H x 6W	6	12	20
3H x 1W	1	3	3
3H x 2W	2	6	9
3H x 3W	3	9	15
3H x 4W	4	12	8
3H x 5W	5	15	24
3H x 6W	6	18	30
4H x 1W	1	4	4
4H x 2W	2	8	12
4H x 3W	3	12	20
4H x 4W	4	16	24
4H x 5W	5	20	32
4H x 6W	6	24	40

Note: The above chart assumes one full bag has been installed over each opening prior to change-out process.

Appendix F

Photographic Documentation

Location: Aptuit KCM
10425 Hickman Mills Drive
Kansas City, MO 64134-0708
Client: Aptuit
Date: 27 September 2011

Shaw Project Number: 144040
Photographer: Zach Peckham

Description: B3-103A incinerator

Photo Number: 1

Description: B2-112 HEPA Housing

Photo Number: 2

Location: Aptuit KCM
10425 Hickman Mills Drive
Kansas City, MO 64134-0708
Client: Aptuit
Date: 27 September 2011

Shaw Project Number: 144040
Photographer: Zach Peckham

Description: B2-119 – HP Support

Photo Number: 3

Description: B2-116 - LSC

Photo Number: 4

Location: Aptuit KCM
10425 Hickman Mills Drive
Kansas City, MO 64134-0708
Client: Aptuit
Date: 27 September 2011

Shaw Project Number: 144040
Photographer: Zach Peckham

Description: B2-117 – LSC Waste

Photo Number: 5

Description: B2 API Common

Photo Number: 6

Location: Aptuit KCM
10425 Hickman Mills Drive
Kansas City, MO 64134-0708
Client: Aptuit
Date: 27 September 2011

Shaw Project Number: 144040
Photographer: Zach Peckham

Description: B2-167/167A – access/egress

Photo Number: 7

Description: B2-166 – view from cubicle hallway

Photo Number: 8

Location: Aptuit KCM
10425 Hickman Mills Drive
Kansas City, MO 64134-0708
Client: Aptuit
Date: 27 September 2011

Shaw Project Number: 144040
Photographer: Zach Peckham

Description: B2-166 – view from cubicle hallway

Photo Number: 9

Description: B2-166 – view from cubicle hallway

Photo Number: 10

Location: Aptuit KCM
10425 Hickman Mills Drive
Kansas City, MO 64134-0708
Client: Aptuit
Date: 27 September 2011

Shaw Project Number: 144040
Photographer: Zach Peckham

Description: View of B2-155 from hallway

Photo Number: 11

Description: B Roof – Legacy stack and fans looking north

Photo Number: 12

Location: Aptuit KCM
10425 Hickman Mills Drive
Kansas City, MO 64134-0708
Client: Aptuit
Date: 27 September 2011

Shaw Project Number: 144040
Photographer: Zach Peckham

Description: Waste Storage (The Hill) - RAD Cage

Photo Number: 13

Description: Waste Storage (The Hill) – hazardous waste storage

Photo Number: 14

Location: Aptuit KCM
10425 Hickman Mills Drive
Kansas City, MO 64134-0708
Client: Aptuit
Date: 27 September 2011

Shaw Project Number: 144040
Photographer: Zach Peckham

Description: Entrance to Waste Storage (The Hill)

Photo Number: 15

Description: B2-103A – Incinerator stack looking northeast

Photo Number: 16

Location: Aptuit KCM
10425 Hickman Mills Drive
Kansas City, MO 64134-0708
Client: Aptuit
Date: 27 September 2011

Shaw Project Number: 144040
Photographer: Zach Peckham

Description: B2 API Stack looking east

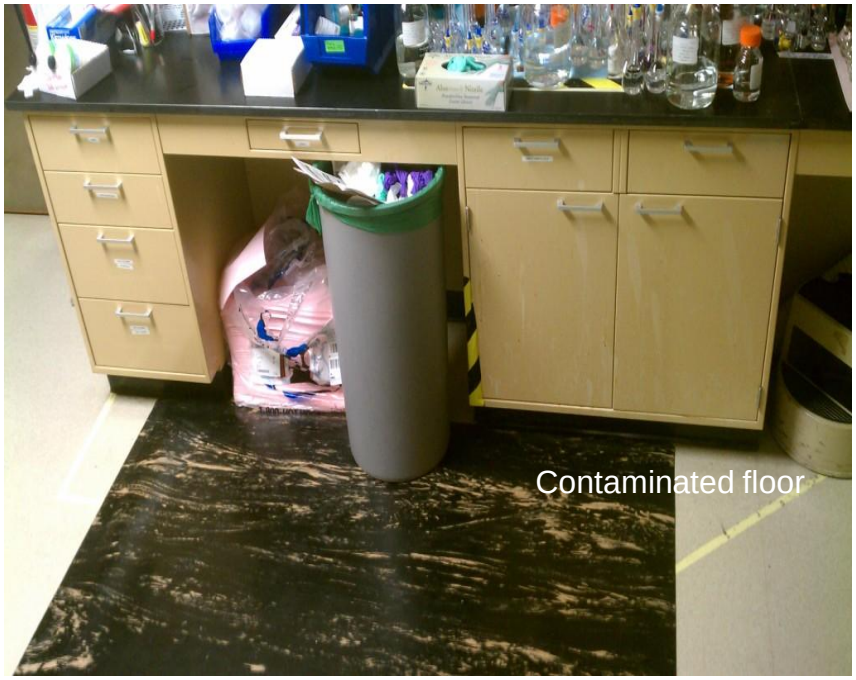
Photo Number: 17

Description: B3-298 lab bench

Photo Number: 18

Location: Aptuit KCM
10425 Hickman Mills Drive
Kansas City, MO 64134-0708
Client: Aptuit
Date: 27 September 2011

Shaw Project Number: 144040
Photographer: Zach Peckham



Description: B3-298 lab bench and floor

Photo Number: 19

Description: B3-298 bench

Photo Number: 20

Location: Aptuit KCM
10425 Hickman Mills Drive
Kansas City, MO 64134-0708
Client: Aptuit
Date: 27 September 2011

Shaw Project Number: 144040
Photographer: Zach Peckham

Description: Legacy ductwork

Photo Number: 21

Description: Legacy ductwork

Photo Number: 22

Appendix G

Ductwork Report

Aptuit CTS Ductwork Report

A Building Roof		
Laboratories	**Fan**	**Serviced Areas**
A3-340 and A3-341	AR-EF 17	Exhaust from laboratory hoods in A3-340 and A3-341. Non radiological use hoods also tie into this exhaust system. These fans are the only exhaust associated with A3-340 and A3-341.
A3-367	AR-EF 30A and AR-EF 30B	This laboratory was decommissioned in 2006. The fans identified used to provide room exhaust for A3-367 and multiple non-radiological laboratories.

B Building Roof		
Laboratories	**Fan**	**Serviced Areas**
B2-119	BR-EF 23	Exhaust from B2-119 that serviced a historical laboratory hood
B2-119 and Non-Radiological Laboratories	BR-EF 24	General Room Exhaust for B2-116/117/119 and Non Radiological Laboratories 114 and 115
B2-119	BR-EF 21A and BR-EF 21B	Exhaust from B2-119 glove box ties into laboratory hood exhaust. This exhaust line services B3-298 and multiple non-radiological laboratories.
B2-119	BR-EF 26	Exhaust from B2-119 that serviced a historical laboratory hood
B2-182, B2-183, and B2-189	BR-EF 29A and BR-EF 29B	Exhaust from one laboratory hood in each room B2-182 and B2-189 and multiple non-radiological laboratories.
B3-274	BR-EF 71A and BR-EF 71B	Exhaust from one ventilated balance enclosure and non impacted laboratory hoods.

AR-EF 17 Fan (A3-340 and A3-341)

The Historical Site Assessment that was performed for CTS identified two laboratories (A3-340 & A3-341) in "A" building as potentially impacted. The assessment identified one laboratory hood in each of those laboratories where exhaust ductwork should be investigated. The exhaust from A3-340 combines with the potentially impacted exhaust line that services the laboratory hood in A3-341, and then continues vertical to the roof. One sample was collected inside the line in A3-340 before the combination with results of 302 dpm/100 cm^2 (^{14}C) total, and 10 dpm/100 cm^2 (^{14}C) removable (No ^{3}H removable contamination was identified). Two samples were collected at a point past the combined line with the highest total count of 413 dpm/100 cm^2 (^{14}C), and 4 dpm/100 cm^2 (^{14}C) removable (No ^{3}H removable contamination was identified). Samples were also collected on the inside of the fan port opening and blower for AR-EF 17 with the highest total results of 754 dmp/100 cm^2 (^{14}C). Removable swipes were taken at the fan port opening, inside the blower, and fan blades with the highest result of 13 dpm/100 cm^2 (^{14}C) (No ^{3}H removable contamination was identified). All survey results are below Aptuit's unrestricted release limits.

Based upon this scoping surveys data results, no further investigation or exhaust removal has been identified.

AR-EF 30A and AR-EF 30B (A3-367)

Historically AR-EF 30A and AR-EF 30B provided room exhaust for A3-367 and non-radiological laboratories. One direct count of 841 dpm/100 cm^2 (^{14}C) was collected in this line on the roof, and two removable with the highest results of 7 dpm/100 cm^2 (^{14}C). All survey results are below Aptuit's unrestricted release limits.

Based upon the scoping surveys data and historical use, no further investigation or exhaust removal has been identified.

BR-EF 23 Fan (B2-119)

BR-EF 23 provided air flow for an exhaust line that had historically connected to a laboratory hood in B2-119. The hood and part of the exhaust line was removed in 2006 as part of a previous decommissioning effort. A swipe sample was collected at the cut point with removable results of 284 dpm/100cm^2 (^{14}C)/28 dpm/100 cm^2 (^{3}H). The exhaust line is currently capped in an adjacent pipe chase room B2-195. The exhaust line continues from B2-195 into an adjacent radiological storage room B2-194 where a noise dampener is installed before the exhaust line goes vertical to the roof. Two samples were collected before the noise dampener with the highest results of 8841 dpm/100 cm^2 (^{14}C) total, and 2348 dpm/100 cm^2 (^{14}C)/128 dpm/100 cm^2 (^{3}H) removable. Two samples were also collected at the point where the exhaust line goes vertical to the roof with the highest results of 937 dpm/100 cm^2 (^{14}C) total, and 56 dpm/100 cm^2 (^{14}C)/14 dpm/100 cm^2 (^{3}H) removable. One total count was collected on the blower access point for BR-EF 23 with a result of 246 dpm/100 cm^2 (^{14}C). Two removable samples were collected on the blower access port/blower blades with the highest count of 98 dpm/100 cm^2 (^{14}C)(No ^{3}H removable contamination was identified).

Data from the scoping surveys indicate the need to remove the exhaust line from B2-195 to after the noise dampener in B2-194. No further investigation has been identified for BR-EF 23 fan and exhaust line.

BR-EF 24 Fan (B2-119)

BR-EF 24 provides general room exhaust for B2-116/117/119 and non-radiological laboratories B2-114/115. Two samples were collected on the roof vent in each of the radiological laboratories with the highest result of 8135 dpm/100 cm^2 (^{14}C) total, and 327 dpm/100 cm^2 (^{14}C)/140 dpm/100 cm^2 (^{3}H) removable.

Data from the scoping surveys data indicate that sections of this general room exhaust will need to be removed as part of the decommissioning effort. More data is needed on the exhaust line before the line goes vertical to the roof and on the internal components of the BR-EF 24 fan.

BR-EF 21A and BR-EF 21B (B2-119)

Historically this fan serviced exhaust from a 6" glove box line in B2-119 that was removed and capped at the wall between B2-119 and B2-195 in 2006 as part of a previous decommissioning effort. A swipe sample was collected at the cut point with removable results of 933 dpm/100 cm^2 (^{14}C) (No ^{3}H removable contamination was identified). As part of the scoping surveys conducted in November 2011, the cap was removed to get a total reading of 138,000 dpm/100 cm^2 (^{14}C). This survey was conducted with a GM detector due to the size and position of the exhaust line. The exhaust line continues from B2-119, goes across the adjacent pipe chase room B2-195 and then proceeds into a radiological storage room B2-194 before going vertical to the next floor. It was not possible to collect a sample at the vertical point of this exhaust line. The 6" line then connects to an exhaust line that provides laboratory exhaust for B3-298 and several non-radiological laboratories. One sample was collected in the large exhaust line after the connection from B2-119 with a result of 849 dpm/100 cm^2 (^{14}C) total, and 11 dpm/100 cm^2 (^{14}C) removable (No ^{3}H removable contamination was identified). From this sampling location it was also possible to collect a swipe sample from the inside of the 6" line right at the connection to the large exhaust line with results of 238 dpm/100 cm^2 (^{14}C)/9 dpm/100 cm^2 (^{3}H) removable. The exhaust line then goes to the roof. One total sample was collected on each of the blower ports of BR-EF 21A and BR-EF 21B with results of 3151 dpm/100cm^2 (^{14}C) and 87 dpm/100cm^2 (^{14}C) respectively. Two swipe samples were taken on each of the blower ports and fan blades for fans BR-EF 21A and BR-EF 21B with the highest results of 31 dpm/100 cm^2 (^{14}C)/1 dpm/100 cm^2 (^{3}H) removable. One final swipe sample was collected at the stack drain port with a result of 2 dpm/100 cm^2 (^{14}C) (No ^{3}H removable contamination was identified).

Data from the scoping surveys indicate that the 6" exhaust line will need to be removed from B2-119 to where it connects to the large exhaust line in the B2-194 hallway. No further investigation has been identified for BR-EF 21A and BR-EF 21B fans and exhaust line.

BR-EF 26 (B2-119)

BR-EF 26 serviced one exhaust line that had historically connected to one laboratory hood in B2-119. The hood and part of the exhaust line was removed in 2006 as part of a previous decommissioning effort. A swipe sample was collected at the cut point with removable results of 401 dpm/100 cm^2 (^{14}C)/12 dpm/100 cm^2 (^{3}H). This line is currently capped in an adjacent pipe chase room B2-195. The exhaust line continues from B2-195 into an adjacent radiological storage room B2-194 where the exhaust line goes vertical to the roof. Two samples were also collected at the point where the exhaust line goes vertical to the roof with the highest results of 17143 dpm/100 cm^2 (^{14}C) total, and 741 dpm/100 cm^2 (^{14}C)/258 dpm/100 cm^2 (^{3}H) removable. One total count was collected on the blower access point for BR-EF 26 with a result of 4683 dpm/100 cm^2 (^{14}C). Two removable samples were

collected on the blower access port/blower blades with the highest count of 205 dpm/100 cm^2 (^{14}C)(No ^{3}H removable contamination was identified).

Data from the scoping surveys indicate the need to remove the entire exhaust line for this fan. No further investigation has been identified for BR-EF 26 fan and exhaust line.

BR-EF 29A and BR-EF 29B (B2-182, B2-183, B2-189)

The exhaust line for BR-EF 29A and BR-EF 29B runs from non-radiological laboratories to B2-189 and then to B2-182 where it turns vertical and goes to the roof. This exhaust line provides air flow for one hood in both B2-189 and B2-182 laboratories. Historically B2-189 was used for the storage of radiological materials; this hood was not identified as potentially impacted. One sample was collected at the inlet of the exhaust from the laboratory hood in B2-182 with a result of 270 dpm/100 cm^2 (^{14}C) total, and 3 dpm/100 cm^2 (^{14}C)/18 dpm/100 cm^2 (^{3}H) removable. One total sample was collected on each of the blower ports of BR-EF 29A and BR-EF 29B with no ^{14}C identified on either sample. Two swipe samples were taken on each of the blower ports and fan blades for fans BR-EF 29A and BR-EF 29B with the highest results of 13 dpm/100 cm^2 (^{14}C) (No ^{3}H removable contamination was identified). All survey results are below Aptuit's unrestricted release limits.

Based upon the scoping surveys results, no further investigation or exhaust removal has been identified.

BR-EF 71A and BR-EF 71B (B3-274)

The fans associated with this exhaust line serviced a ventilated balance enclosure that had been utilized for radiological material. This line combines with two non-impacted laboratory hoods before going vertical in B3-274 to the roof. Two samples were collected above the ventilated balance enclosure with no ^{14}C (total) identified, and 26 dpm/100 cm^2 (^{14}C) (No ^{3}H removable contamination was identified) removable. This exhaust line joins a large exhaust line on the roof that supplies air flow for multiple non-radiological laboratories. Five samples were collected in this combined exhaust line on the roof with the highest results of 1675 dpm/100 cm^2 (^{14}C) total, and 12 dpm/100 cm^2 (^{14}C) (No ^{3}H removable contamination was identified). One total sample was collected on each of the blower ports of BR-EF 71A and BR-EF 71B with no ^{14}C identified on either sample. Two swipe samples were taken on each of the blower ports and fan blades for fans BR-EF 71A and BR-EF 71B with the highest results of 48 dpm/100 cm^2 (^{14}C) (No ^{3}H removable contamination was identified). All survey results are below Aptuit's unrestricted release limits.

Based upon the scoping surveys results, no further investigation or exhaust removal has been identified.

Location: Aptuit KCM
10425 Hickman Mills Drive
Kansas City, MO 64134-0708
Client: Aptuit

Shaw Project Number: 144039
Photographer: Aptuit

Description: A3-340 & 341 – exhaust system.

Photo Number: 1

Description: A3-340 & 341 – exhaust system

Photo Number: 2

Location: Aptuit KCM
10425 Hickman Mills Drive
Kansas City, MO 64134-0708
Client: Aptuit

Shaw Project Number: 144039
Photographer: Aptuit

Description: A3-340 & 341 – exhaust system.

Photo Number: 3

Description: A3-340 & 341 – exhaust system.

Photo Number: 4

Location: Aptuit KCM
10425 Hickman Mills Drive
Kansas City, MO 64134-0708
Client: Aptuit

Shaw Project Number: 144039
Photographer: Aptuit

Description: A3-340 & 341 – exhaust system.

Photo Number: 5

Description: A3-340 & 341 – exhaust system.

Photo Number: 6

Location: Aptuit KCM
10425 Hickman Mills Drive
Kansas City, MO 64134-0708
Client: Aptuit

Shaw Project Number: 144039
Photographer: Aptuit

Description: A3-340 & 341 – exhaust system.

Photo Number: 7

Description: A3-340 & 341 – exhaust system.

Photo Number: 8

Location: Aptuit KCM
10425 Hickman Mills Drive
Kansas City, MO 64134-0708
Client: Aptuit

Shaw Project Number: 144039
Photographer: Aptuit

Description: A3-340 & 341 – exhaust system.

Photo Number: 9

Description: B2-189

Photo Number: 1

Location: Aptuit KCM
10425 Hickman Mills Drive
Kansas City, MO 64134-0708
Client: Aptuit

Shaw Project Number: 144039
Photographer: Aptuit

Description: B2-189

Photo Number: 2

Description: B2-189

Photo Number: 3

Location: Aptuit KCM
10425 Hickman Mills Drive
Kansas City, MO 64134-0708
Client: Aptuit

Shaw Project Number: 144039
Photographer: Aptuit

Description: B2-189

Photo Number: 4

Description: B2-189

Photo Number: 5

Location: Aptuit KCM
10425 Hickman Mills Drive
Kansas City, MO 64134-0708
Client: Aptuit

Shaw Project Number: 144039
Photographer: : Aptuit

Description: B2-189

Photo Number: 6

Description: B2-189

Photo Number: 7

Location: Aptuit KCM
10425 Hickman Mills Drive
Kansas City, MO 64134-0708
Client: Aptuit

Shaw Project Number: 144039
Photographer: : Aptuit

Description: B2-189

Photo Number: 8

Description: B2-189

Photo Number: 9

Location: Aptuit KCM
10425 Hickman Mills Drive
Kansas City, MO 64134-0708
Client: Aptuit

Shaw Project Number: 144039
Photographer: : Aptuit

Description: B2-189

Photo Number: 10

Description: B2-189

Photo Number: 11

Location: Aptuit KCM
10425 Hickman Mills Drive
Kansas City, MO 64134-0708
Client: Aptuit

Shaw Project Number: 144039
Photographer: : Aptuit

Description: B3-274

Photo Number: 1

Description: B3-274

Photo Number: 2

Location: Aptuit KCM
10425 Hickman Mills Drive
Kansas City, MO 64134-0708
Client: Aptuit

Shaw Project Number: 144039
Photographer: : Aptuit

Description: B3-274

Photo Number: 3

Description: B3-274

Photo Number: 4

Location: Aptuit KCM
10425 Hickman Mills Drive
Kansas City, MO 64134-0708
Client: Aptuit

Shaw Project Number: 144039
Photographer: : Aptuit

Description: B3-274

Photo Number: 5

Description: B3-274

Photo Number: 6

Location: Aptuit KCM
10425 Hickman Mills Drive
Kansas City, MO 64134-0708
Client: Aptuit

Shaw Project Number: 144039
Photographer: : Aptuit

Description: B3-274

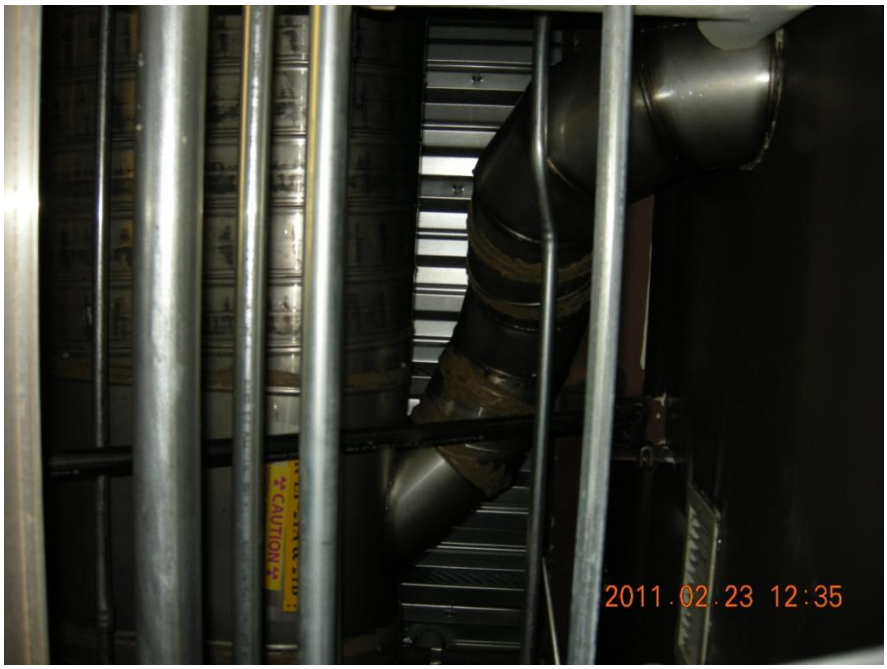
Photo Number: 7

Description: B3-298

Photo Number: 1

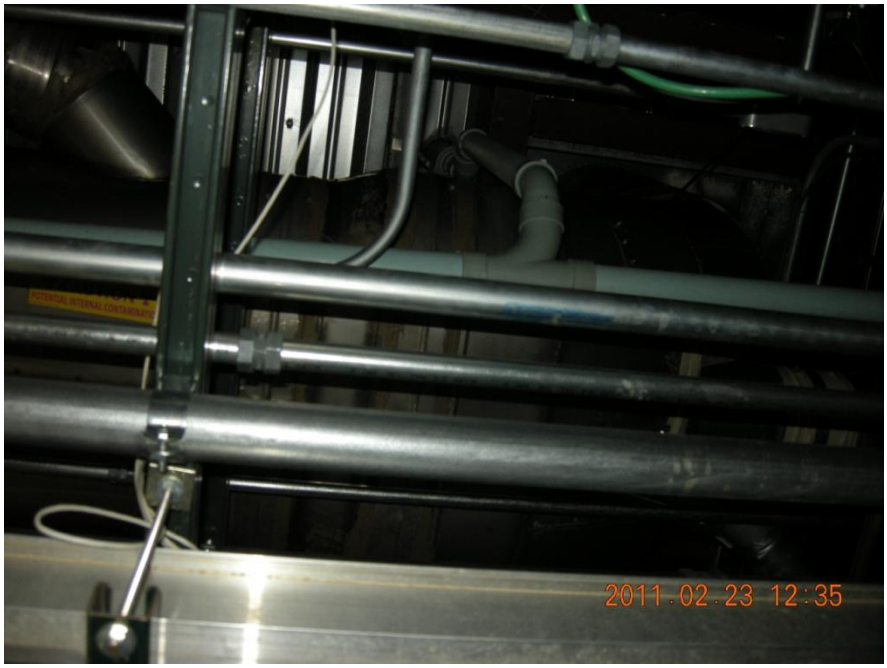
Location: Aptuit KCM
10425 Hickman Mills Drive
Kansas City, MO 64134-0708
Client: Aptuit

Shaw Project Number: 144039
Photographer: : Aptuit



Description: B3-298

Photo Number: 2



Description: B3-298

Photo Number: 3