Aptuit, LLC
10245 Hickman Mills Rd., Suite B-2
Kansas City, MO 64137

January 13, 2012

UNITED STATES NUCLEAR REGULATORY COMMISSION
REGION III
2443 WARRENVILLE ROAD STE 210
LISLE, ILLINOIS 60532-4352
Attn: Decommissioning Branch
Michael Lafranzo
Lionel Rodriguez

Response: Updates for License No. 24-15595-01

Dear Mr. Rodriguez:

This letter serves as Aptuit, LLC's request for an amendment to our license incorporating the enclosed decommissioning plan. Two copies of our decommissioning plan are submitted for your review. Please let me know if you would like us to arrange a call to discuss any aspects of the decommissioning plan.

Aptuit, LLC has completed its last contracted radio-synthesis project and are now moving into a strictly analytical phase. Because of this, Aptuit, LLC would like to have the following authorized users removed from our radioactive material license: Andrew Damon, Hari Pennaka and David Leuck.

Please let me know if additional information is needed. I can be reached at (816)767-3745 or by cell at (816)769-4382.

Sincerely,

Clint Gregg

Radiation Safety Officer

Cc: Licensing Branch
Kevin Null
Bill Reichhold

RECEIVED JAN 1 8 2012

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

Prepared for:

Aptuit, LLC
10245 Hickman Mills Drive
Kansas City, Missouri 64134-0708

Prepared by:

Shaw Environmental & Infrastructure, Inc.
312 Directors Drive
Knoxville, Tennessee 37923

January 2012

Decommissioning Plan
Aptuit Scientific Operations
Aptuit, LLC
10245 Hickman Mills Drive
Kansas City, Missouri

Prepared by:

Shaw Environmental & Infrastructure, Inc.

Tony D. Stempkowski
Tony Stempkowski
Primary Author

January 13, 2012
Date

Rick Greene
Rick Greene, CHP
Project Health Physicist

January 13, 2012
Date

Clinton Gregg
Clinton Gregg
Aptuit Radiation Safety Officer

13 Jan 2012
Date

Marcello DiMare
Marcello DiMare
Aptuit Decommissioning Project Manager

13 JAN 2012
Date

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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
^{14}C	carbon-14
Ci	curie(s)
CFH	chemical fume hood
CFR	Code of Federal Regulations
CHP	certified health physicist
cm^2	square centimeters
^{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 assessment
^{125}I	iodine-125
^{131}I	iodine-131
IPA	instrument performance assessment
LAR	Lab Animal Resources
LOTO	lockout/tagout

Acronyms and Abbreviations *(continued)*

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
^{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
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
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 areas*.

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.

Executive Summary

Aptuit, LLC (Aptuit), a pharmaceutical research and development facility located at 10245 Hickman Mills Drive in Jackson County, Kansas City, Missouri, 64134-0708, is discontinuing radiological operations and will perform decontamination and decommissioning (D&D) activities as described in this decommissioning plan (DP). With concurrence from the U.S. Nuclear Regulatory Commission (NRC), Aptuit intends to release the facilities currently licensed by the NRC from radiological controls and to terminate the license. Prior to release, a final status survey (FSS) will be conducted to demonstrate compliance with the NRC release criteria in Title 10, Part 20, Subpart E of the Code of Federal Regulations (CFR). The FSS will be performed in accordance with the guidance in the Multi-Agency Radiation Survey and Site Investigation Manual.

Shaw Environmental & Infrastructure, Inc. is working with Aptuit to provide guidance on the process for decommissioning of the facility with the end result being unrestricted release and termination of the NRC license. In preparing to conduct D&D 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.* 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 must be submitted making this a Group 3 decommissioning.

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). A crosswalk of this DP against the Decommissioning Plan Checklist (Appendix D of NUREG-1757, Vol.1, Rev. 2) is presented in Table ES-1.

This DP includes the results of the investigation that was conducted to collect existing information describing the site's radioactive material use history from the start of licensed activities to the present time. This investigation identified the radionuclides of concern, radioactive material use and storage areas, and areas of potential residual contamination. The investigation provides information that will be used by survey planners in preparing the FSS plan.

Radioactive materials are used at Aptuit's Kansas City, Missouri, facilities 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), hereafter referred to as the License. The activities authorized under the License are performed by two separate business lines at Aptuit's Kansas City facility. The Scientific Operations (SO) group performs synthesis of radiolabeled compounds, and the clinical trials supplies (CTS) group performs research and development and analytical procedures using radiolabeled compounds.

All of the current Aptuit activities involving radioactive materials will be discontinued. Decommissioning of the CTS facilities is taking place under Aptuit's existing license. Decommissioning of the SO facilities will be in accordance with this DP and will commence upon approval of the DP by the NRC. Once approval of the DP is granted, decommissioning activities are expected to last for eight months.

Preliminary 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 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 ^{3}H and ^{14}C combined.

It is anticipated that principal operations with radioactive materials will cease in the SO facilities by the end of January 2012. Therefore, Aptuit requests that Radioactive Materials License Number 24-15595-01 be amended to incorporate this DP.

1.0 Introduction

1.1 Scope and Purpose

Aptuit, LLC (Aptuit), a pharmaceutical research and development facility in Kansas City, Missouri (Figure 1-1), is transferring its clinical trials supplies (CTS) capabilities and staff to Catalent Pharma Solutions and ceasing its scientific operations (SO) business. The SO group performs synthesis of radiolabeled compounds, and the clinical trials supplies CTS group performs research and development and analytical procedures using radiolabeled compounds. Aptuit intends to release all CTS and SO facilities currently licensed under U.S. Nuclear Regulatory Commission (NRC) Radioactive Materials License Number 24-15595-01 from radiological controls and to terminate the license.

A final status survey (FSS) of the CTS areas was conducted in accordance with NRC guidelines in December 2011. The primary purpose of the FSS was to demonstrate that residual radioactivity in each survey unit satisfied the release criteria. A final status survey report (FSSR) for the CTS areas is being prepared. Decommissioning of the CTS facilities is being completed under the existing license (Barton, 2011).

The specific scope of this decommissioning plan (DP) is the decommissioning of the SO facilities. To accomplish the goal of releasing the SO facilities, Aptuit intends to establish, through a process of site investigation, decommissioning, and final status determination, that these facilities meet the criteria for radiological release established in the Code of Federal Regulations (CFR), Title 10, Part 20, Subpart E, *Radiological Criteria for License Termination.* The decommissioning activities will be performed in accordance with NRC's Consolidated Decommissioning Guidance, NUREG-1757, Volumes 1 and 2 (NRC, 2003; 2006). The FSS will be planned and implemented using the guidance in NUREG-1575, Rev. 1, *Multi-Agency Radiation Survey and Site Investigation Manual* (MARSSIM) (NRC, 2000).

The MARSSIM recommends the performance of a historical site assessment (HSA) as the first step in the radiation survey and site investigation process. To this end, in September and November 2011, site visits, records review, and interviews were performed by Shaw Environmental & Infrastructure, Inc. (Shaw). In addition, scoping surveys of CTS and SO areas were performed in October through December 2011. Results of these investigations were used in the preparation of this DP.

An FSS of the SO areas will be performed after the decontamination and removal of contaminated items has been completed. 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 facilities being investigated. Collected data will be used in the data assessment process to determine the final status for facility release. Upon completion of the data collection, data assessment will begin. At the culmination of data assessment, an FSSR will be prepared for submittal to the NRC. If the data evaluation indicates that the SO facilities are acceptable for release, that release will be recommended in the FSSR and, once accepted by the NRC, the license will be terminated.

1.2 Operational and License History

1.2.1 License Number and Authorized Activities

Radioactive materials are used at Aptuit's Kansas City, Missouri, facilities 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 activities authorized under the license are performed by two separate business lines. The SO group performs synthesis of radiolabeled compounds using millicurie (mCi) to curie (Ci) quantities of ^{3}H and ^{14}C, and the CTS group performs research and development and analytical procedures using radiolabeled compounds. The license was amended in 2008 (Amendment 27) to increase license limits for tritium (^{3}H) and carbon-14 (^{14}C) and to authorize radiosynthesis operations. However, activities that are part of the CTS business line have continued as research and development and analysis using mCi quantities of ^{3}H, ^{14}C, and iodine-125 (^{125}I).

The facility was originally operated by Marion Laboratories, Inc. In 1989, ownership was transferred to Marion Merrell Dow. Ownership was then transferred to Hoechst Marion Roussel, Inc. (HMRI) in 1995. In 1999, company ownership was transferred from HMRI to Quintiles, Inc. (Quintiles). Aptuit took ownership from Quintiles in 2005 and has maintained ownership to the present day.

1.2.2 License History

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, but the list of radionuclides that could be possessed had grown to seven: ^{14}C, ^{3}H, phosphorus-32 (^{32}P), sulfur-35 (^{35}S), ^{125}I, iodine-131 (^{131}I), and cesium-137 (^{137}Cs). With the exception of ^{137}Cs, the License authorized the radionuclides in any form, and the authorized uses were expanded to research and development in the synthesis of labeled pharmaceuticals for nonhuman experimentation and in vivo and/or in vitro animal studies. ^{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 was added and later deleted. Until 2008, the primary use was microcurie to mCi quantities of ^{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, as defined in Title 10 CFR Part 30, Section 30.4, and for radiosynthesis of radiolabeled organic chemicals. The License also authorizes barium-133 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 License has been amended 32 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 calcium-45) 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 32 were to change authorized users and to add use and support areas. Synthesis operations are located on the B2 level of Building B and are part of the SO business.

1.2.3 Previous Investigations and Decommissioning Activities

Following is a discussion of the decommissioning activities previously conducted at the site. All of these activities were performed under the Aptuit license.

1.2.3.1 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). 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 ^3H 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."

1.2.3.2 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.

1.2.3.3 L Building and Lab Animal Resources Historical Site Assessment, 2006

Shaw performed an HSA in L Building and the Lab Animal Resources (LAR) section of B Building in August 2006 in preparation for releasing those areas from radiological controls (Shaw, 2006a). The HSA identified the radionuclides of concern (^{14}C and ^3H), determined that the next step toward removing those areas from the License was to complete an FSS, and determined preliminary derived concentration guideline levels (DCGL). 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. Neither the L Building nor the LAR section of B Building are part of the current investigation other than the legacy ductwork from B2-119, which was part of the LAR section in B Building.

1.2.3.4 Final Status Surveys

FSSs have been performed on several occasions at this site. Although none of the areas involved in the previous FSSs are within the scope of this investigation, it is worthwhile to note the results of those investigations.

In the L Building (formerly an Aptuit facility), three laboratories were released from radiological controls prior to release of the entire building in 2006. Laboratories L4-421 and L4-422 were released in 2002 and Laboratory L5-526 was released in 2006.

An FSS was performed within each of these three laboratories following MARSSIM guidance. The radionuclides of concern were ^{3}H and ^{14}C. All three 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.

An FSS was conducted in Laboratory A3-367 in 2006 (Shaw, 2006b). The FSS included surface scans, direct measurements, and wipe sampling. The radionuclides of concern were ^{3}H and ^{14}C. All direct measurements and wipe sample results were below the DCGLs; therefore, no statistical tests were performed. The data indicated that the laboratory was acceptable for unconditional radiological release.

FSSs were performed in L Building and in the LAR section of B Building in 2006 (Shaw, 2007). Radionuclides of concern in these areas were ^{3}H and ^{14}C. Potentially impacted areas were laboratories and support areas in which these radionuclides were used or stored. The FSS included 12 survey units. The completed FSS design included systematic, random, and biased locations. The DCGLs used during these surveys were 3.7E+05 dpm/100 cm^2 for total contamination and 3.7E+04 dpm/100 cm^2 for removable contamination. All survey units in the LAR section and L Building met the DCGLs. 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.

1.2.4 Incidents/Spills

There are no incident reports (i.e., spills or releases of radioactive materials) pertinent to CTS operations and facilities. Five documented radiological incidents in the SO areas are 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 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.

1.3 Facility Description

1.3.1 Site Location and Description

The Aptuit facility is located at 10245 Hickman Mills Drive in Kansas City, Missouri, Jackson County, 64134-0708. 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 (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 buildings total approximately 417,000 square feet (ft^2).

Research and development and analytical activities, which are part of the CTS business line, are performed in portions of Buildings A, B, and E. Radiosynthesis and support operations that are part of the SO business line are located in Building B and the Waste Storage Building (also known as the Hill).

Construction of the Aptuit facility started in 1965 with A Building. B Building was built in 1972. The expansion of Production Operation (Building P) was completed in 2005, with an additional expansion on the north side of the building completed in 2008. A pH treatment building (constructed in 2000) is located on the western boundary of the Property. A pond located on the southeast corner of the site adjacent to Building N is listed in the National Wetlands Inventory. Tennis and basketball courts are located north of the pond.

Prior to construction of A Building in 1965, the Property was utilized for agricultural purposes. Since 1965, the facility has been operated for pharmaceutical research and development, sample analysis, and administrative functions. In 2008, a portion of the B2 floor of B Building was authorized, through Amendment 27 of the License, for synthesis of radiolabeled compounds.

Company ownership was transferred from Marion Laboratories, Inc. to Marion Merrell Dow in 1989. Ownership was then transferred to HMRI in 1995. In 1999, company ownership was transferred from HMRI to Quintiles. Aptuit took ownership from Quintiles in 2005 and has maintained ownership to the present day.

The impacted CTS portions of the site comprise approximately 12,160 ft^2 in A Building, 16,940 ft^2 in B Building, and 9,200 ft^2 in E Building, for a total potentially impacted area of 38,300 ft^2. The CTS facilities are currently being surveyed for release from radiological controls under the current license.

The impacted areas associated with SO and with this DP comprise 7,700 ft^2 in B Building (on the B2 and B3 levels) and 1,930 ft^2 in the Waste Storage Building.

Drains to sanitary sewer are located in bathrooms, janitor closets, and some laboratories. The Kansas City, Missouri, Waste Water Department provides sewage disposal. Sewage from office areas runs directly to the city sewer. Sewage from the laboratory and production areas is first sent to the on-site pH treatment building and adjusted if necessary prior to disposal to the city sewage system.

The 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. Surface water drainage at the Property is directed through storm water inlets with off-site drainage through a catch basin located on the west side of the Property and to the pond located on the southeast corner of the Property.

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. 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.

As stated previously, 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).

The use of radioactive materials was limited to the internal rooms, laboratories, and storage areas.

1.3.2 Radiological Status of Facility

A description of all historical and current radioactive material use and storage areas is contained in Appendix C. Facilities and systems that are being decommissioned under this DP include legacy ductwork in B Building, the incinerator (B2-103A), Dock 5 (B Building), the API filter room (B2-112), the API laboratories (B2-155 through B2-170), the API exhaust, drain, and vacuum systems, an analytical laboratory (B3-298), the waste storage building, and the health physics (HP) support areas (B2-116, 117, 119). The owner of these areas is noted in Appendix C as "SO." These areas of concern are shown on Figures 1-4 through 1-10, and photographs of the areas to be decommissioned are included in Appendix D.

The radioactive contaminants of concern were determined through personnel interviews and a review of the License, amendments, and other records. Although the radionuclides presented in Section 1.2.2 were approved by the NRC for use and storage at the facility, interviews and records indicate only ^{14}C, ^{3}H, and ^{125}I have been used in recent years. The last use of ^{125}I occurred in February 2010 and occurred in a CTS laboratory. The low activity used plus the short half-life of ^{125}I effectively removed it from consideration as a radionuclide of concern[1].

Other sources, including ^{32}P, ^{35}S, ^{137}Cs, ^{131}I, and ^{63}Ni, have been used during the life of the License but not in recent years. The short half-lives of ^{32}P, ^{35}S, ^{125}I, and ^{131}I (14.28, 87.2, 59.9, and 8.04 days, respectively) provide reason to eliminate these radionuclides from concern.

[1] The site inventory of ^{125}I in January 2010 was 0.03 mCi. ^{125}I has a 60 day half-life. There have been no additions to the inventory or any uses of ^{125}I since January 2010. The total inventory on site as of January 2012 would be 0.02% of 0.03 mCi or 15,000 dpm.

Sources of ^{63}Ni and ^{137}Cs have only been used in sealed sources, not in open form. Leak tests indicate that the sources have remained intact. Therefore, ^{63}Ni and ^{137}Cs can be eliminated as radionuclides of concern.

The remaining two radionuclides (^{3}H and ^{14}C) are the only radionuclides of concern in the SO facilities at Aptuit.

Although full characterization surveys have not been completed because some of these areas are still operational, the following describes the nature and extent of radiological contamination based on operational surveys and preliminary characterization.

1.3.2.1 B Building Structures, 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 E. 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 (see 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. All 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. Additional ash samples have been collected from the bottom of the stack and will be analyzed for ^{3}H and ^{14}C.

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. Scoping surveys will be performed in this area, although 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. These laboratories are currently operational and are expected to be until the end of January 2012. Routine operational surveys reveal that there is low-level ^{3}H and ^{14}C 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.

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 were 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.

API Systems. The exhaust system that provides exhaust ventilation for the rooms, hoods and instrument drops is contaminated as described previously.

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. Drain disposal of radioactive materials is not allowed. The first rinse of glassware is 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 once operations cease in the API area.

The API laboratories are equipped with a central vacuum system; however, it is not routinely used. Vacuum for experiments is typically provided by portable vacuum pumps. However, due to the possibility that the central vacuum system has been used for radiosynthesis procedures, it will be investigated once operations have ceased.

Analytical Laboratory (B3-298). There are two documented incidents in B3-298 that resulted in ^{14}Ccontamination 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 1.2.4.

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 ^3H 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.

1.3.2.2 Waste Storage Building

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.

1.3.2.3 Surface Soil

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. 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. The purpose of the sampling was determine if any there were impacts to the surface soils attributable to air effluents from the API B2 area stack. The samples were analyzed for ^3H and ^{14}C.

All ^{14}C results were below the sample detection limits of 0.99 – 1.1 pCi/g. ^3H 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 surface soil sampling will be conducted at the conclusion of operations in the API radiosynthesis area.

1.3.2.4 Surface Water and Groundwater

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

1.4 Financial Assurance

1.4.1 Cost Estimate

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.

1.4.2 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.

1.5 Plan Organization

This DP presents the project organization in Chapter 2.0. The planned decommissioning field activities are described in Chapter 3.0, and the radiation safety and health program is described in Chapter 4.0. Field data collection is described in Chapter 5.0, and the waste management plan is provided in Chapter 6.0. Development of the final status survey report is described in Chapter 7.0, and the references are provided in Chapter 8.0. Appendix A provides Aptuit's NRC Radioactive Materials License and amendments. Appendix B includes the incident reports that describe the known spills that have occurred at Aptuit. Appendix C lists the historical radioactive material use and storage areas including preliminary survey unit classifications. Appendix D includes the photographs of the areas to be decommissioned under this DP. Appendix E includes a summary of the legacy ductwork investigation. Appendix F contains the survey forms that will be used to document survey activities.

2.0 Project Management and Organization

The Aptuit decommissioning project organization chart is provided as Figure 2-1.

2.1 Facility Radiological Controls Organization

All on-site activities associated with the D&D of the facility will be conducted under the Aptuit License and the radiation protection requirements as set forth in the Aptuit Radiation Safety Program Manual (RSPM) (Aptuit, 2011) and this DP. The radioactive materials license is managed by the facility RSO and the Radiation Oversight Committee (ROC).

2.1.1 Radiation Oversight Committee

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

2.1.2 Radiation Safety Officer

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.

2.2 Task Organization

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 Shaw personnel. Representatives from Aptuit and Shaw 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 task manager is responsible for managing and directing the tasks of the decommissioning at the SO facilities. This includes management of report preparation and control of the related costs and schedule. The task manager is also responsible for coordinating subcontractor activities.

The Shaw 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 Shaw 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 Shaw 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.

3.0 Decommissioning Activities

The decommissioning activities will be performed in accordance with NRC's Consolidated Decommissioning Guidance, NUREG-1757, Volumes 1 and 2 (NRC, 2003; 2006). The following sections provide a discussion of the planned approach for completing the decommissioning field activities.

3.1 Unrestricted Release Using Screening Criteria

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, 2003) for the radionuclides of concern, ^{3}H and ^{14}C. 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).

3.2 Decommissioning Field Activities

This section describes the field activities that are planned to be performed during the D&D of the Aptuit SO facilities. All activities for this project will be conducted in accordance with this plan.

Items of the SO facilities to be decontaminated or removed, and decommissioned will include fume hoods, lab benches and tables, sinks and drains, floors, walls, exhaust system components (ductwork, HEPA housing, fans, and stacks), vacuum system, and an incinerator. A preliminary, rough schedule of the decommissioning field activities is provided as Figure 3-1.

3.2.1 Decommissioning Preparation Activities

Preparation for decommissioning fieldwork activities will include the following:

- Prior to decommissioning activities, the contents of the SO laboratories, including 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.

In an effort to minimize the impact on ongoing research work in B Building B2 and eliminate the need to transport radiologically contaminated waste through the API common area, a route with direct access to the outside of B Building will be created. An API access route will be created by removing part of the west wall of room B2-166 prior to beginning D&D activities that involve removal of radiologically contaminated items. To create the opening, several windows of B2-166 will be removed and the concrete block and brick under the windows will be cut with a concrete saw and removed. Before cutting the block and brick, all utilities in the wall will be identified and properly LOTO'd and disconnected or rerouted.

After the hole in the wall has been made, a waste roll-off will be backed up to the access opening. A containment structure, made of wood and plastic sheeting, will built between the building and the waste roll-off.

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.

3.2.2 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. Equipment/materials required for radiological monitoring are discussed in Section 4.2.4.

3.2.3 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.

3.2.4 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.

3.2.5 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.

3.2.6 Bench Tops and Tables

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.

3.2.7 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.
- 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 siphoned from the traps using rubber tubing and a hand pump or a small electric vacuum pump. Liquids will be collected in U.S. Department of Transportation-approved plastic buckets with lids.

- A second mercury vapor measurement will be made after the liquids have been removed from the traps.

- If only mercury is detected, the liquid contents of the trap will be removed and segregated for analysis as potentially hazardous waste. If only radiological contamination is detected, the liquid contents of the trap will be removed and held until final determination of mercury contamination is made upon removal of the trap. If both mercury and radiological contamination are detected, the water contents of the trap will be removed and segregated as mixed waste. If neither mercury vapor, nor radiological contamination is detected, the liquid will be held in a sealed container until the final determination of contamination is made upon removal of the trap.

- 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.

- 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 Chapter 5.0 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.

3.2.8 Vacuum Line Removal

The vacuum lines in the API area, as well as a vacuum line remaining in B2-119 will be characterized and removed, as necessary. Most of the vacuum lines are made of 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. Vacuum lines that are removed and meet the release criteria may be recycled.

3.2.9 Chemical Fume Hood Removal

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 as outlined in Section 3.2.1.
- 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 3.2.7.

- All asbestos abatement will be completed as described in Section 3.2.6 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 Chapter 5.0 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 Chapter 6.0.

- CFH pieces that meet the free release criteria may be disposed of as construction debris.

3.2.10 Exhaust Ductwork Removal

Aptuit will disconnect and remove exhaust ductwork from CFHs and snorkel exhausts. In addition, impacted legacy ductwork described in Section 1.3.2.1 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 Chapter 5.0 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.

3.2.11 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 D.

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 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 Chapter 5.0 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.

3.2.12 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 D. 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 1.3.2.1, 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 D, 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.

3.2.13 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.

3.2.14 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.

3.2.15 Walls, Floors, and Drains

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 scoping 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.

3.2.16 HP Support Areas

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.

4.0 Radiation Health and Safety Program

Work involving radioactive materials conducted in the SO facilities falls under Aptuit's License. For this reason, the Aptuit radiation protection requirements, as presented in the RSPM and this DP, will be enforced during decommissioning activities. The radiation protection goal is to limit all radiological exposures to radiation to ALARA, as defined in 10 CFR 20.1003. In order to determine the radiation safety controls and monitoring necessary to keep D&D worker exposures ALARA, it is first necessary to assess the potential exposures.

4.1 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 is 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 in the system.

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 x 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} X 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

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.

4.2 Radiation Safety Controls and Monitoring for Workers

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.

4.2.1 Workplace Air Sampling and Respiratory Protection

Based on the evaluation of maximum potential exposures, 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. 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, as directed by the RSO, when opening contaminated systems or when performing aggressive decontamination or demolition activities.

4.2.2 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 4-1. Bioassay for ^{3}H and ^{14}C 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.

4.2.3 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.

4.2.4 Instrumentation Program

Instrumentation has been selected consistent with the type, use, and sensitivity necessary to accomplish decommissioning activities. These instruments are listed in Table 4-2. Instruments will have current calibration to the manufacturer's specifications, and a daily performance test will be performed and documented.

Wipe samples will be collected for ^{3}H and ^{14}C analysis using a liquid scintillation counter.

4.3 ALARA Program

"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.

4.4 Training

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.

4.5 Health Physics Audits and Record-Keeping Program

4.5.1 Health Physics Audits

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 Shaw management.

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.

4.5.2 Record-Keeping Program

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

The surveys performed as part of this decommissioning shall be documented using the survey forms established for the project (Appendix F). The survey forms provide a standard format for documenting the data gathered during decommissioning. These survey forms shall be completed by the radiological control technician in a timely manner and given to the survey coordinator for review. The forms will be consecutively numbered and noted in a survey log. All records generated as a result of this investigation shall be maintained and stored in accordance with the survey protocol.

5.0 Field Data Collection

Radiological surveys and sampling conducted in support of this DP serve several purposes, as described in this chapter.

All data collection will be conducted in compliance with the RSPM and this DP.

5.1 Facility Radiation Survey

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.

M&E meeting Aptuit's release criteria (see Table 1-2) will be designated for unrestricted release under direction of the RSO. M&E that do not meet the release criteria will be evaluated to determine if decontamination should be attempted or if the component should be managed as radioactive waste. The RSO will be notified of contamination levels that approach or exceed the release criteria and will make final decisions regarding release of M&E.

5.1.1 Survey Protocols

In general, the following steps will be taken when performing radiation surveys:

- Ensure that all instrumentation is properly calibrated and operating properly in accordance with manufacturer instructions.

- Survey/sampling technicians will review any previous surveys of the survey unit, if available, to determine radiological conditions prior to starting a task.

- Survey/sampling technicians will have proper PPE for area to be surveyed based on area postings, site control requirements, and the radiation work permit (if applicable). Minimum PPE for performance of survey/sampling activities will be latex or nitrile gloves and safety glasses.

- Survey/sampling technicians will be instructed regarding the quality control measurement/sample requirements prior to performing any survey or sampling activity.

- For any samples to be analyzed at an off-site laboratory that does not hold a radioactive materials license, the surface and/or media will be screened with field instruments. Any potentially contaminated samples or samples known to be contaminated will only be shipped to a licensed facility with the appropriate authorization and consent of the RSO prior to shipment.

5.1.2 Equipment and Materials

The following equipment and materials may be utilized during the radiation surveying activities:

- Preprinted laboratory survey maps and data forms (plan view of area, items, or components to be surveyed)

- Ludlum Model 2360 or 2221 scaler/ratemeter with a Model 43-68 gas-flow proportional counter (or functional equivalent)

- Ludlum Model 2360 or 2221 scaler/ratementer with a Model 43-37 floor monitor (or functional equivalent)

- Ludlum Model 3 ratemeter with Model 44-9 PGM detector (or functional equivalent)

- Check sources for instrumentation

- P-10 gas

- Minimum 10-foot, rule tape measure

- Metal or plastic laboratory tweezers

- Properly prepared liquid scintillation vials and smears

- Paper wipes for beta analysis

- Gloves and safety glasses.

5.1.3 Scan Surveys

Scan surveys will be performed as described in this section. With the instrument in operation at a nominal height of 1 centimeter above the area to be surveyed, move the detector 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. Depending on the purpose of the survey, areas that exhibit elevated readings during scanning may have follow-up monitoring conducted in the form of integrated direct measurements and judgmental wipe samples.

5.1.4 Direct Measurements (Static Counts)

Direct measurements will be performed as described in this section. 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 minimum detectable concentration requirements for the parameter being measured. Document the direct surface contamination reading measured at the location on the survey data forms.

5.1.5 Wipe Surveys

Wipes will be collected and analyzed for ^{3}H and ^{14}C using liquid scintillation counting. These samples will be counted on site.

The methodology for collection of low-energy beta contamination wipe samples is as follows:

- Prepare liquid scintillation vials by placing the predetermined amount of cocktail in the vials and cap the vials.
- Survey/sampling technician will don new gloves at the start of work at each new work location or survey unit, at a minimum, and as needed thereafter.
- At each sample point, a single wipe will be wiped over an area of approximately 100 square cm^2 (a square area of approximately 4 inches by 4 inches or an "S" pattern approximately 16 inches long).
- Once the wipe is performed, the wipe will quickly be placed into an individual prepped scintillation vial.
- The lid of the scintillation vial containing the wipe will be marked with a unique number identifying the sample location. The scintillation vials containing the wipes will be delivered to the on-site LSC area for analysis.

5.1.6 Final Status Surveys

At the completion of remediation and characterization activities, a final status survey plan (FSSP) will be prepared. This plan will establish data quality objectives (DQO), verify DCGLs, establish area classifications and survey units, determine data assessment requirements, determine number of samples and scan coverage, determine sample locations, establish data evaluation requirements, and outline the FSSR. Preliminary survey unit classifications are included in Appendix C.

The FSS will be conducted in accordance with the FSSP, and upon completion of the surveys and assessment of the data, the FSSR will be prepared for submittal to the NRC.

5.2 Documentation and Record Keeping

The surveys performed as part of this investigation will be documented using the forms found in Appendix F. The survey forms (cover sheet, continuation sheet, and blank map forms) provide a standard format for documenting the data gathered during this investigation. Alternate maps and forms may be used as long as all of the information contained on the standard survey forms is included. These survey forms shall be completed by the surveyor in a timely manner and given to the sample coordinator for review. The forms will be consecutively numbered and noted in a survey log.

All records generated as a result of this investigation shall be maintained and stored in accordance with Aptuit procedures.

5.3 Data Quality Assurance

Data quality assessment will be an ongoing process. All personnel involved with the collection of the data for this investigation have some responsibility. From properly sampling to data review, various activities will be performed to ensure data quality.

During and after data collection, original survey objectives need to be reviewed with consideration for whether the data generated satisfactorily meet the requirements. Any problems implementing this DP should be identified and addressed as early as possible.

5.3.1 Instrument Calibration and Frequency

Instruments will be properly calibrated, charged, and in good general working condition at the beginning of each day. 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).

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.

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.

5.3.2 Field and Laboratory Calibration Records

Field calibration records will be kept for all instruments used during D&D activities at the Aptuit facility. These records will include the following:

- Type, identification, and serial number of instrument.
- Identification of individual(s) and/or organizations performing the calibration.
- Reference standards, including sources and lot numbers used for each calibration.
- Initial and daily check records.
- Certifications or statements of calibration provided by manufacturers and external agencies and traceability of calibration standards to national standards.
- Information on calibration acceptances or failures. Any equipment that fails calibration shall be tagged and taken out of service.

The field analyst and/or laboratory will prepare and maintain calibration records for each instrument and test method in a manner that can be associated with each FSS measurement taken in the field or laboratory.

6.0 Waste Management

Waste minimization practices will be implemented throughout the decommissioning project in order to reduce the quantity of waste requiring disposal. Aptuit is the generator of the equipment and materials to be removed as part of the decommissioning activities. Aptuit will dispose of the regulated materials utilizing existing permits, licenses, and waste identification numbers. Aptuit will provide an area outside of the Aptuit facility for staging of nonregulated wastes. Aptuit will dispose of all recyclable and nonrecyclable materials that are nonregulated.

All dismantled components will be stored within the laboratory or an identified staging area for reuse, recycling, or disposal. Regulated materials will be stored separately in a designated staging area and properly managed for disposal in accordance with federal and state regulations.

Waste streams associated with decommissioning activities include used PPE (gloves and Tyvek suits). If not suspected of being contaminated with radioactive or hazardous constituents, PPE items can be disposed as trash. If radioactive or Resource Conservation and Recovery Act (RCRA) concerns are possible, based on survey data and process knowledge, PPE will be bagged as potentially radioactive waste or mixed waste or hazardous waste and managed under Aptuit's waste management program for disposition. Waste streams will be labeled, inventoried, and properly stored in appropriate containers pending characterization and corresponding designation.

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

The sink traps and contents associated with the sink traps will be removed as described in Section 3.2.7. 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 ^{3}H and ^{14}C. 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.

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.

6.1.3.1 Solid Radiological Waste

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

6.1.3.2 Liquid Radiological Waste

It is conservatively estimated that approximately 100 gallons of liquid radiological waste may be generated during the D&D activities.

6.1.3.3 Mixed Waste

It is conservatively estimated that approximately 500 pounds of mixed waste may be generated during the D&D activities. Mixed waste could include ACM or mercury contaminated items.

7.0 Final Status Report Development

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

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 facilities being investigated. Collected data will be used in the data assessment process to determine the final status for facility release. Upon completion of the data collection, data assessment will begin. At the culmination of data assessment, an 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 SO facilities can be released from radiological controls.

The FSSR will be prepared using the guidance provided in Section 4.5 of NUREG 1757, Volume 2. The report will be divided into three main headings:

- General Information – Site history and description and physical setting
- Nature and Extent of Contamination – Contamination sources, survey design, number and type of measurements, types and extent of contamination
- Dose Assessment – Exposure setting, identification of pathways, quantification of exposures.

A general outline of an FSSR is presented below:

- ***Chapter 1.0 – General Site Information***
  - Site location and description
  - Site history
  - General physical setting
  - Potentially exposed populations.
- ***Chapter 2.0 – Nature and Extent of Contamination***
  - Sources of contamination
  - Survey design summary
  - Extent of contamination
  - Structures
  - Equipment.

- ***Chapter 3.0 – Dose Assessment***
  - Exposure setting
  - Exposure pathways
  - Sources of exposure
  - Quantification of exposure
  - Application of dose assessment codes.

- ***Chapter 4.0 – Conclusions and Recommendations***
  - Conclusions
  - Remediation requirements
  - Final status determinations.

8.0 References

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TABLES

Table ES-1

Crosswalk of Decommissioning Plan Against NUREG-1757, Vol. 1, Rev. 2, Appendix D, Decommissioning Plan Checklist
Decommissioning Plan
Aptuit, LLC
Kansas City, Missouri

NUREG-1757, Vol. 1, Rev. 2, Appendix D, Decommissioning Plan Checklist		Aptuit Decommissioning Plan section
Site Description		
I	Executive Summary	Executive Summary
II.	Facility Operating History	1.2 Operational and License History
II.a.	the activities authorized under the current license;	1.2.1 License Number and Authorized Activities
II.b.	past authorized activities using licensed radioactive material at the site;	1.2.2 License History
II.c.	all previous decommissioning or remedial activities at the site;	1.2.3 Previous Investigations and Decommissioning Activities
II.d.	descriptions the locations of all spills and releases of radioactive material at the site; and,	1.2.4 Incidents/Spills
II.e.	all previous burials of radioactive material, including those where the material was subsequently exhumed.	NA
III.	Facility Description	1.3 Facility Description
III.a.	a description of the site and environs;	1.3.1 Site Location and Description
III.b.	a description of the current population distribution;	NA
III.c.	a summary of current and potential future uses of land in and around the site;	NA
III.d.	descriptions of the site meteorology,	NA
III.e.	geology, seismology, climatology,	NA
III.f.	surface hydrology	1.3.1 Site Location and Description
III.g.	groundwater hydrology, geotechnical characteristics;	1.3.1 Site Location and Description
III.h.	and descriptions of the natural and water resources at the site.	1.3.1 Site Location and Description
IV.	Radiological Status of the Facility	1.3.2 Radiological Status of Facility
IV.a.	Contaminated structures	1.3.2.1 B Building Structures, Equipment, and Systems 1.3.2.2 Waste Storage Building
IV.b.	Contaminated systems and equipment	1.3.2.1 B Building Structures, Equipment, and Systems
IV.c.	Surface soil contamination	1.3.2.3 Surface Soil
IV.d.	Subsurface soil contamination	NA
IV.e.	Surface water	NA
IV.f.	Ground water	NA

Table ES-1

Crosswalk of Decommissioning Plan Against NUREG-1757, Vol. 1, Rev. 2, Appendix D, Decommissioning Plan Checklist Decommissioning Plan Aptuit, LLC Kansas City, Missouri

NUREG-1757, Vol. 1, Rev. 2, Appendix D, Decommissioning Plan Checklist		**Aptuit Decommissioning Plan section**
V.	Dose Modeling	3.1 Unrestricted Release Using Screening Criteria
V.a.	Unrestricted release using screening criteria	3.1 Unrestricted Release Using Screening Criteria
V.b.	Unrestricted release using site-specific information	NA
V.c.	Restricted release using site-specific information	NA
V.d.	Release involving alternate criteria	NA
VI.	Environmental information	NA
VII.	ALARA analysis	3.1 Unrestricted Release Using Screening Criteria
Program Organization		
VIII.	Planned Decommissioning Activities	3.2 Decommissioning Field Activities
VIII.a.	Contaminated structures	3.2.4 Incinerator Removal 3.2.6 Wall Cabinetry 3.2.7 Benchtops and Tables 3.2.13 Laboratory B3-298 3.2.14 Waste Storage Building 3.2.15 Walls, Floors, and Drains 3.2.16 HP Support Areas
VIII.b.	Contaminated systems and equipment	3.2.5 Storage Cabinets and Freezers 3.2.8 Sink Trap and Strainer Removal 3.2.9 Vacuum System Removal 3.2.10 Chemical Fume Hood Removal 3.2.11 Exhaust Ductwork Removal 3.2.12 Exterior and Rooftop Exhaust Components
VIII.c.	Soil	1.3.2.3 Surface Soil
VIII.d.	Surface and Groundwater	1.3.2.4 Surface Water and Groundwater
VIII.e.	Schedules	Figure 3-1
IX.	Project Management and Organization	2.0 Project Management and Organization
IX.a.	Decommissioning management organization	2.1 Facility Radiological Controls Organization
IX.b.	Decommissioning task management	2.2 Task Organization
IX.c.	Decommissioning management position and qualifications	2.0 Project Management and Organization
IX.d.	Radiation safety officer	2.1.2 Radiation Safety Officer
IX.e.	Training	4.4 Training

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Crosswalk of Decommissioning Plan Against NUREG-1757, Vol. 1, Rev. 2, Appendix D, Decommissioning Plan Checklist Decommissioning Plan Aptuit, LLC Kansas City, Missouri

NUREG-1757, Vol. 1, Rev. 2, Appendix D, Decommissioning Plan Checklist		**Aptuit Decommissioning Plan section**
IX.f.	Contractor support	2.2 Task Organization
X.	Radiation Safety and Health Program During Decommissioning	4.0 Radiation Health and Safety Program
X.a.	Air sampling program	4.2.1 Workplace Air Sampling and Respiratory Protection
X.b.	Respiratory protection program	4.2.1 Workplace Air Sampling and Respiratory Protection
X.c.	Internal exposure determination	4.1 Assessment of Radiation Hazards 4.2.2 Internal Exposure Determination
X.d.	External exposure determination	4.1 Assessment of Radiation Hazards
X.e.	Summation of internal and external exposures	NA
X.f.	Contamination control program	4.2.3 Contamination Control Program
X.g.	Instrumentation program	4.2.4 Instrumentation Program
X.h.	Nuclear criticality safety	NA
X.i.	Health physics audits, inspections, and recordkeeping program	4.5 Health Physics Audits and Record-Keeping Program
XI.	Environmental Monitoring and Control Program	NA
XI.a.	Environmental ALARA evaluation program	NA
XI.b.	Effluent monitoring program	NA
XI.c.	Effluent control program	NA
XII.	Radioactive Waste Management Program	6.1.3 Radioactive Waste
XII.a.	Solid radwaste	6.1.3.1 Solid Radiological Waste
XII.b.	Liquid radwaste	6.1.3.2 Liquid Radiological Waste
XII.c.	Mixed waste	6.1.3.3 Mixed Waste
XIII.	Quality Assurance Program	5.3 Data Quality Assurance
XIII.a.	Organization	2.2 Task Organization
XIII.b.	Quality assurance program	5.3 Data Quality Assurance
XIII.c.	Document control	5.2 Documentation and Record Keeping
XIII.d.	Control of measuring and test equipment	5.3.1 Instrument Calibration and Frequency
XIII.e.	Corrective action	4.5.1 Health Physics Audits
XIII.f.	Quality assurance records	4.4.2 Record-Keeping Program 5.3.2 Field and Laboratory Calibration Records
XIII.g.	Audits and surveillances	4.4.1 Health Physics Audits
XIV.	Facility radiation surveys	5.1 Facility Radiation Survey
XIV.a.	Release criteria	3.1 Unrestricted Release Using Screening Criteria

Table ES-1

Crosswalk of Decommissioning Plan Against NUREG-1757, Vol. 1, Rev. 2, Appendix D, Decommissioning Plan Checklist Decommissioning Plan Aptuit, LLC Kansas City, Missouri

NUREG-1757, Vol. 1, Rev. 2, Appendix D, Decommissioning Plan Checklist		Aptuit Decommissioning Plan section
		5.1 Facility Radiation Survey
XIV.b.	Characterization surveys	5.1 Facility Radiation Survey
XIV.c.	In-process surveys	5.1 Facility Radiation Survey
XIV.d.	Final status survey design	5.1.6 Final Status Surveys
XIV.e.	Final status survey report	7.0 Final Status Report Development
XV.	Financial Assurance	1.4 Financial Assurance
XV.a.	Cost estimate	1.4.1 Cost Estimate
XV.b.	Certification statement	1.4.1 Cost Estimate
XV.c.	Financial mechanism	1.4.2 Financial Mechanism
XVI	Restricted Use/Alternate Criteria	NA

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	Research and development in the synthesis of labeled pharmaceutical for non-human experimentation and in vivo and/or in vitro animal studies	
				H-3	Any	100		
				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	Laboratory research including animal studies.	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		
				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	Research and development as defined in 10CFR 30.4(q)	
				C-14	Any	1 Curie		
				P-32	Any	20		
				S-35	Any	20		
				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			Research and development as defined in 10CFR 30.4(q)	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		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
				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.	Clint Gregg named RSO
				C-14	Any	2 Curies		
				S-35	Any	20		
				I-125	Any	70		
				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 C-14 S-35 I-125 Ba-133 Cs-137	Any Any Any Any Sealed source Sealed source	100 Curies 100 Curies 1.5 Curies 70 20 90 microcuries	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.
February 11, 2011	Aptuit, Inc.	10245 Hickman Mills Drive	Amend 32	H-3 C-14 S-35 I-125 Ba-133 Cs-137	Any Any Any Any Sealed source Sealed source	100 Curies 100 Curies 1.5 Curies 70 20 90 microcuries	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.
January 4, 2012	Aptuit, LLC.	10245 Hickman Mills Drive	Amend 33	H-3 C-14 S-35 I-125 Ba-133 Cs-137	Any Any Any Any Sealed source Sealed source	100 Curies 100 Curies 1.5 Curies 70 20 90 microcuries	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

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, June 2011

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 4-1

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 4-2

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 ^3H 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

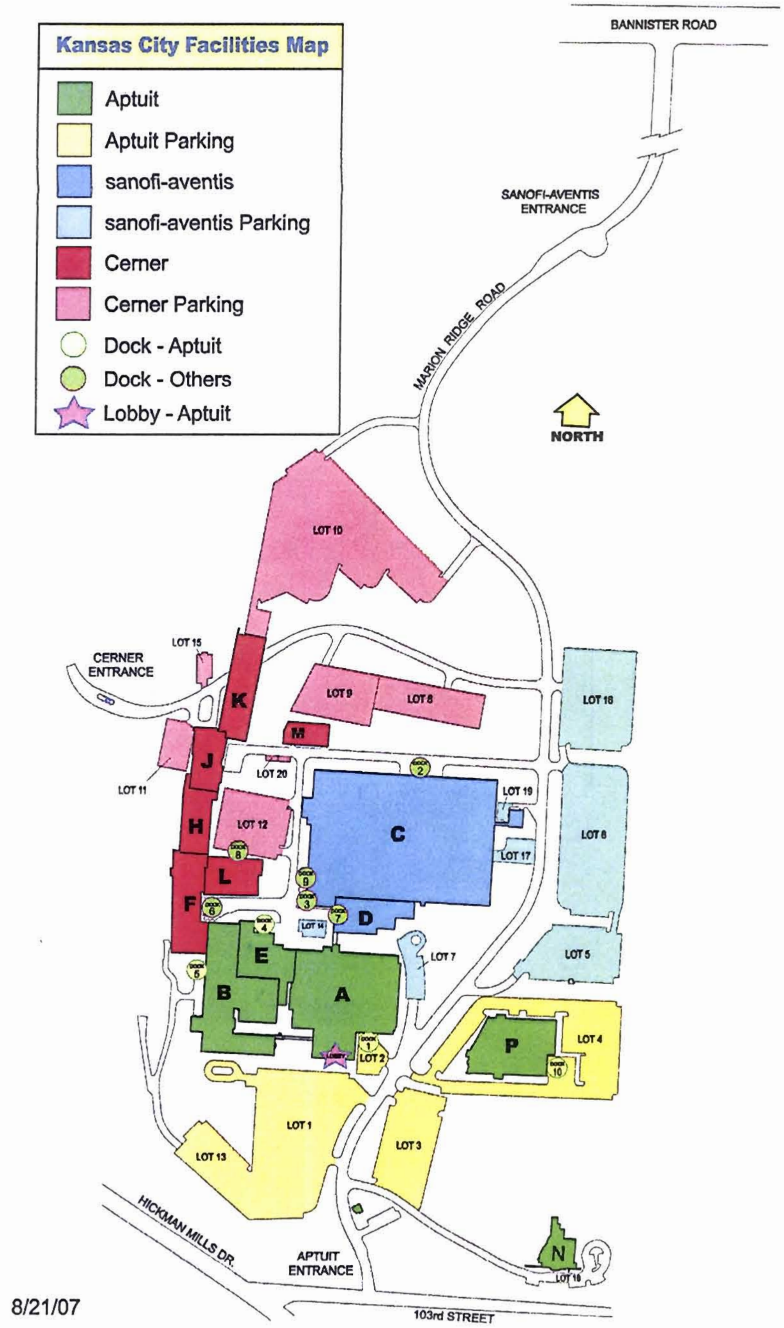

FIGURE 1-1
APTUIT FACILITY SITE DRAWING

DECOMMISSIONING PLAN
APTUIT, LLC
KANSAS CITY, MISSOURI

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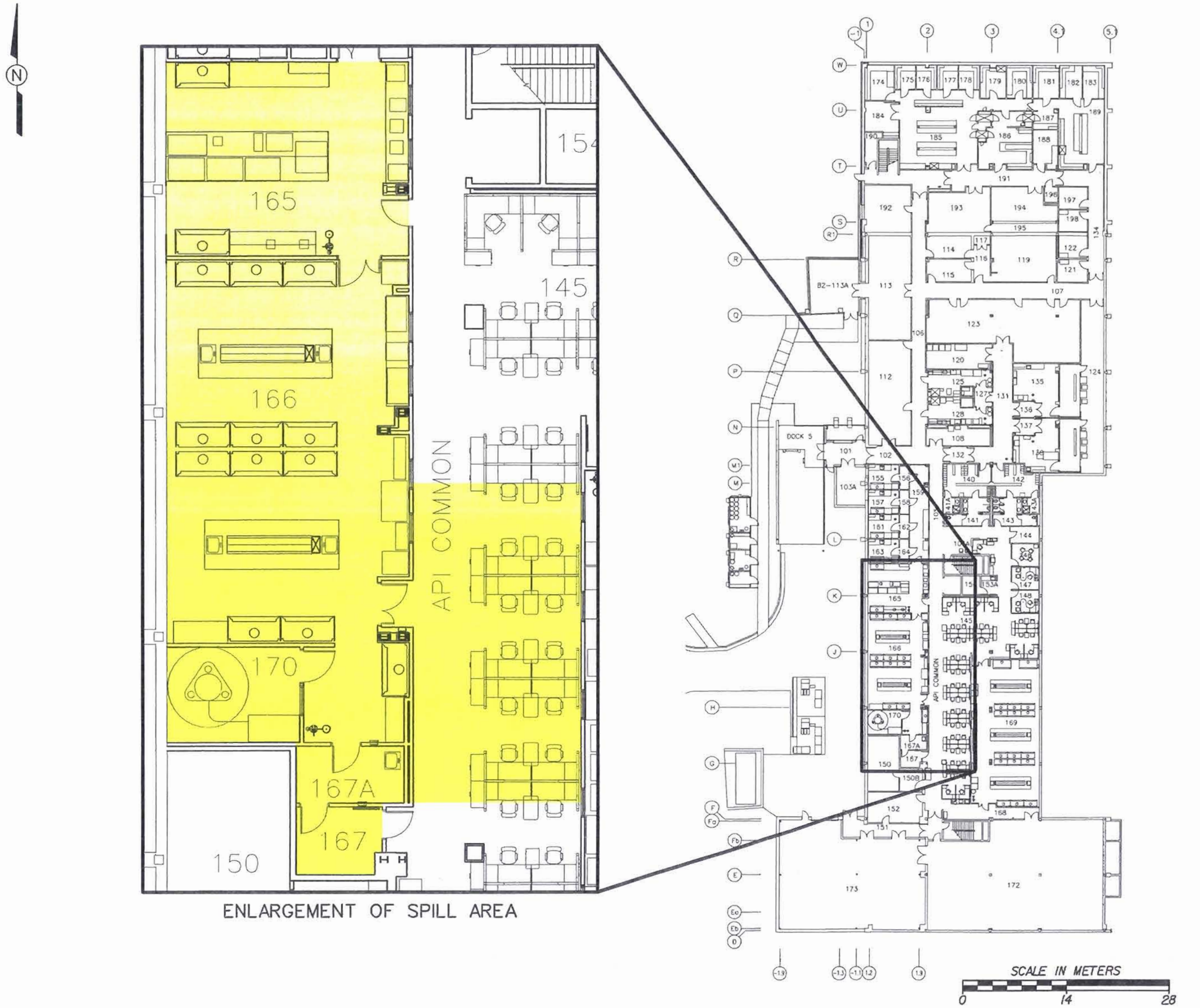
LEGEND:

APPROXIMATE AREA OF SPILL



ENLARGEMENT OF SPILL AREA

FIGURE 1-2
LOCATION OF SPILL
B BUILDING B2

DECOMMISSIONING PLAN
APTUIT, LLC
KANSAS CITY, MISSOURI

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LEGEND:

APPROXIMATE AREA OF SPILL

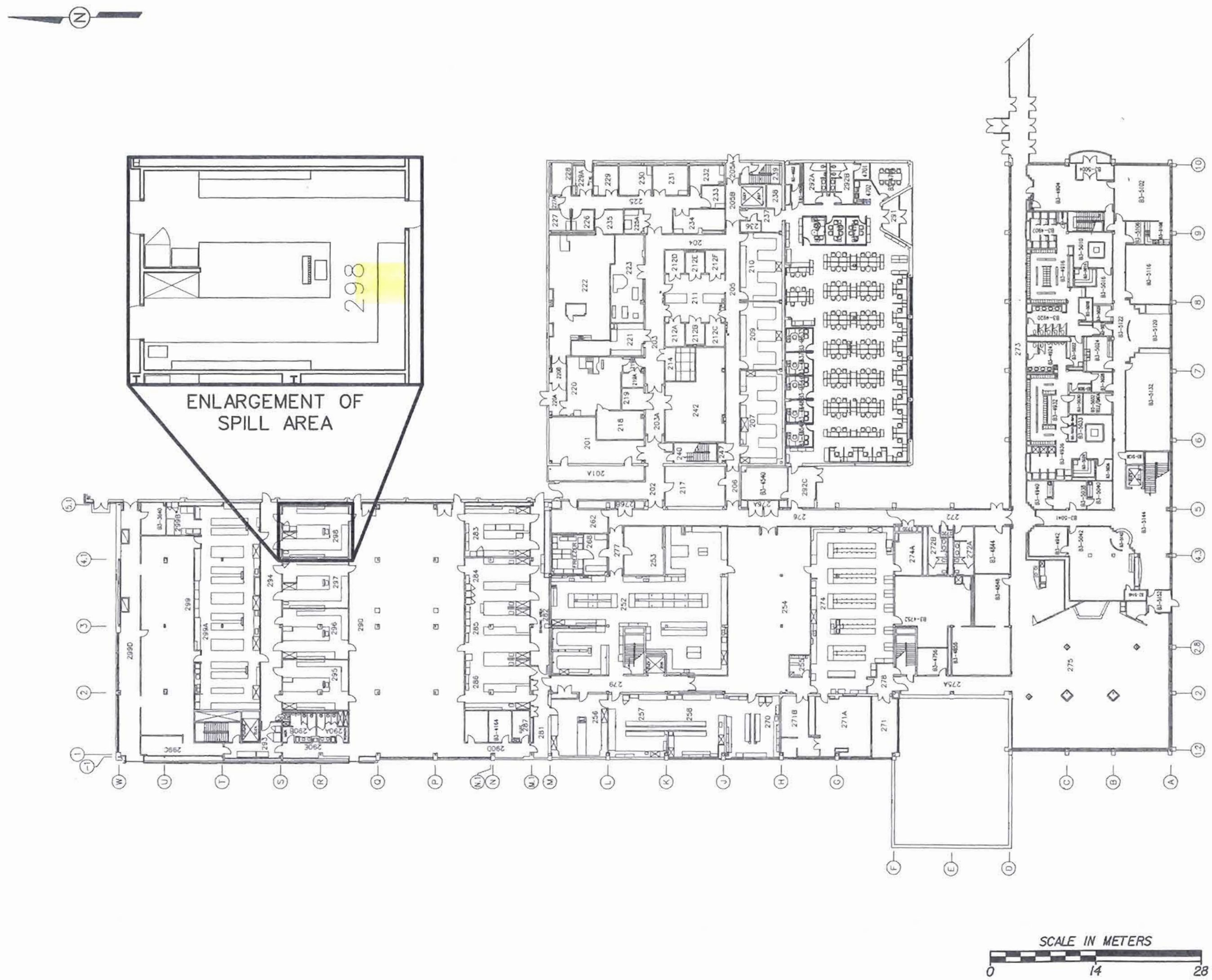

FIGURE 1-3
LOCATION OF SPILL
B BUILDING B3

DECOMMISSIONING PLAN
APTUIT, LLC
KANSAS CITY, MISSOURI

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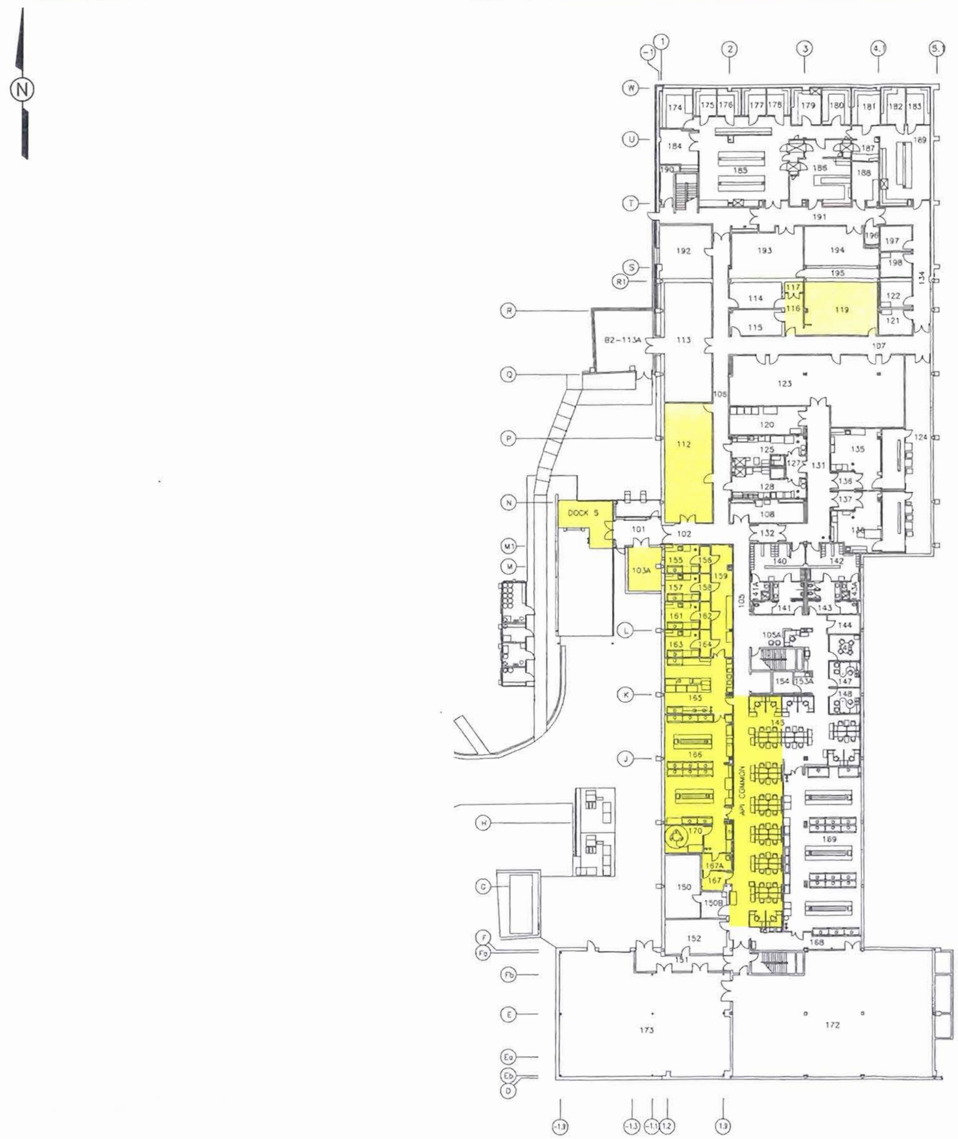

LEGEND:

AREA OF POTENTIAL CONCERN

SCALE IN METERS

0 14 28

FIGURE 1-4
AREAS OF POTENTIAL CONCERN
B BUILDING B2

DECOMMISSIONING PLAN
APTUIT, LLC
KANSAS CITY, MISSOURI

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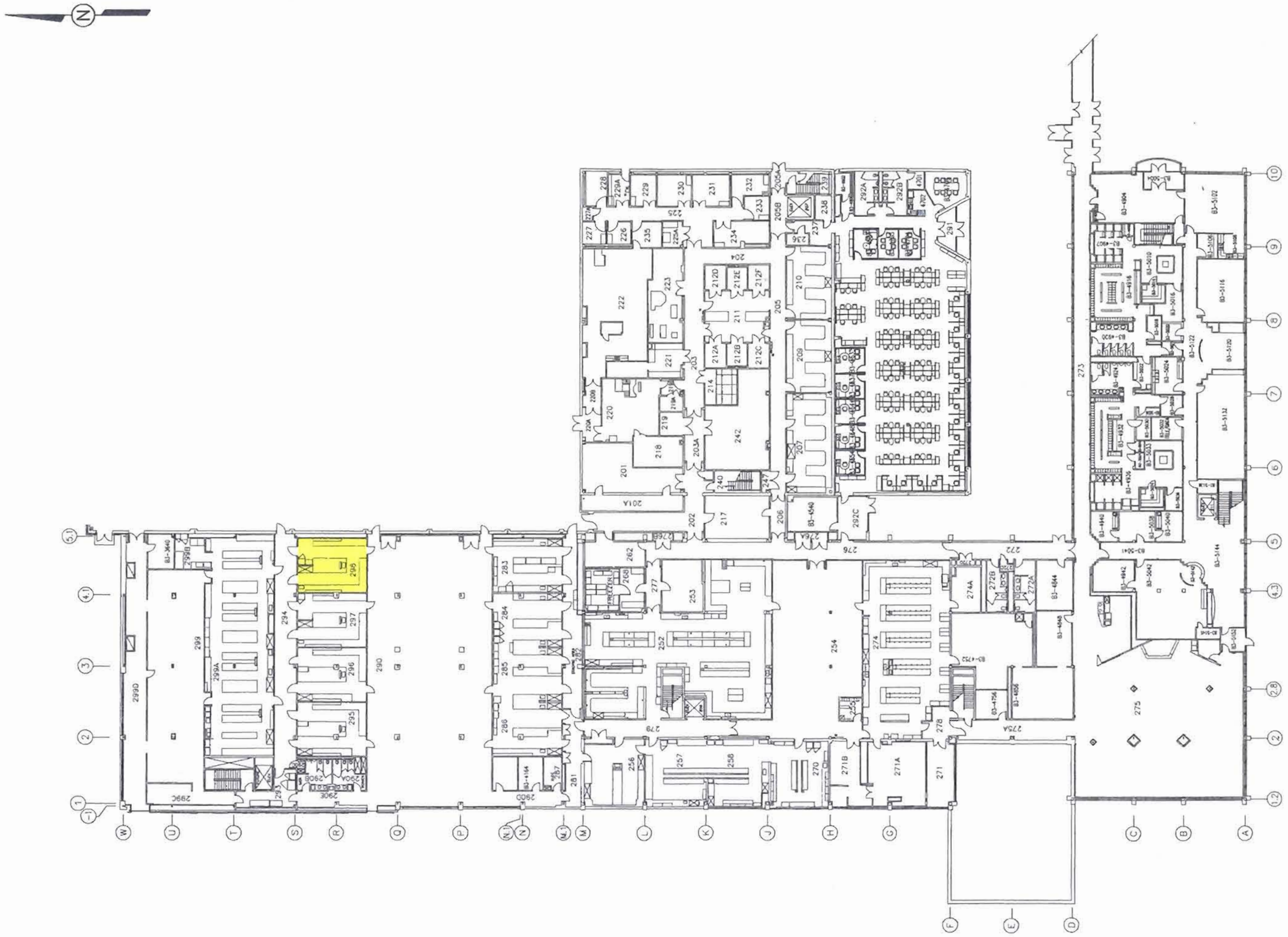
LEGEND:

AREA OF POTENTIAL CONCERN



SCALE IN METERS
0 14 28

FIGURE 1-5
AREAS OF POTENTIAL CONCERN
B BUILDING B3

DECOMMISSIONING PLAN
APTUIT, LLC
KANSAS CITY, MISSOURI

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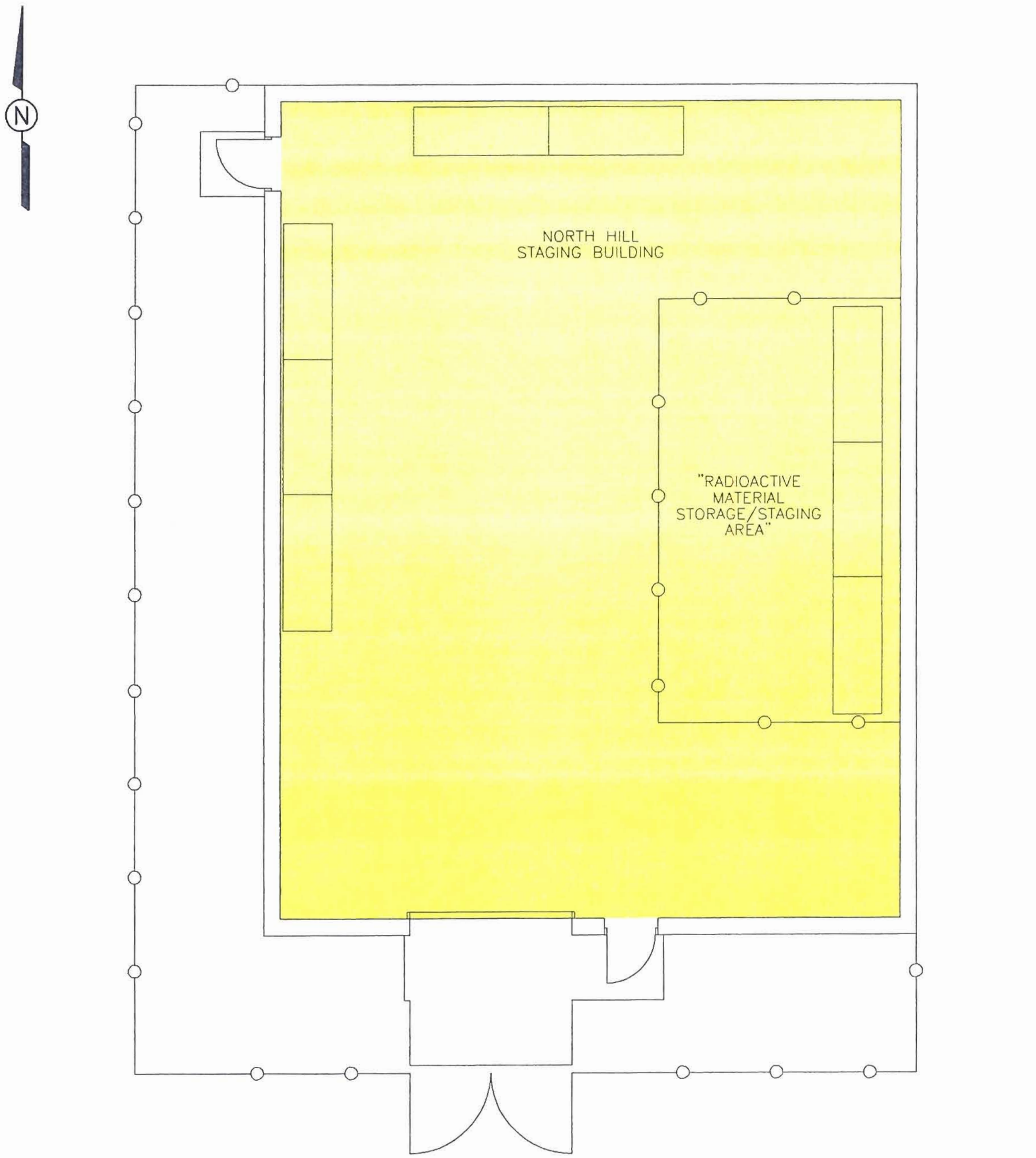

LEGEND:

AREA OF POTENTIAL CONCERN

FIGURE 1-6
AREAS OF POTENTIAL CONCERN
NORTH HILL STAGING BUILDING

DECOMMISSIONING PLAN
APTUIT, LLC
KANSAS CITY, MISSOURI

SCALE IN METERS
0 3 6

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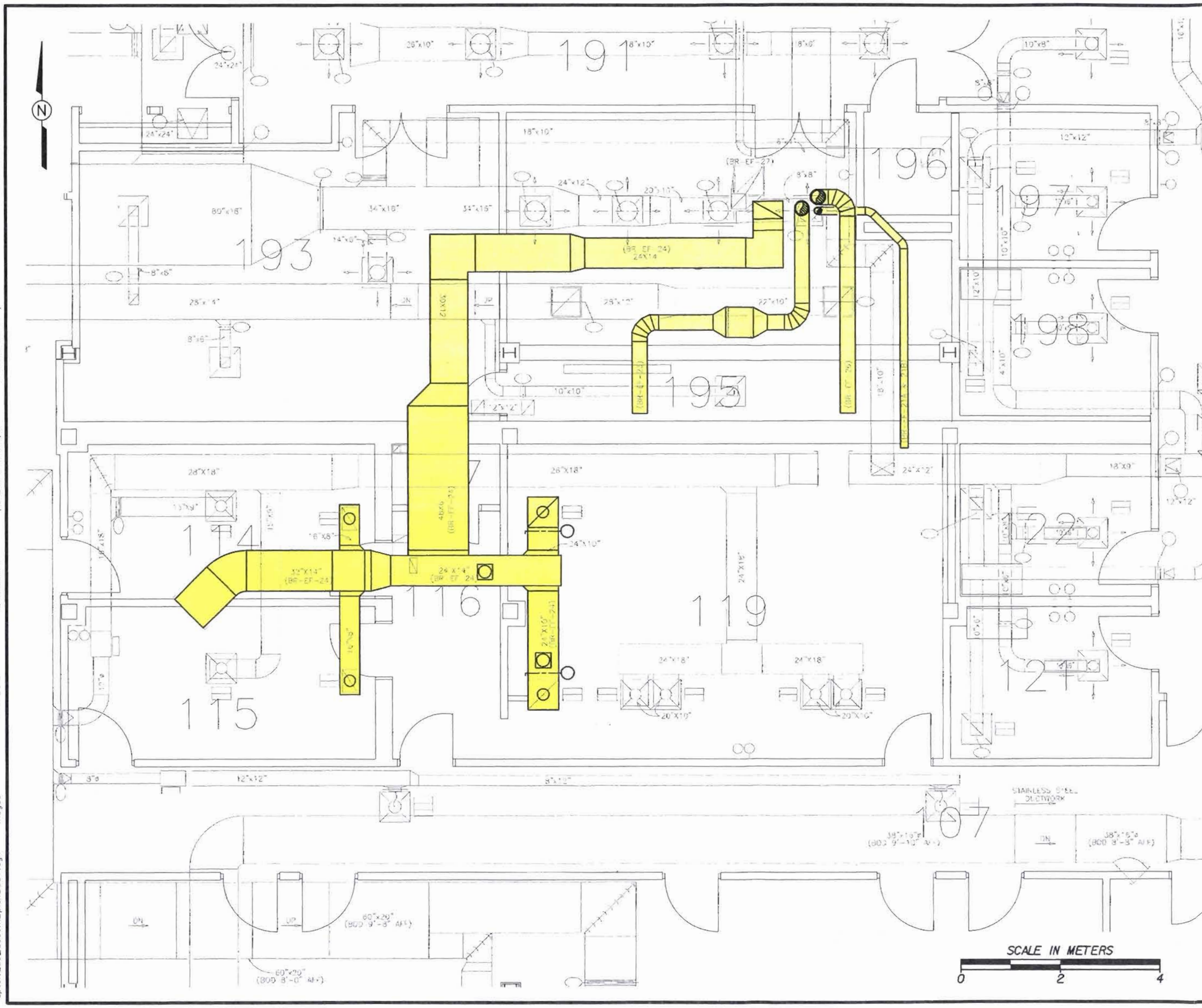

LEGEND:

AREA OF POTENTIAL CONCERN

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

DECOMMISSIONING PLAN

APTUIT, LLC
KANSAS CITY, MISSOURI

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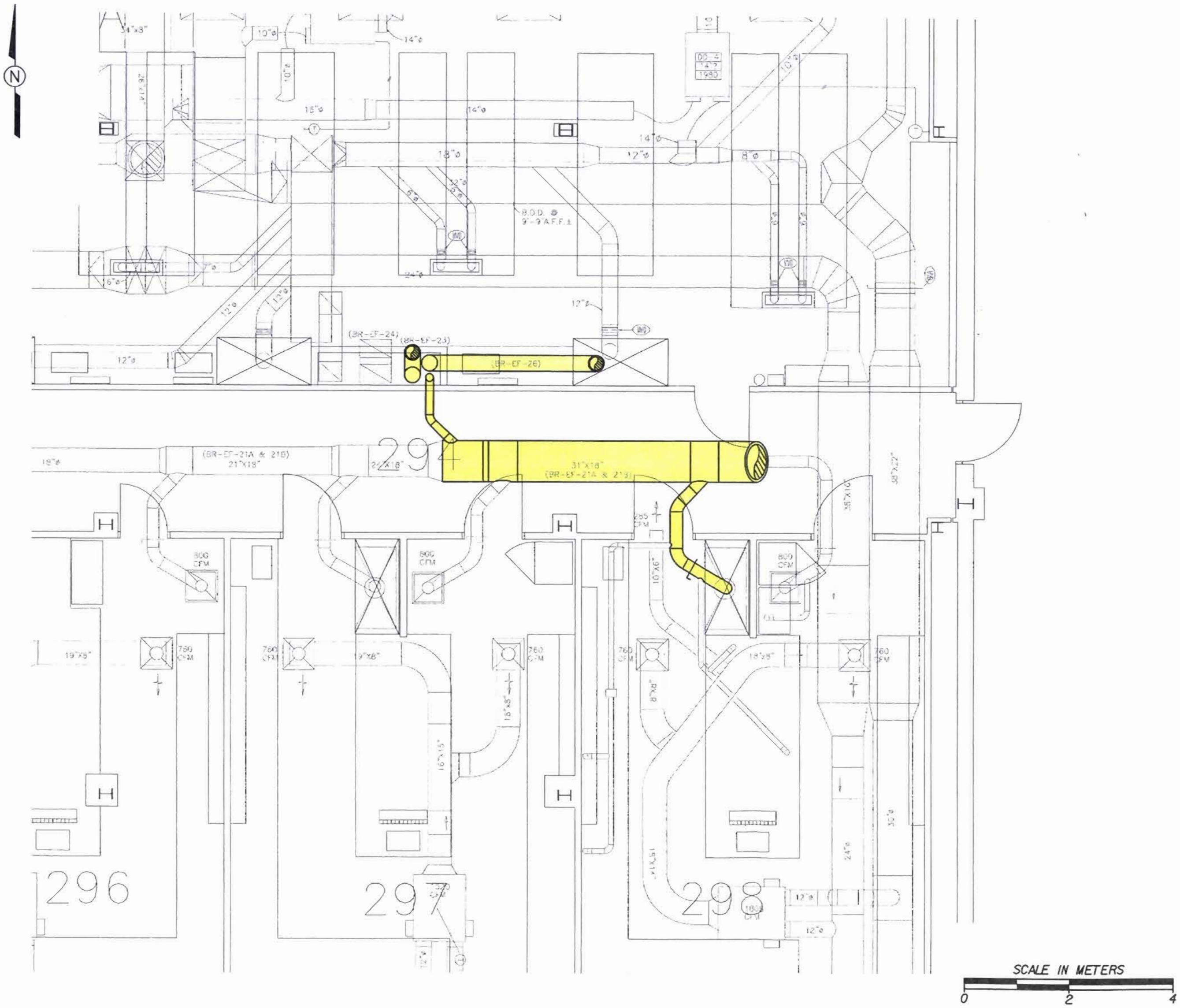

LEGEND:

AREA OF POTENTIAL CONCERN

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

DECOMMISSIONING PLAN

APTUIT, LLC
KANSAS CITY, MISSOURI

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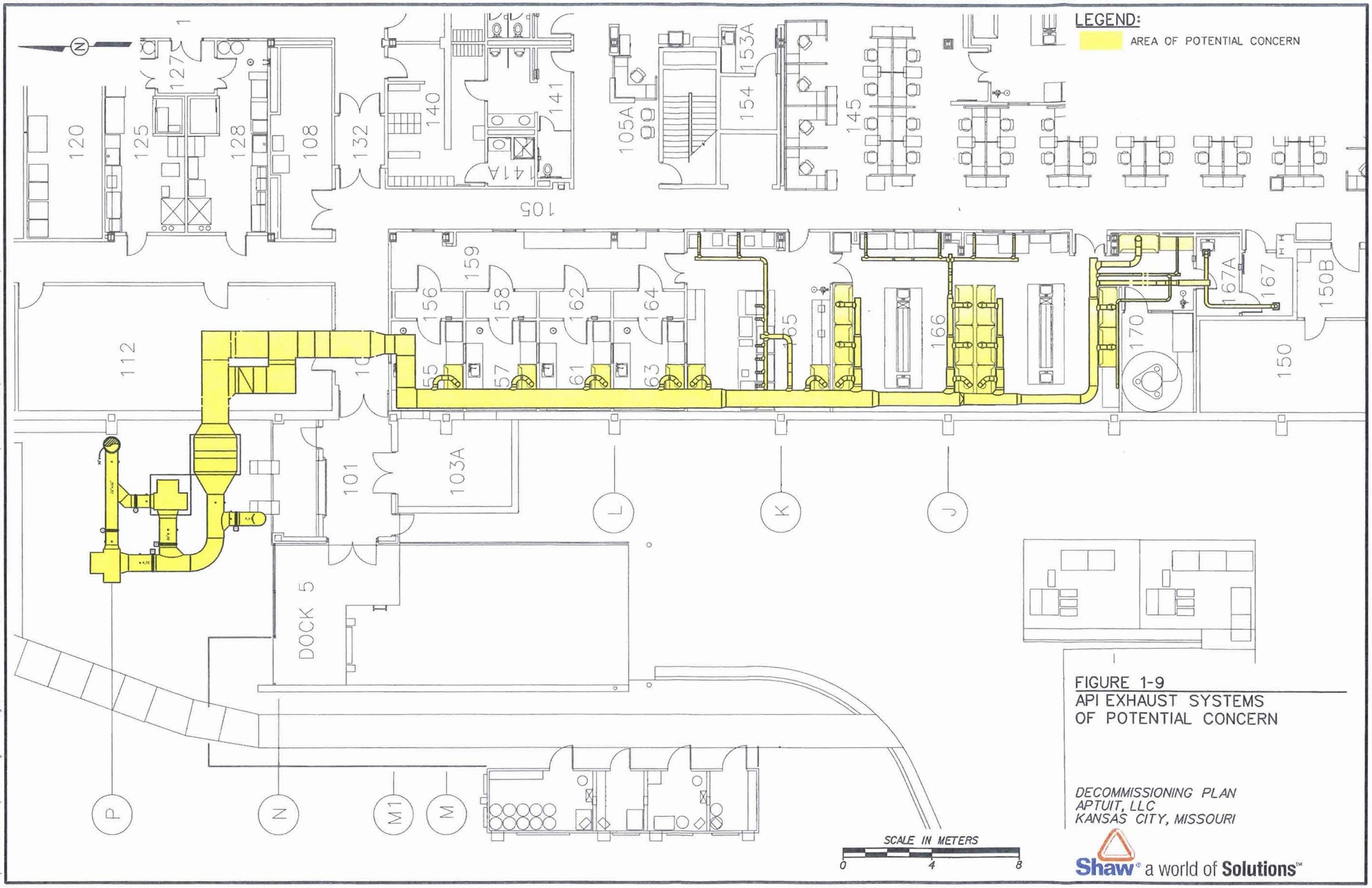

FIGURE 1-9
API EXHAUST SYSTEMS
OF POTENTIAL CONCERN

DECOMMISSIONING PLAN
APTUIT, LLC
KANSAS CITY, MISSOURI

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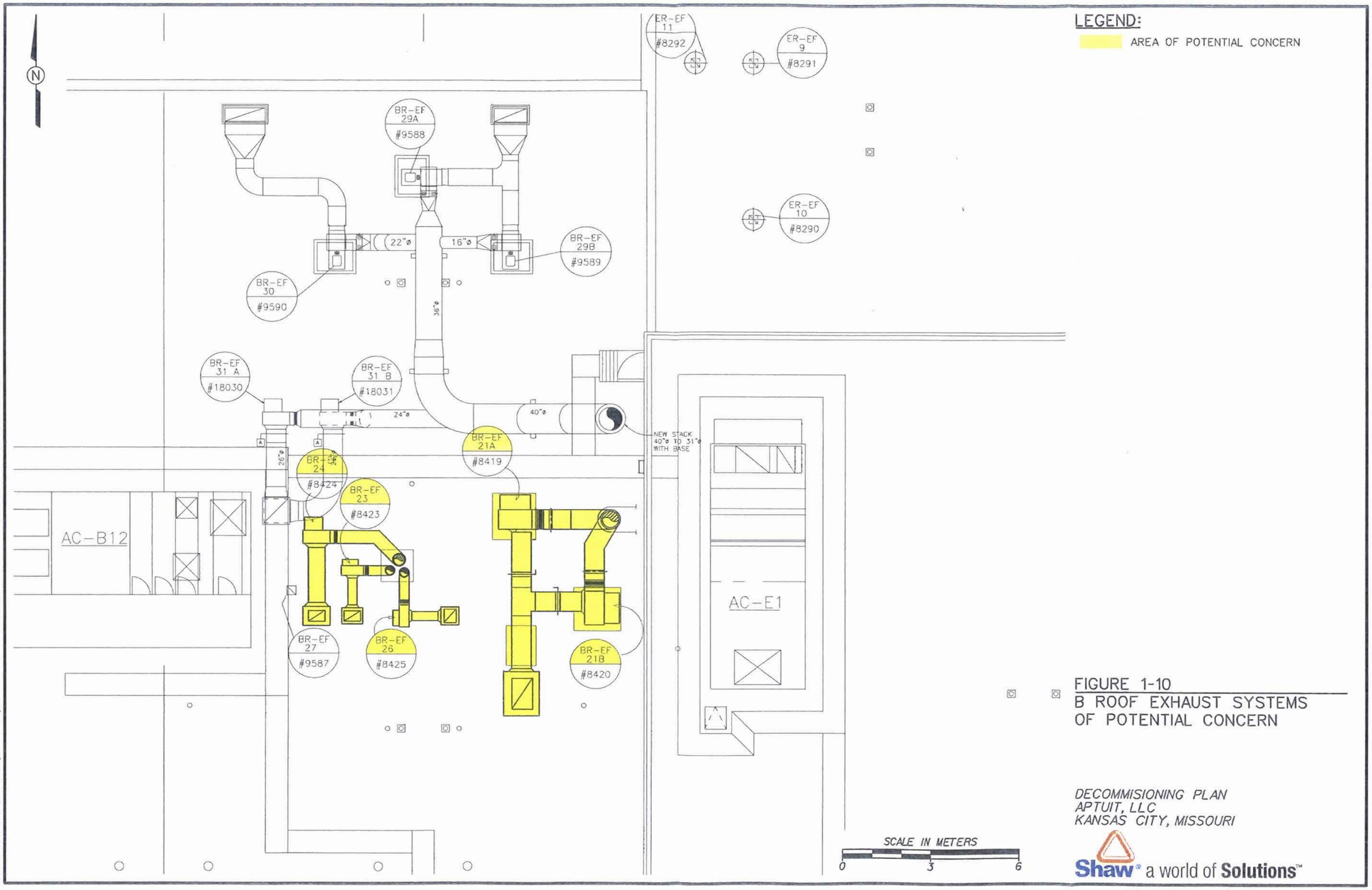

FIGURE 1-10
B ROOF EXHAUST SYSTEMS OF POTENTIAL CONCERN

DECOMMISIONING PLAN
APTUIT, LLC
KANSAS CITY, MISSOURI

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Figure 2-1
Aptuit Decommissioning Organization Chart

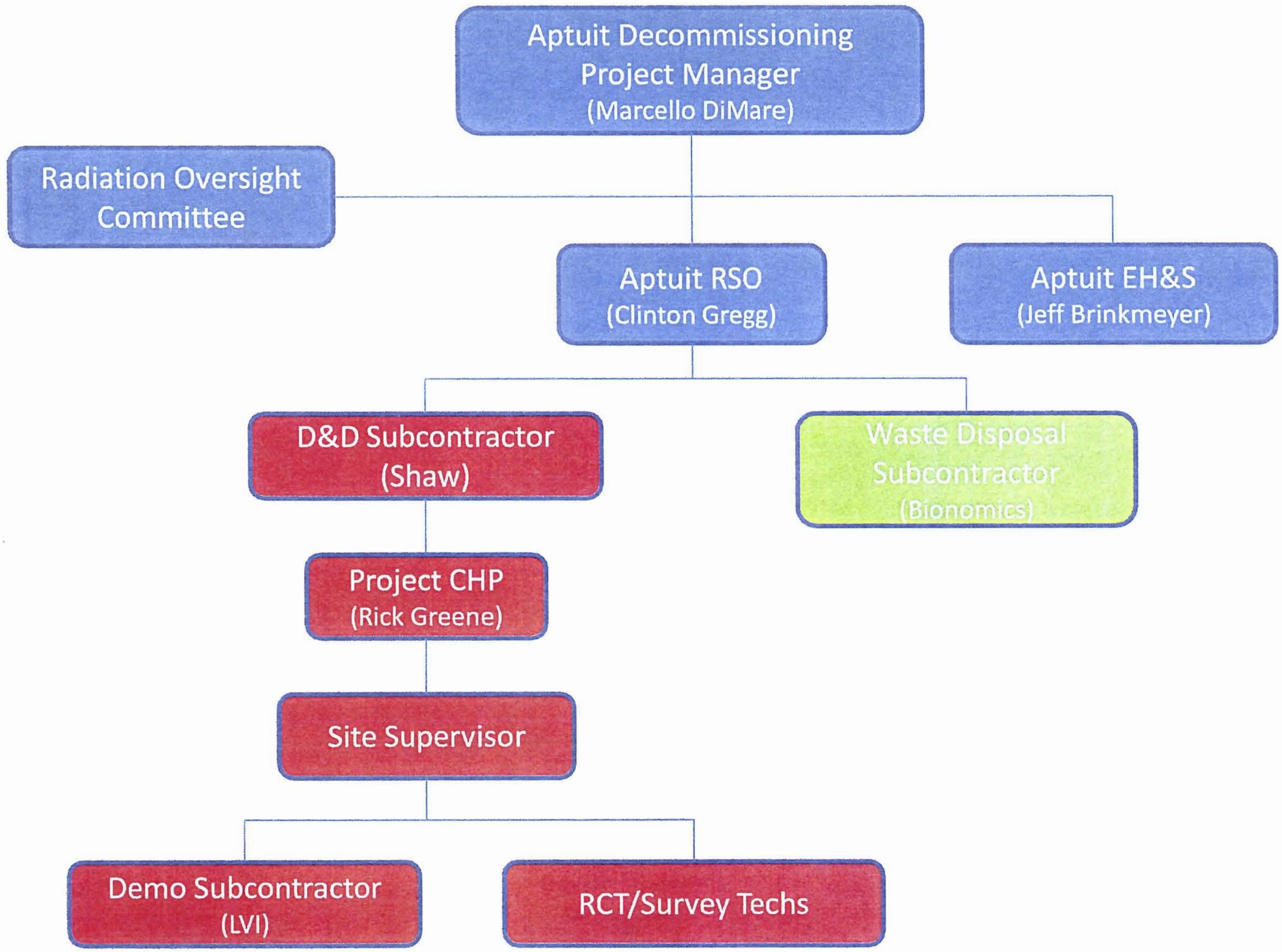
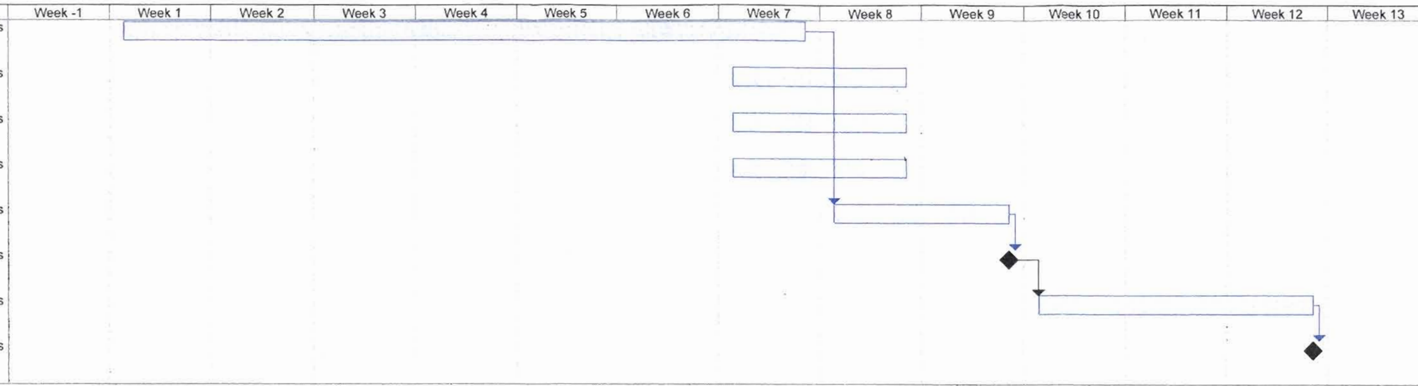


Figure 3-1
Aptuit SO Decommissioning Fieldwork Schedule

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

APPENDIX A

RADIOACTIVE MATERIALS LICENSE

U.S. NUCLEAR REGULATORY COMMISSION Amendment No. 33

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.

RC0 3632 576238

Licensee	
1. **Aptuit, LLC**	In accordance with the letter dated **October 20, 2011,**
	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 C. To be used for research and development as defined in 10 CFR 30.4, and for radiosynthesis of radiolabeled organic chemicals.

D. To be used for research and development as defined in 10 CFR 30.4.

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

F. 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. 33

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.
David Leuck	Hydrogen-3 and Carbon-14 for research and development and radiosynthesis, and Items 6.E. and 6.F.
Hari Pennaka	Hydrogen-3 and Carbon-14 for research and development and radiosynthesis, and Items 6.E. and 6.F.
Murali Ukkalam	Hydrogen-3 and Carbon-14 for research and development and radiosynthesis, and Items 6.E. and 6.F.
Andrew Damon	Hydrogen-3 and Carbon-14 for research and development, 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.
Kevin W. Carter, Ph.D.	Hydrogen-3, Carbon-14, Sulfur-35, and Iodine-125 for research and development,

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.

MATERIALS LICENSE SUPPLEMENTARY SHEET	License Number 24-15595-01
	Docket or Reference Number 030-09415
	Amendment No. 33

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.

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."

MATERIALS LICENSE SUPPLEMENTARY SHEET	License Number 24-15595-01
	Docket or Reference Number 030-09415
	Amendment No. 33

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 JAN 0 4 2012

By William P. Reichhold
William P. Reichhold
Materials Licensing Branch
Region III

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
	NA	

Radiation/Contamination Survey Report

CONTAMINATION / RADIATION SURVEY REPORT	PROJECT NUMBER: 120089
LOCATION: Aptuit B3-298	SURVEYOR: A. Martinez/S. Baumgardt
	SURVEY NUMBER: 041207-1
	MAP ID: Attached

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

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	α (LOOSE)	α (TOTAL)	β-γ (LOOSE)	β-γ (TOTAL)	Radiation Surveys Beta-Gamma
Instrument	N/A	N/A	LSC 6000	2360/43-68	N/A
Source Type and I.D.	↓	↓	C^{14}/H^3	C^{14}	↓
Source Strength in dpm			SADS	48,369	µCi
Efficiency 2πinst. 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) 2360/237229 / 43-68/PR190298
Radiation Survey INSTRUMENT / SERIAL #	BETA-GAMMA N/A	BETA-GAMMA N/A

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
2	↓	↓	↓	GPDS	↓	- South Wall Casework
3				↓		Floor
4						Floor
5			↓	↓	↓	Floor
6						Casework side
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. Martinez 4-12-07

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

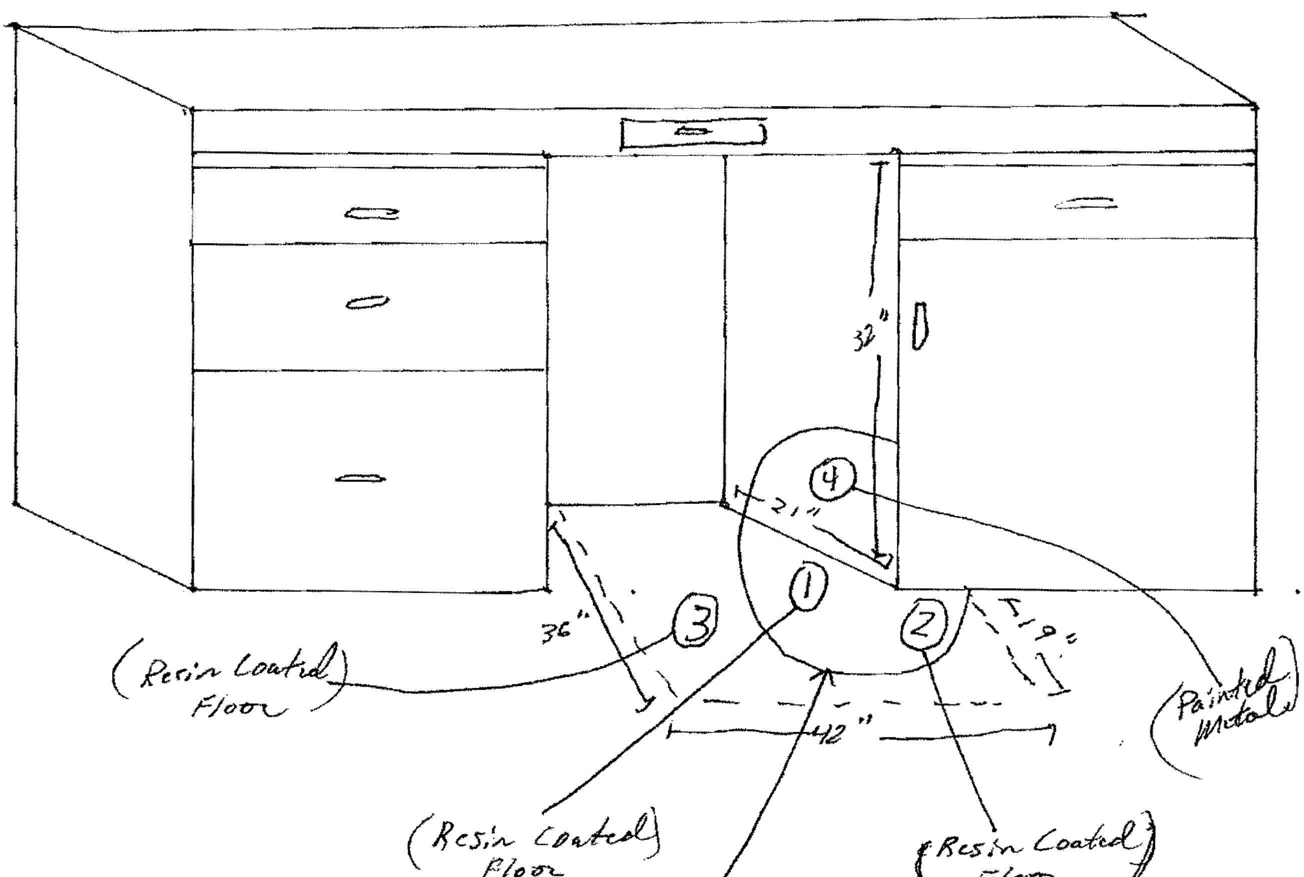
Chkd. By Am Date 4-12-07 Survey # 041207-1 Proj. No. 120089

.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.

108A-05-02

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	30.00	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	60.79	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

[redacted]

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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**		

Estimated cost of Incident

Shaw Environmental personnel during initial incident		$17,000
Additional Shaw involvement		$10,000
New NMR Computer and revalidation		$22,000
Ancillary workers (carpet layer/Team Office)		$ 5,000
Estimated Aptuit Employee hours for clean-up, etc.		
Hari Pennaka	12 hours	
Shawn Earll	14 hours	
Clint Gregg	60 hours	
Kevin Tarwater	12 hours	
Additional chemists	20 hours	
	118 hours x $200	$23,600
TOTAL		$77,600
TOTAL WITH MULTIPLIER (X1.4)		$108,640

Estimated waste costs:

Solid Radioactive Waste (1000 lbs @ $6/lb)	$6000
Liquid Radioactive Waste (300 gal @ $30/gal)	$9000

Supervisor Incident/Injury Report

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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).

CJM 11/28/08

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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

[handwritten initials] 11/20/08

Incident in B3-298 on July 26, 2010

Clinton J. Gregg

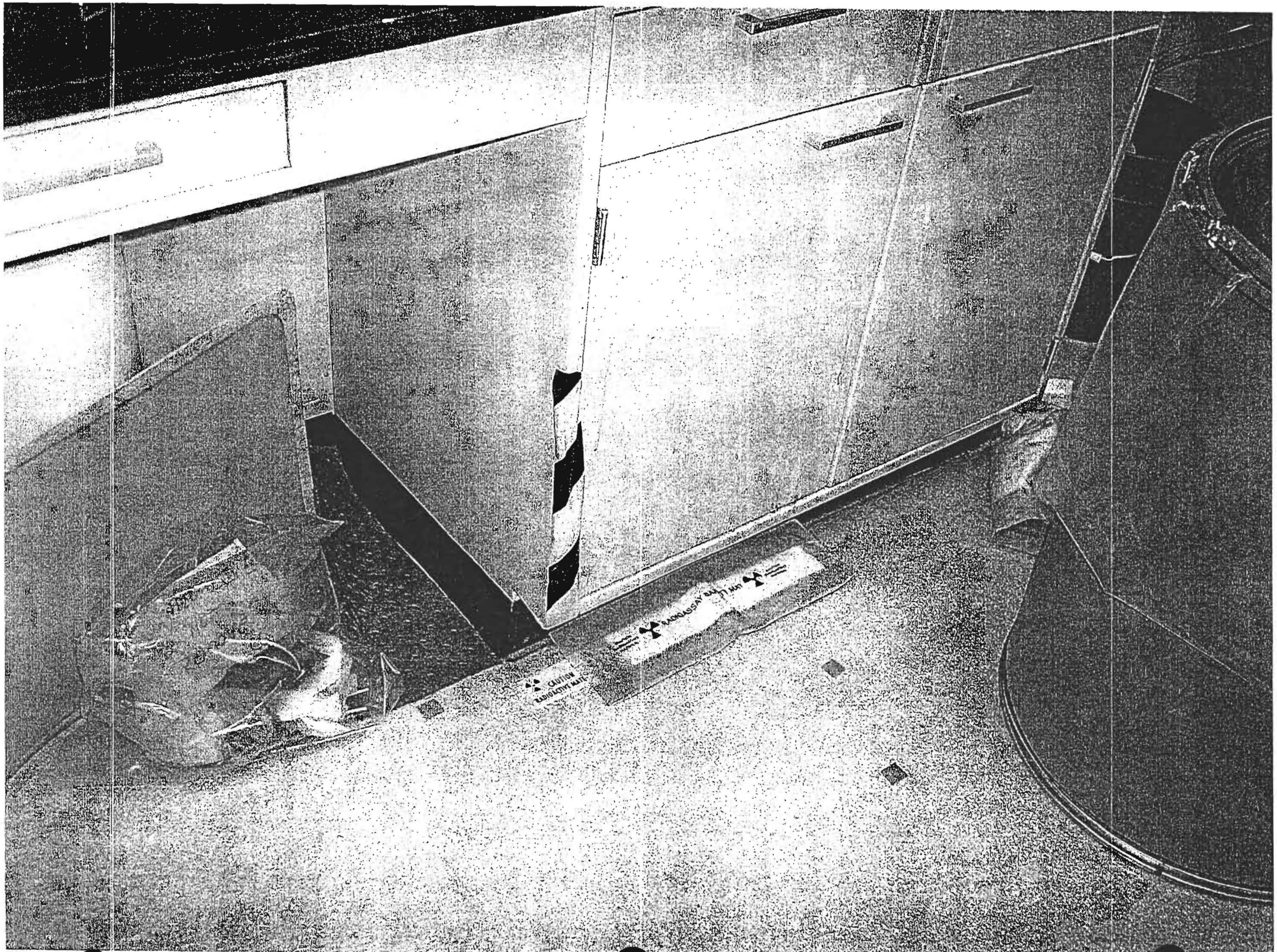
From: Clinton J. Gregg

Sent: Monday, July 26, 2010 9:13 PM

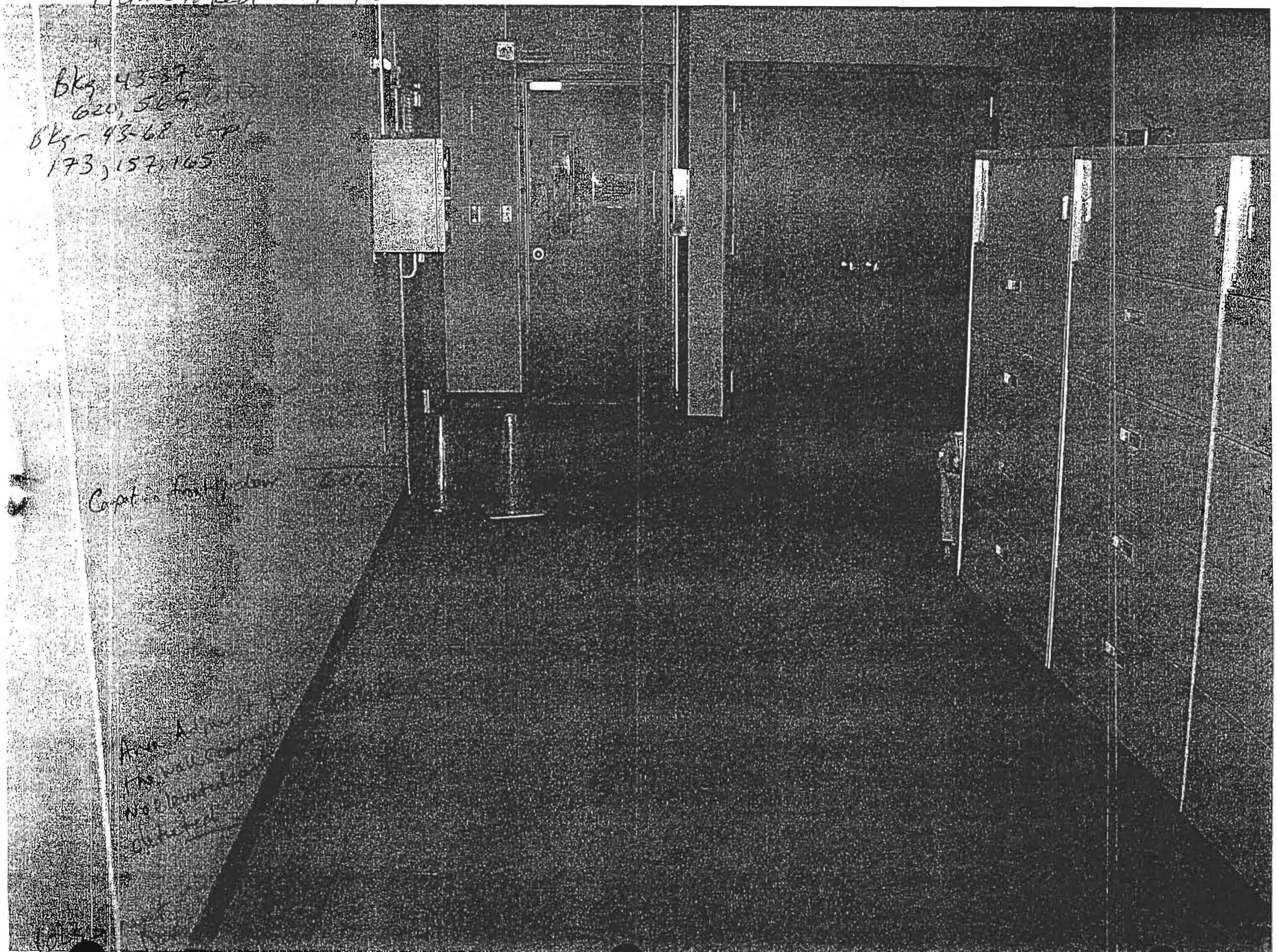
To: pamela.barton@aptuit.com; Kevin Tarwater

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
RADIOASSAY

Picture taken 7/26/10



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-

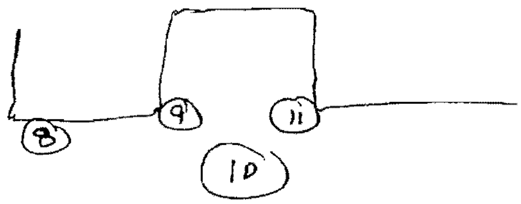
Half Life Correction: Off

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



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

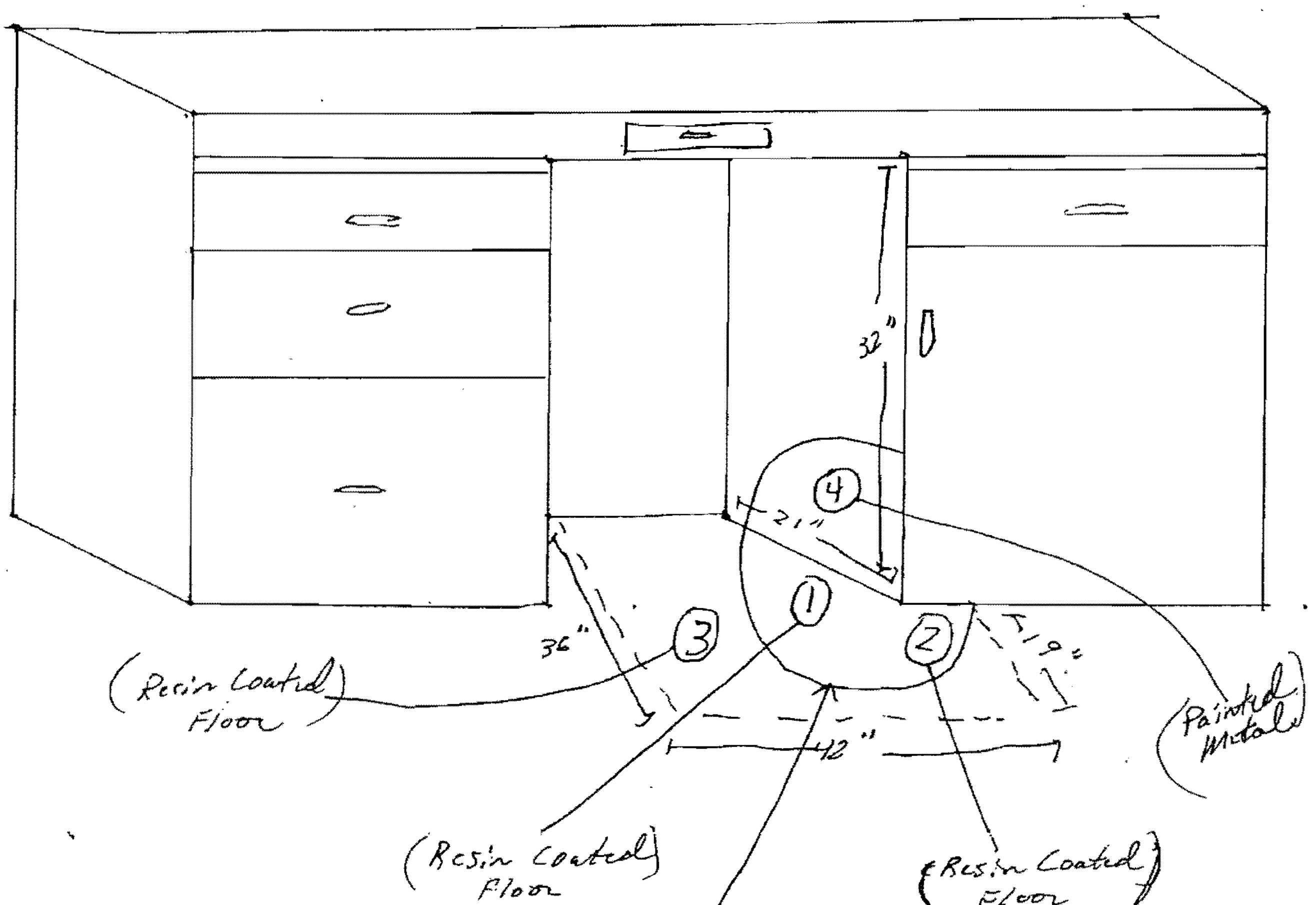
Chkd. By Am Date 4-12-07 Survey # 041207-1 Proj. No. 120089

.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) 1478
5) 14,587



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

108A-05-02

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"

[redacted] 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: 26 Sep 2011

Incidents in areas previously released from radiological controls

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.

John
x6708

09Dec04 Rm...

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	Bkg
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 Bren

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:~~

Note: This was per study. And 2 studies were done. Therefore total potential dose could have been 24uCi ^{14}C-CO_2

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

RADIOACTIVE MATERIAL USE AND STORAGE AREAS

Aptuit

Radioactive Material Use and Storage Areas

Area	Owner	Notes	Active - area is in use Inactive - area is not is use Active radio - area is still	Preliminary MARSSIM Classification
A3-320	CTS	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.	Inactive	Class 3
A3-323	CTS	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.	Inactive	Class 3
A3-324	CTS	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 prescence of X-ray diffraction equipment.	Inactive	Class 3
A3-327	CTS	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.	Inactive	Class 3
A3-340	CTS	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. Shaw performed a characterization survey in A3-340 in 2004 with no contamination found. Shaw surveyed the floor and equipment surfaces in April 2010 (scan, directs, survey 041910-02). No contamination found.	Inactive	Class 3
A3-341	CTS	This lab has not been on the routine survey schdule since Shaw has been performing surveys (2004). Interviews indicated that lab was used for FTIR or HPLC analysis (C-14) for about 2 years (maybe 1994-1996). Other interviews 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). Shaw surveyed the floor and equipment surfaces in April 2010 (scan, directs, survey 041910-03). No contamination found.	Inactive	Class 3
A3-348	CTS	Document storage center. Rad labeled animal samples (slices) were found stored here. All samples have been removed and the area surveyed.	Active	Non impacted or Class 3 impacted.

Area	Owner	Notes	Active - area is in use Inactive - area is not is use Active radio - area is still	Preliminary MARSSIM Classification
A3-367	CTS	C-14 former use. Final Status Survey (FSS) was performed by Shaw. FSSR report was issued May 2006.	Area has been released.	NA
A3-394	CTS	Found daily survey record. C-14 1996. It's unclear if this is A3-394 or some other area.	Active	Class 3
A Building Potentially contaminated legacy ducts (from A3-341)	CTS	Insight group researched and labeled ducts. Ducts, stacks and fans have been traced & labeled. Fans have been locked out. Documentation on potentially contaminated ductwork is maintained by the RSO (info was also provided on CD during the HSA). Scoping surveys conducted November 2011. Results were below Aptuit release limits.	Inactive	Non-impacted
A building Dock 1 (303)		Radioactive materials were shipped/received at this dock. No uncontained materials handled here. Contaminated mats were found and removed during the scoping survey (October 2011). Area resurveyed after mats were removed. No additional contamination found. Further investigation revealed that mats came from a lab (maybe A3-367) 5-6 years ago. Mats have been stored in Bldg A-East end tornado shelter for several years prior to going to the dock.	Active	Class 3
A Mezzanine (loft)	CTS	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.	Active	Class 3
A building roof	CTS	Assigned to CTS but could be impacted from continuing operations in API. Scoping surveys conducted November 2011. Results were below Aptuit release limits.	Active	Non-impacted
Bldg A-East end tornado shelter 300E	CTS	Contaminated mats were found in Dock 1. These had come from a lab but prior to going in the lab they were stored in the Bldg A-East end tornado shelter. Scoping surveys performed in October 2011 confirmed non-impacted status.	Active	Non-impacted

Area	Owner	Notes	Active - area is in use Inactive - area is not is use Active radio - area is still	Preliminary MARSSIM Classification
B2-103A	SO	C-14, H-3, I-125. Old incinerator room currently used for rad waste accumulation. Incinerator and incinerator stack are still present. There are elevated readings on the refractory lining of the incinerator (probably 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 cm^2 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.	Active radio	Class 2 or 3
B2 API Common	SO	There was a water spill in API that resulted in contamination of carpet tiles in the API cubicle area. Need to review and summarize incident/survey report.	Active	pending
B2-112	SO	HEPA filter room that services B2.	Active radio	pending
B2 API Exhaust	SO	Primary use in B2 API has been C-14. However, H-3 has been used in some hoods. The ventilation system for B2 API is equipped with inlet and exhaust HEPA filters. Exhaust filters have not been changed (as of 10/5/11) since operation began in July 2008. There is measurable activity on the filters per RSO.	Active radio	pending
B2 API Vacuum system	SO	Vacuum system used with rad materials. Cold traps were used between experiment and vacuum system connection but it is possible that system is contaminated.	Active radio	pending
B2 API Drains	SO	Drain disposal not allowed. First rinse of glassware is collected and disposed as rad waste. Soaking bath water is assayed - disposal depends on results.	Active radio	pending
B2-116	SO	Accumulation room for LSC vials & storage of floor monitor. This area will remain active for support of SO demo.	Active radio	pending
B2-117	SO	H-3, C-14. LSC. This area will remain active for support of SO demo.	Active radio	Class 3
B2-119	SO	H-3, C-14. HP office/work area. This lab was decontaminated in 1999 and was deconned and released with the LAR FSS in 2007. Notes for E-119 are actually for this lab. This area will remain active for support of SO demo.	Active radio	Class 3
B2-155	SO	This area is within the "synthesis" footprint that was submitted to the NRC with Amendment 27.	Active radio	Class 1

Area	Owner	Notes	Active - area is in use Inactive - area is not is use Active radio - area is still	Preliminary MARSSIM Classification
B2-156	SO	This area is within the "synthesis" footprint that was submitted to the NRC with Amendment 27.	Active radio	Class 1
B2-157	SO	This area is within the "synthesis" footprint that was submitted to the NRC with Amendment 27.	Active radio	Class 1
B2-158	SO	This area is within the "synthesis" footprint that was submitted to the NRC with Amendment 27.	Active radio	Class 1
B2-159	SO	This area is within the "synthesis" footprint that was submitted to the NRC with Amendment 27.	Active radio	Class 1
B2-161	SO	This area is within the "synthesis" footprint that was submitted to the NRC with Amendment 27.	Active radio	Class 1
B2-162	SO	This area is within the "synthesis" footprint that was submitted to the NRC with Amendment 27.	Active radio	Class 1
B2-163	SO	This area is within the "synthesis" footprint that was submitted to the NRC with Amendment 27. Typical use 2 mCi to 1 Ci of C-14 per John Goehl.	Active radio	Class 1
B2-164	SO	This area is within the "synthesis" footprint that was submitted to the NRC with Amendment 27.	Active radio	Class 1
B2-165	SO	H-3, C-14. Radioanalytical QC work.	Active radio	Class 1
B2-166	SO	H-3, C-14. Radiosynthesis. Typical use 2 mCi to 1 Ci of C-14 (primarily used carbonate or KCN as starting material).	Active radio	Class 1
B2-167	SO	Access/egress	Active radio	Class 1
B2-167A	SO	Room added in access/egress. Room 167 was split so technically the costs are included in the DFP but it is not called out there as a separate area. A simple fix would be to correct the DFP to show 167/167A as the area.	Active radio	Class 1
B2-170	SO	This is the NMR room. It is within the "synthesis" footprint that was submitted to the NRC with Amendment 27. Typical use 2 mCi to 1 Ci of C-14.	Active radio	Class 1
B2-179	NA	Room was numbered wrong. Use area was actually B2-180. It has been corrected in the license and needs to be corrected in the DFP.		Non-impacted
B2-180	CTS	C-14, 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. It has been corrected in the license and needs to be corrected in the DFP. If only I-125 used then FSS will be much simpler. Work with I-125 was completed in February 2010. Everything used for I-125 work (M&E) was moved into B2-181 for storage.	Active	Class 3

Area	Owner	Notes	Active - area is in use Inactive - area is not is use Active radio - area is still	Preliminary MARSSIM Classification
B2-181	CTS	C-14, I-125. Plates set up & counted. If only I-125 used then FSS will be much simpler. 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.	Inactive	Class 3
B2-182	CTS	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).	Active	Class 3
B2-189	CTS	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/refrigerator. C-14 was not used in B2.	Active	Class 3
B2-194	CTS	C-14. Storage of API in low temperature freezer. Last removed in 2006. I-125 was also stored in the freezer.	Active	Class 3
B2-195	CTS	Pipe chase. Vents from B2-119 marked RAM. Added 8/27/10. Amendment 32 (received February 23, 2011) added B2-195 pipe chase to the license.	Inactive	Class 3
B3 labs (250-270)	CTS	These labs were demo'd around 2001 and may not have been used for rad work (per former RSO). 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.	Active	Class 3
B3-268	CTS	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. Drawing RD-103. Former location of the LSC. Shaw performed a characterization survey in B3-268 in 2004 with no contamination found. Shaw surveyed the floor and equipment surfaces in April 2010 (scan, directs, survey 041910-01). No contamination found.	Active	Class 3
B3-268 (F)	CTS	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. Drawing RD-103. This is a walkin freezer where rad materials are stored . The floor was found to be contaminated and it was painted. Floor will need to be replaced or decontaminated. Facilities currently has 3 quotes for replacing the freezer. Rad materials are still stored here.	Active radio	Class 2

Area	Owner	Notes	Active - area is in use Inactive - area is not is use Active radio - area is still	Preliminary MARSSIM Classification
B3-274	CTS	C-14. HPLC & balance located in lab for one project. Both were moved to B2 radiolab. 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. Drawing RD-103. Based on interviews there was an attempt to depost the area (early to mid 2000s), however it could not be deposted due to contamination on the benchtop. There was a spill near prep-HPLC/marble table where balance was located. An email from Pam Barton (5/24/99) regarding false H-3 readings in the lab that never used H-3. 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).	Active	Class 3
B3-275 (cafeteria)	CTS	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.	Active	Class 3
B3-278	CTS	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. Any documentation supporting release of this area? Now part of 274	Active	Class 3
B3-295	CTS	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).	Active	Class 3
B3-297	CTS	Some indication of rad use.	Active	Class 3
B3-298	SO	HPLC & hood used for C-14 project. Spill from HPLC contaminated casework & floor. Drawing RD-103. Currently used for QC work for API (cold work) using HPLC. API use is expected until January. Interviews indicate that rad use was throughout the laboratory with the exception of the glovebox (maybe). A 2007 Shaw survey shows contamination on floor and side of cabinet. Two incidents have been reported in this area.	Active	Class 2
Building B - Dock 5	SO	Shipping/receiving of rad	Active	pending

Area	Owner	Notes	Active - area is in use Inactive - area is not is use Active radio - area is still	Preliminary MARSSIM Classification
B Building Potentially contaminated legacy ducts (from B2-119 and B3-274)	CTS	Insight group researched and labeled ducts. Ducts, stacks and fans have been traced & labeled. Fans have been locked out. Documentation on potentially contaminated ductwork is maintained by the RSO (info was also provided on CD during the HSA). Contamination surveys were performed inside blowers BR-EF23 & BR-EF26. Minor contamination detected (178 dpm H-3, 560 dpm C-14 BR-EF26 and 49 dpm H-3, 62 dpm C-14 BR-EF23). Additional surveys conducted in November 2011 confirm contamination.	Inactive	Will be removed.
B building stacks	SO	The B2 API stack is still operational but the incinerator stack and the old stacks that serviced LAR and micro are still there (inactive and locked out).	Active	Pending
B building roof	SO	See survey 121306-03. Two smears collected on roof (<30 dpm).	Active	Pending
E-119 (See B2-119)	SO	This was referred to as E-119 in the Duratek reports.	Active radio	Class 3
E-205	CTS	Former use of C-14. HPLC & balance moved to B2 radiolab. From multiple interviews the only use was from sampling in a hood (BSC) for 3 projects, the last of which, resulted in contamination of the hood (2004-2005). The hood was moved to rad storage where it is awaiting disposal. No rad work done since then.	Active	Class 3
E 208 (warehouse)	CTS	Several C-14 samples found in warehouse All items in secondary containment. No loose contamination.	Active	Class 3
E-222	CTS	Former use area. 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.	Inactive	Class 3
E-250	CTS	There was a contaminated scale in this area but no other use reported according to interviews.	Active	Class 3
E-253	CTS	Former use. This is a clean room and has undergone numerous (hundreds) of cleanings since use of material. Chances of loose contamination are remote.	Active	Class 3
E-260	CTS	Former use. Use in this area has been called into question.	Active	Class 3 or non-impacted

Area	Owner	Notes	Active - area is in use Inactive - area is not is use Active radio - area is still	Preliminary MARSSIM Classification
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, 143, 148, 150A, 150B, 153, 155, 156, 158, 159, 160, 161, 162, 163, 164, 165, 166, 167, 168, 169, 170, 171	NA	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. Upon final review of the data, all building and work surfaces in LAR met the Aptuit removable contamination release criterion of less than 200 disintegrations per minute per 100 square centimeters (<200 dpm/100 cm2).	NA	NA
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,	NA	L Building was decommissioned and sold. FSSP were conducted as follows: Lab L4-422 - FSSR May 2005; Lab L5-526 – FSSR June 2006; L Building – FSSR January 2007	NA	NA
Rad Waste Storage (The Hill)	SO	Floor in the rad waste storage area is contaminated.	Active	pending
Soil	SO	Baseline sampling has been conducted. Will be investigated as part of SO decommissioning.	NA	pending

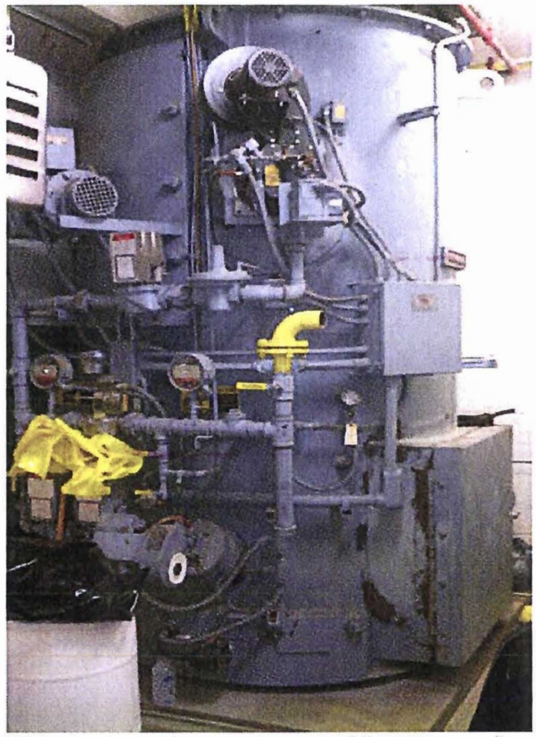
Previously released or not applicable

APPENDIX D

PHOTOGRAPHIC DOCUMENTATION

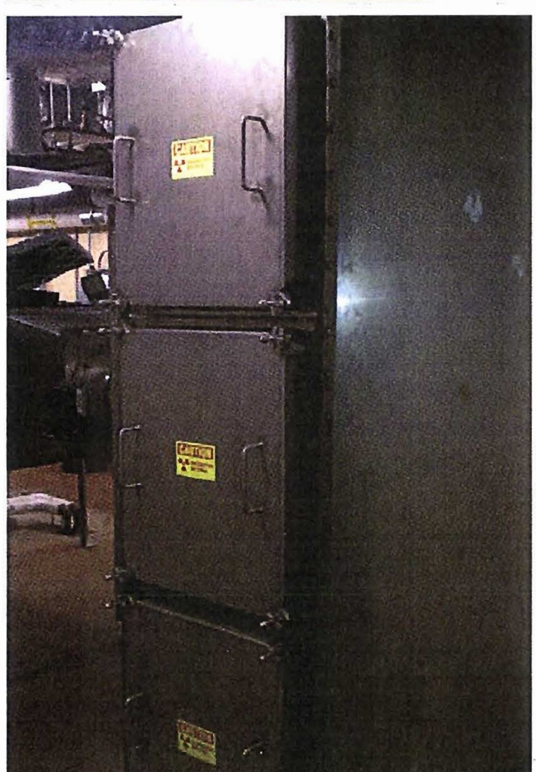
Location: Aptuit KCM
10425 Hickman Mills Drive
Kansas City, MO 64134-0708
Client: Aptuit
Date: 27 September 2011

Shaw Project Number: 144040
Photographer: Zach Peckham



Description: B3-103A incinerator

Photo Number: 1



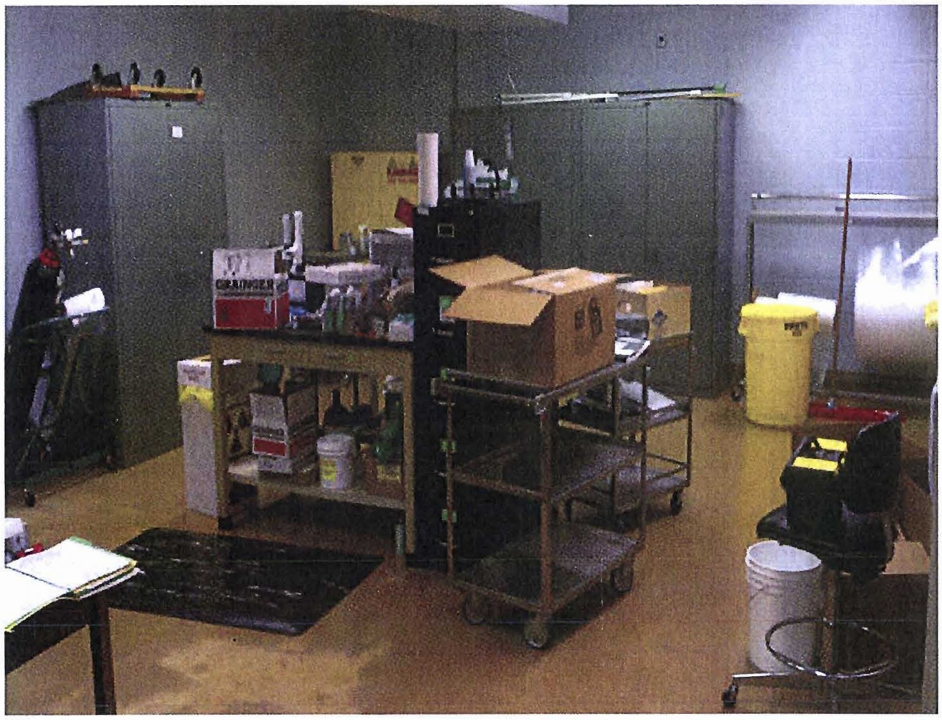
Description: B2-112 HEPA Housing

Photo Number: 2

Photographic Documentation

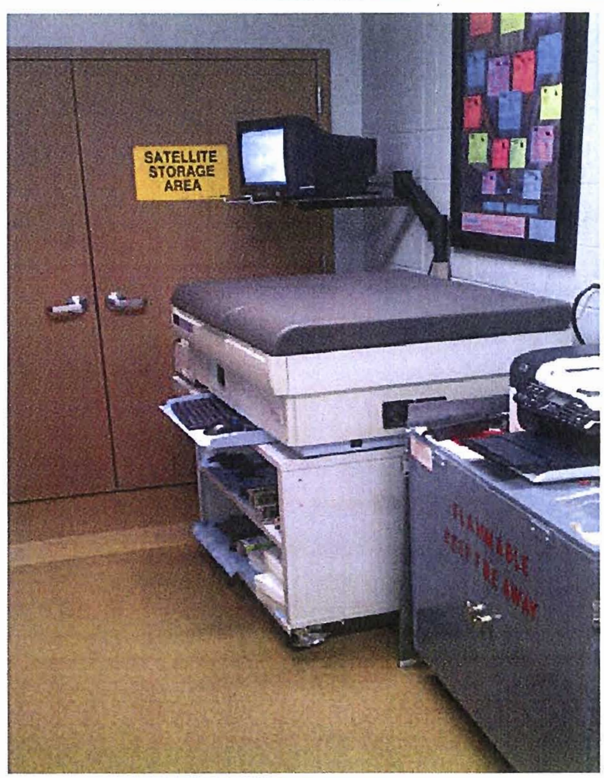
Location: Aptuit KCM
10425 Hickman Mills Drive
Kansas City, MO 64134-0708
Client: Aptuit
Date: 27 September 2011

Shaw Project Number: 144040
Photographer: Zach Peckham



Description: B2-119 – HP Support

Photo Number: 3



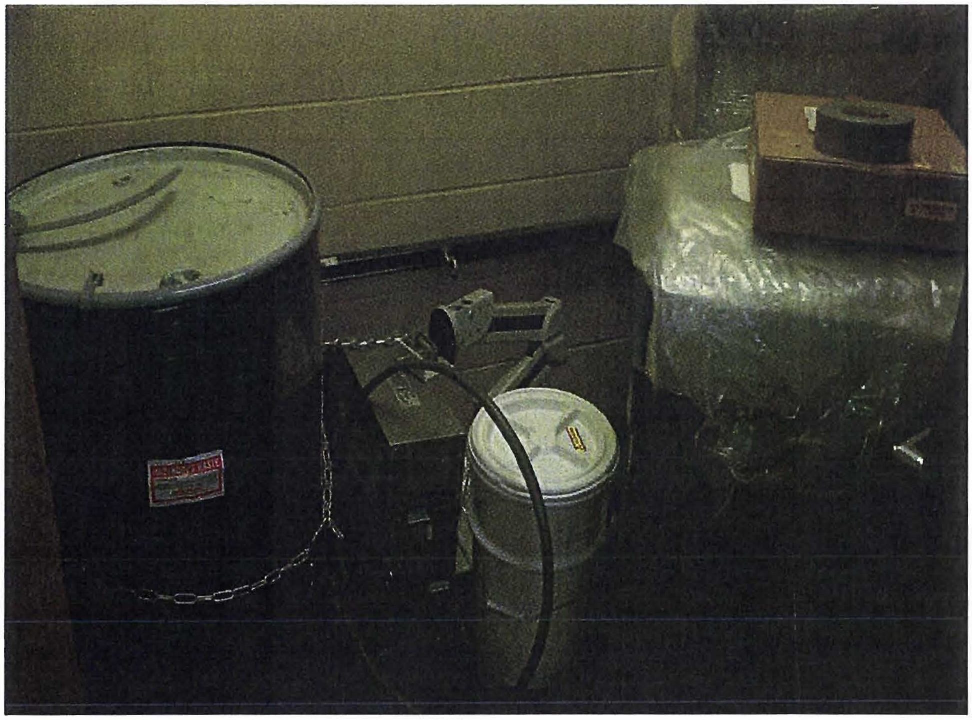
Description: B2-116 - LSC

Photo Number: 4

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: B2-117 – LSC Waste

Photo Number: 5

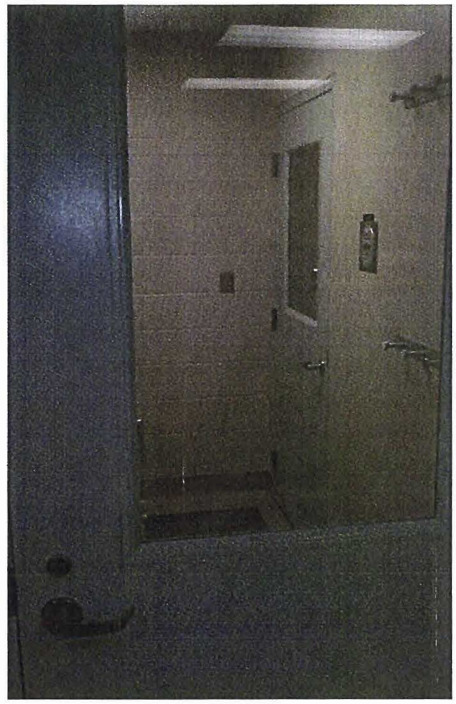
Description: B2 Cubicles

Photo Number: 6

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: B2-167/167A – access/egress

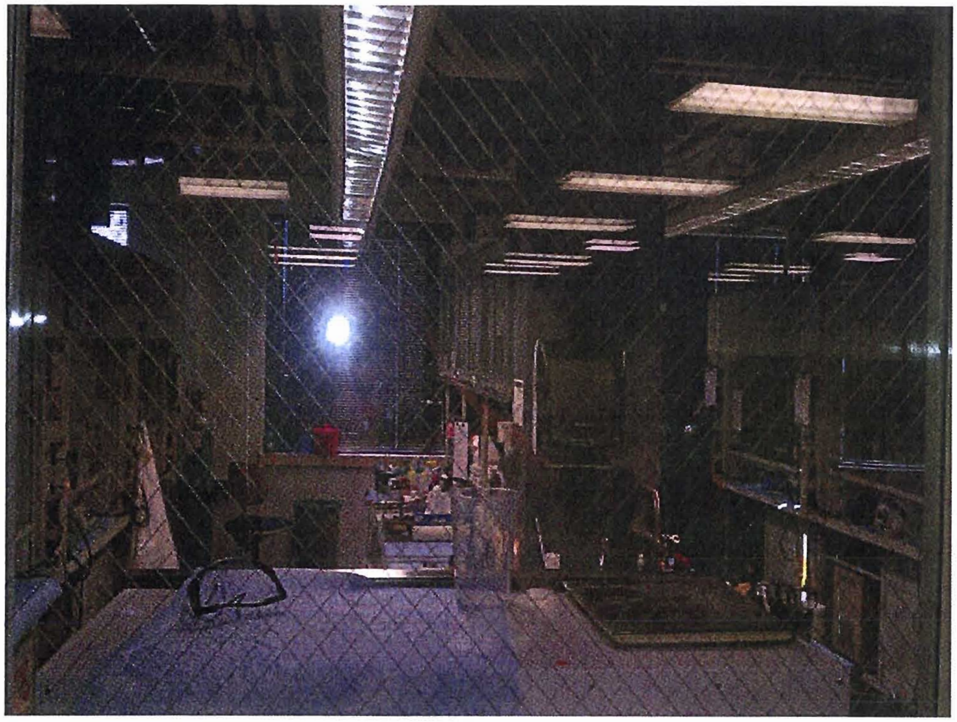
Photo Number: 7

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

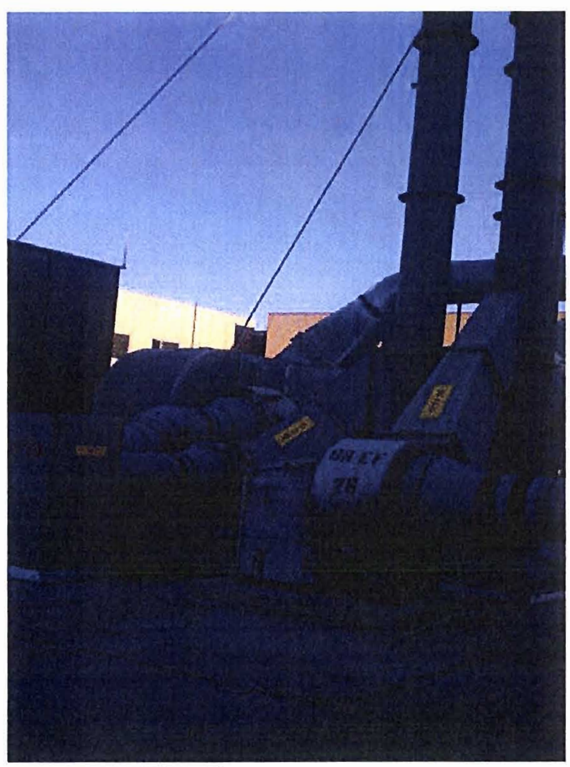
Photo Number: 10

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: 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

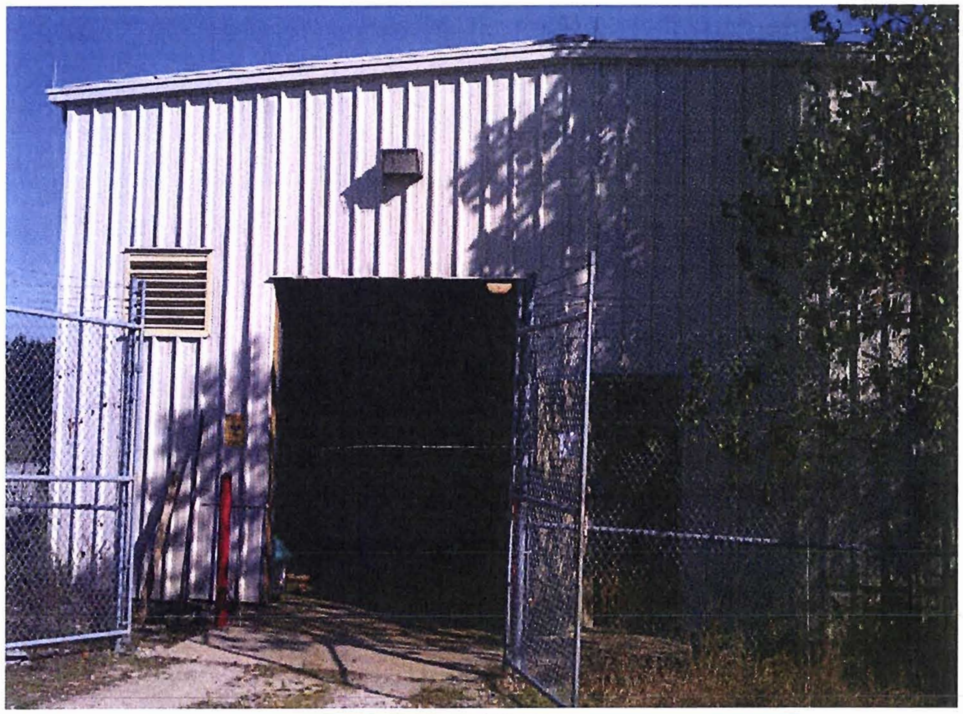
Description: Waste Storage (The Hill) – hazardous waste storage

Photo Number: 14

Photographic Documentation

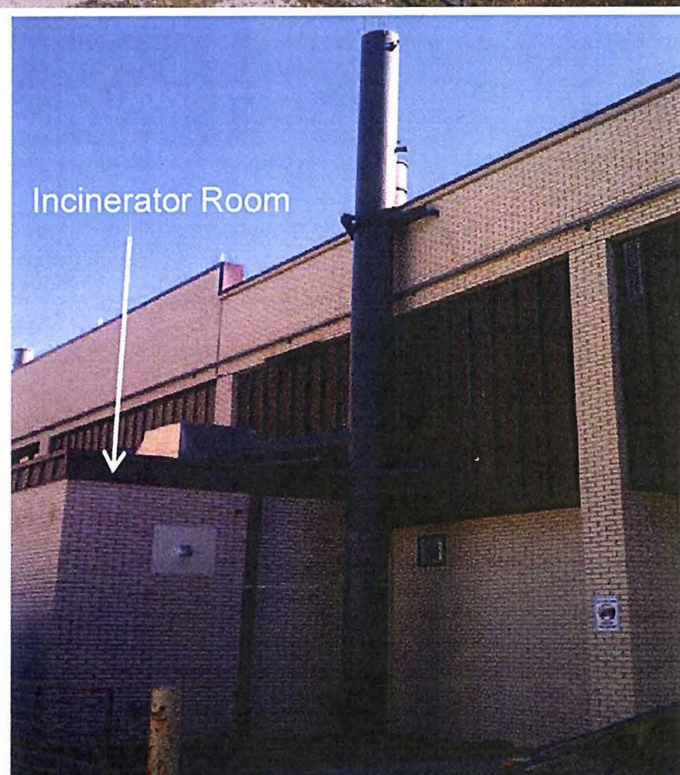
Location: Aptuit KCM
10425 Hickman Mills Drive
Kansas City, MO 64134-0708
Client: Aptuit
Date: 27 September 2011

Shaw Project Number: 144040
Photographer: Zach Peckham



Description: Entrance to Waste Storage (The Hill)

Photo Number: 15



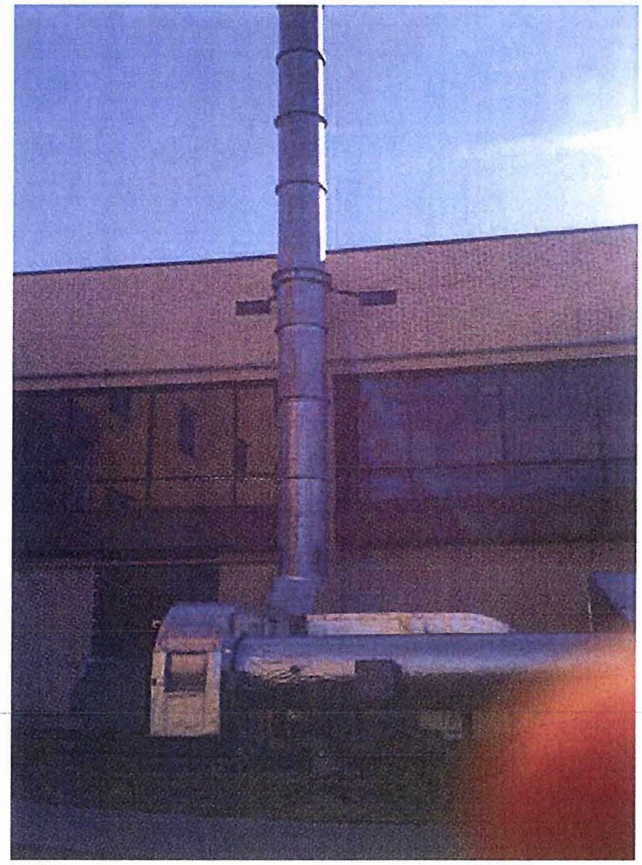
Description: B2-103A – Incinerator stack looking northeast

Photo Number: 16

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: B2 API Stack looking east

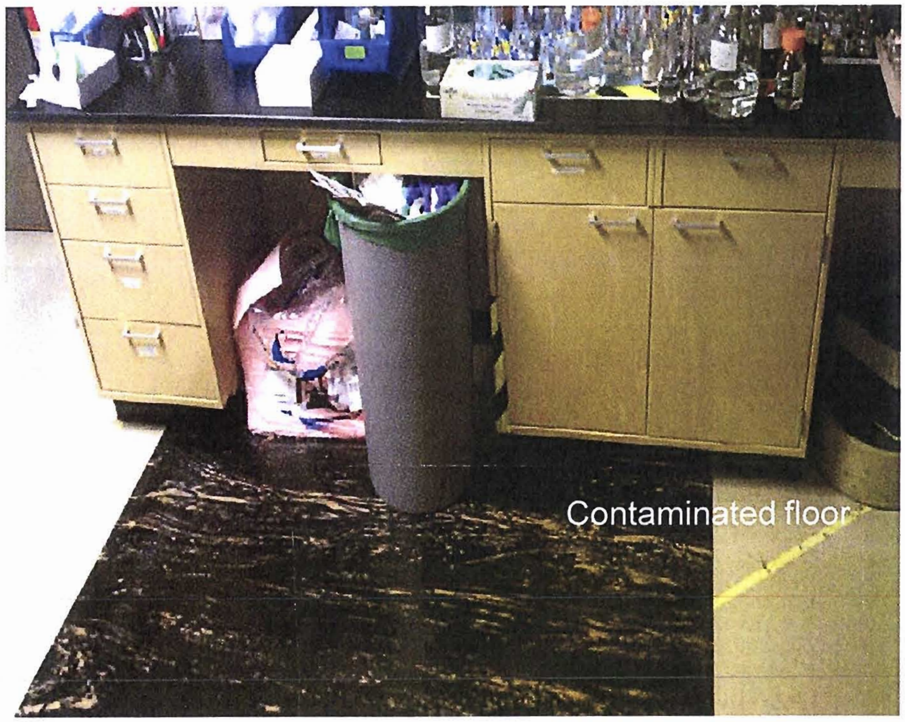
Photo Number: 17

Description: B3-298 lab bench

Photo Number: 18

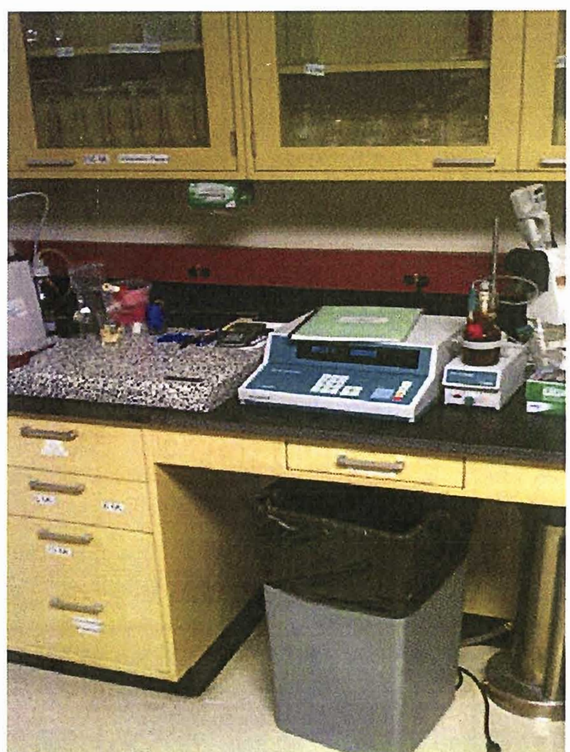
Location: Aptuit KCM
10425 Hickman Mills Drive
Kansas City, MO 64134-0708
Client: Aptuit
Date: 27 September 2011

Shaw Project Number: 144040
Photographer: Zach Peckham



Description: B3-298 lab bench and floor

Photo Number: 19



Description: B3-298 bench

Photo Number: 20

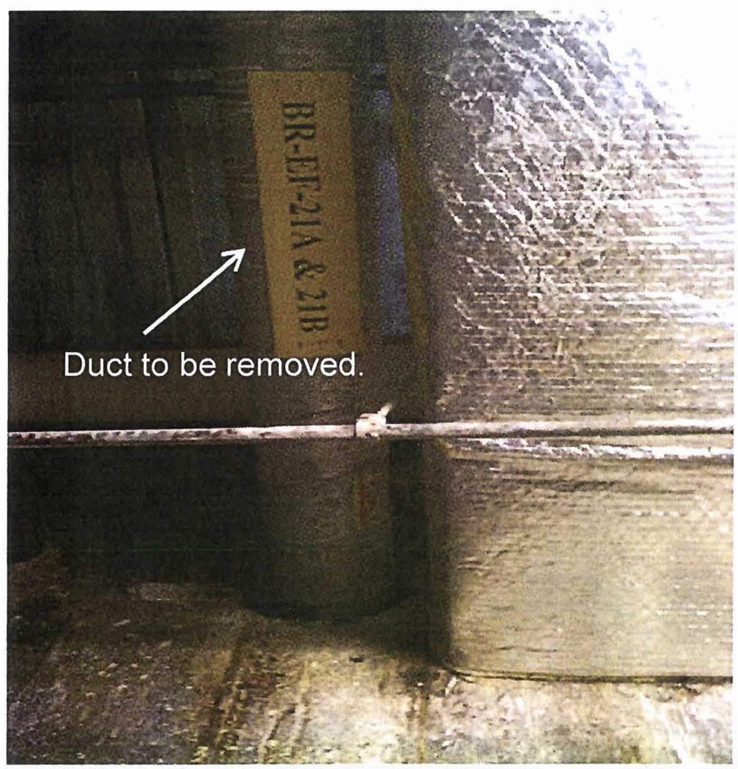
Photographic Documentation

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: Legacy ductwork

Photo Number: 21



Description: Legacy ductwork

Photo Number: 22

APPENDIX E

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 ^3H 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 ^3H 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 ^3H removable contamination was identified). <u>All survey results are below Aptuit's unrestricted release limits.</u>

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). <u>All survey results are below Aptuit's unrestricted release limits.</u>

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 (^3H). 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 (^3H) 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 (^3H) 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 ^3H 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 ^3H 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 (^3H) 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 ^3H 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)

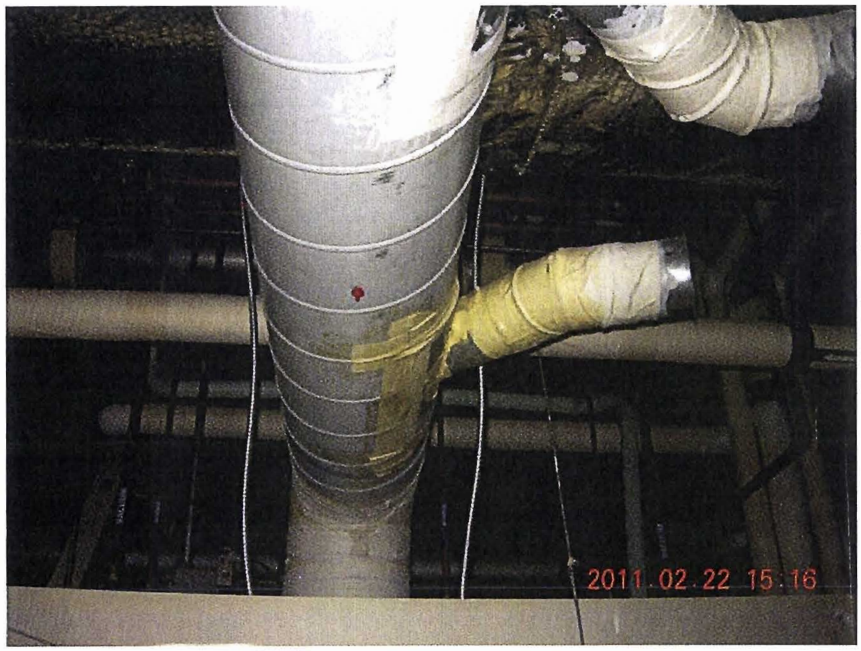
The fans associated with this exhaust line serviced a ventilated balance enclosure that had been utilized for radiological material. This line combines with two non-impacted laboratory hoods before going vertical in B3-274 to the roof. Two samples were collected above the ventilated balance enclosure with no ^{14}C (total) identified, and 26 dpm/100 cm^2 (^{14}C) (No ^3H 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 ^3H 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 ^3H 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.

Photographic Documentation

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

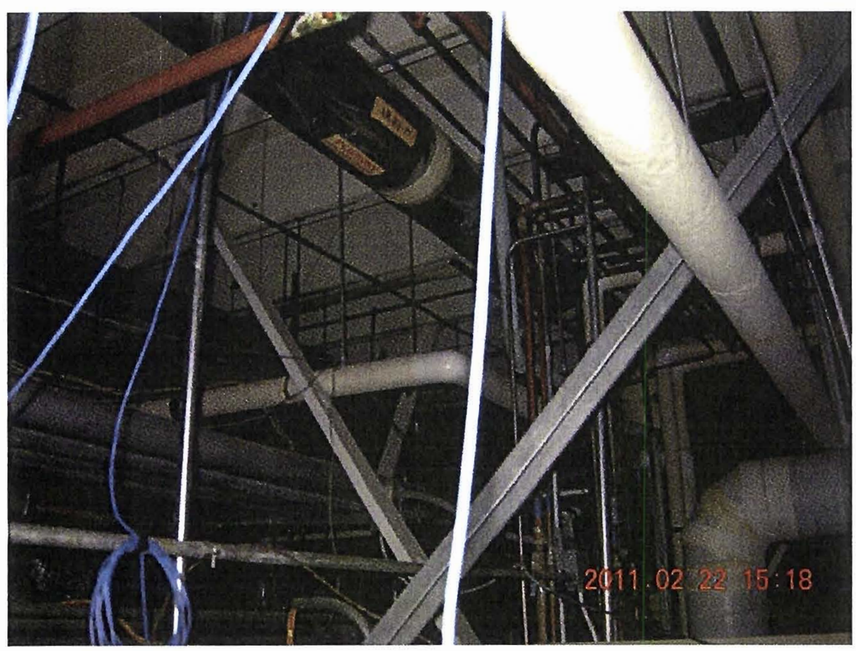
Photo Number: 2

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

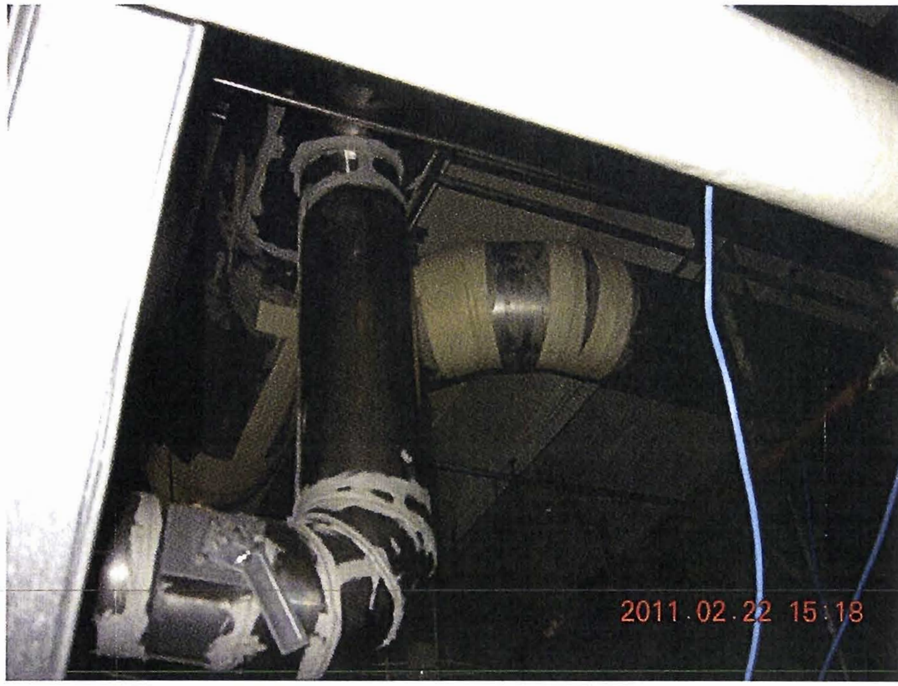


Description: A3-340 & 341 – exhaust system.

Photo Number: 4

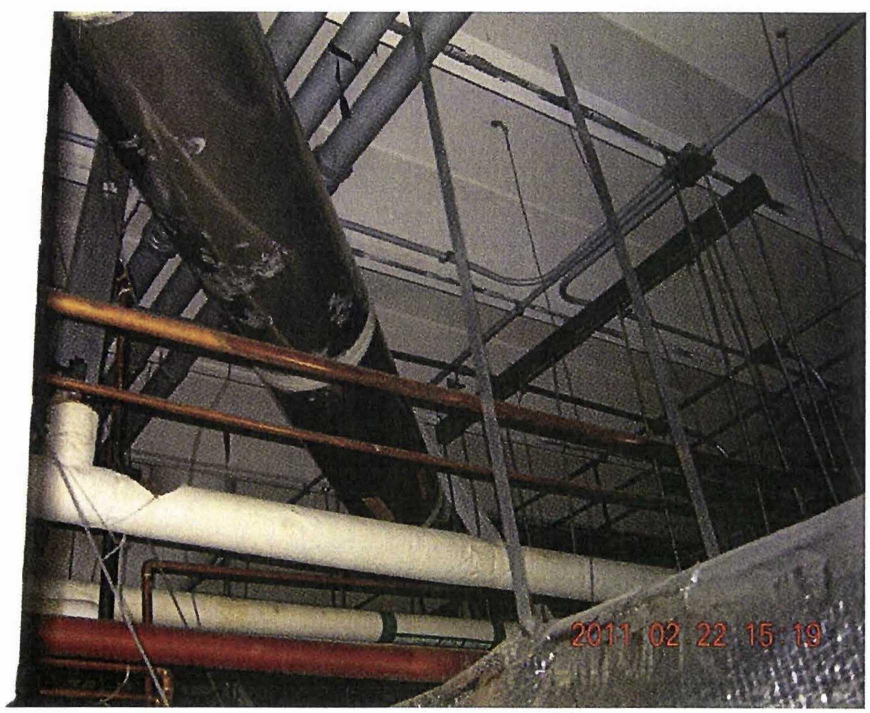
Location: Aptuit KCM
10425 Hickman Mills Drive
Kansas City, MO 64134-0708
Client: Aptuit

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

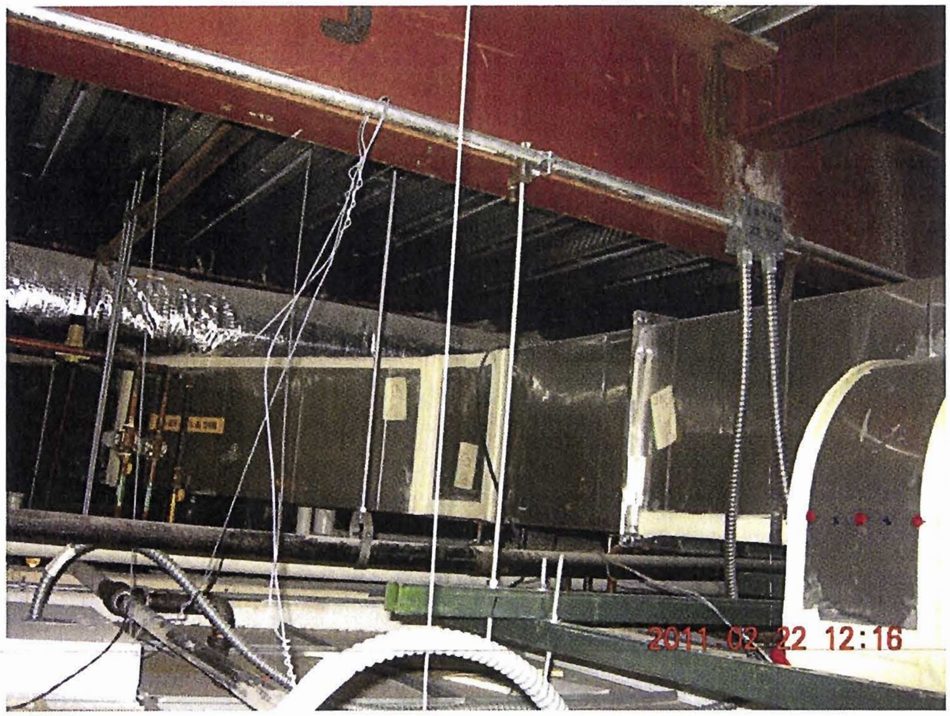
Photo Number: 2

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

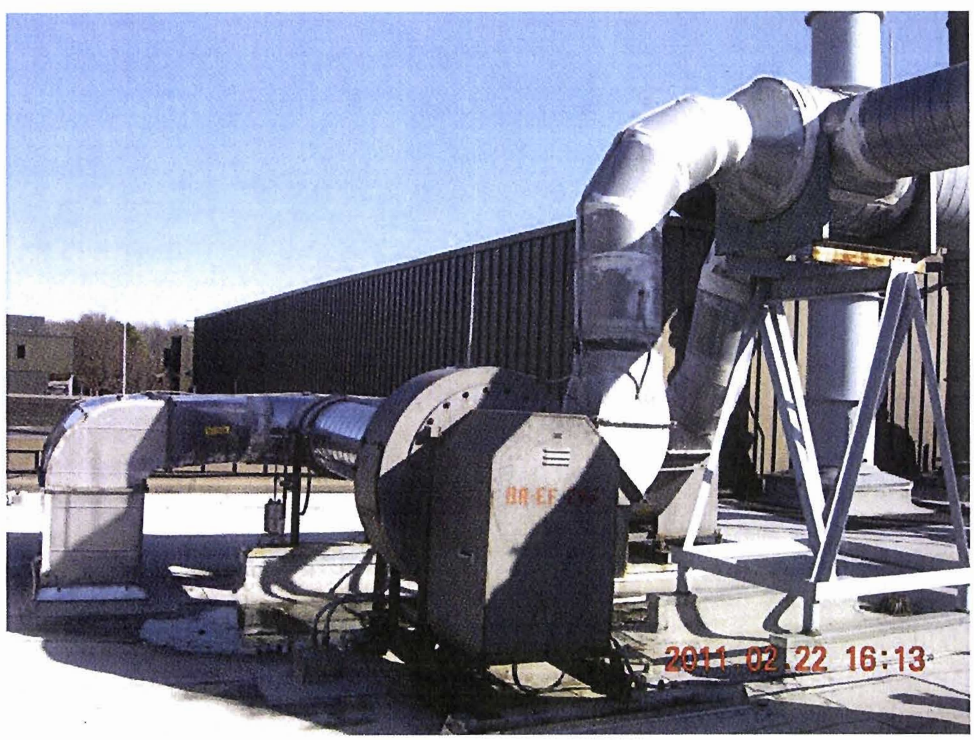
Photo Number: 5

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

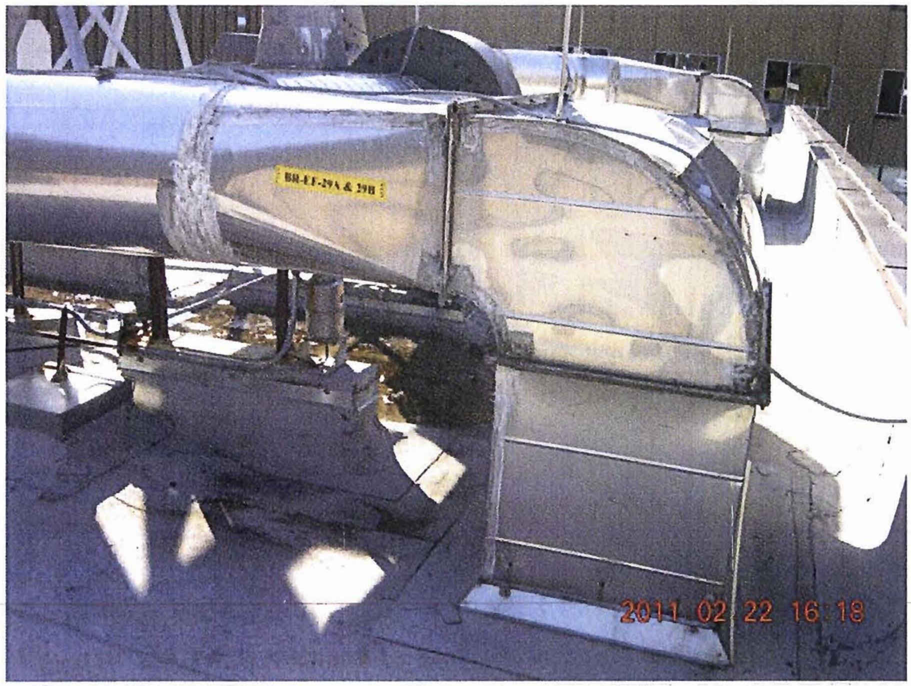


Description: B2-189

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

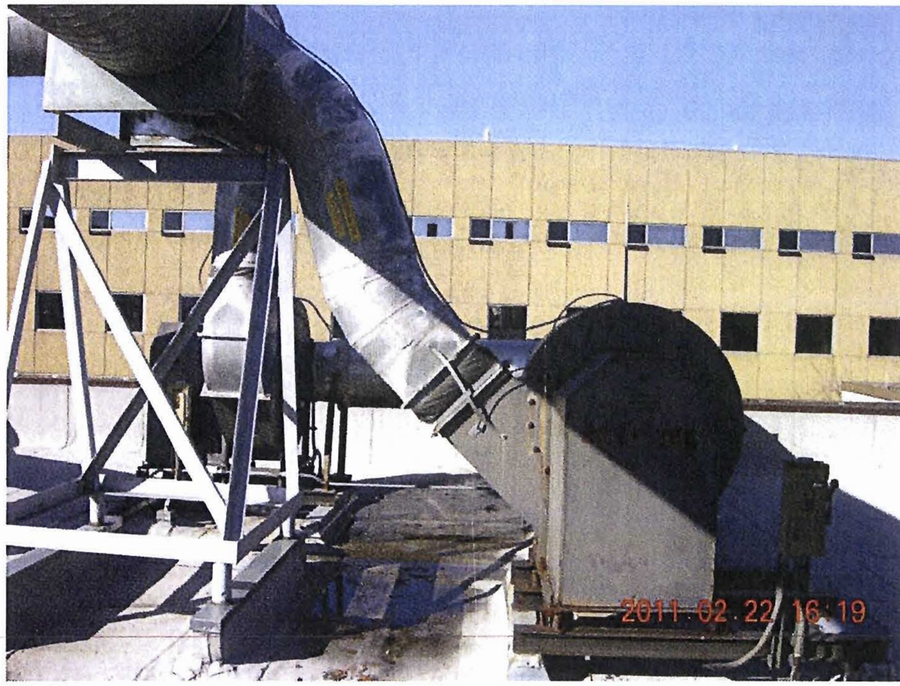
Photo Number: 8

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

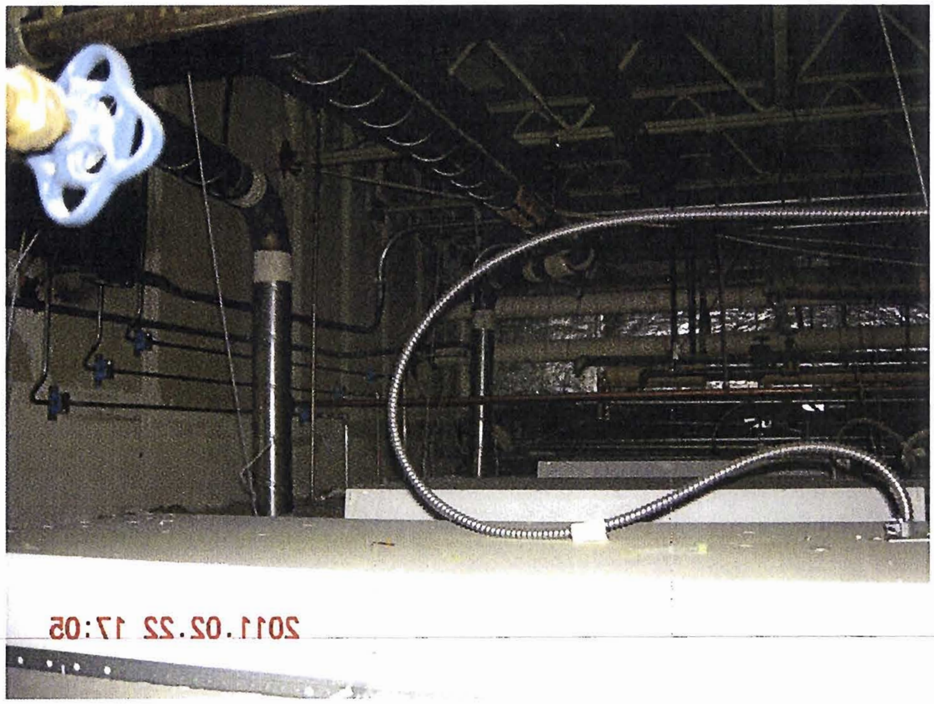
Photo Number: 10

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

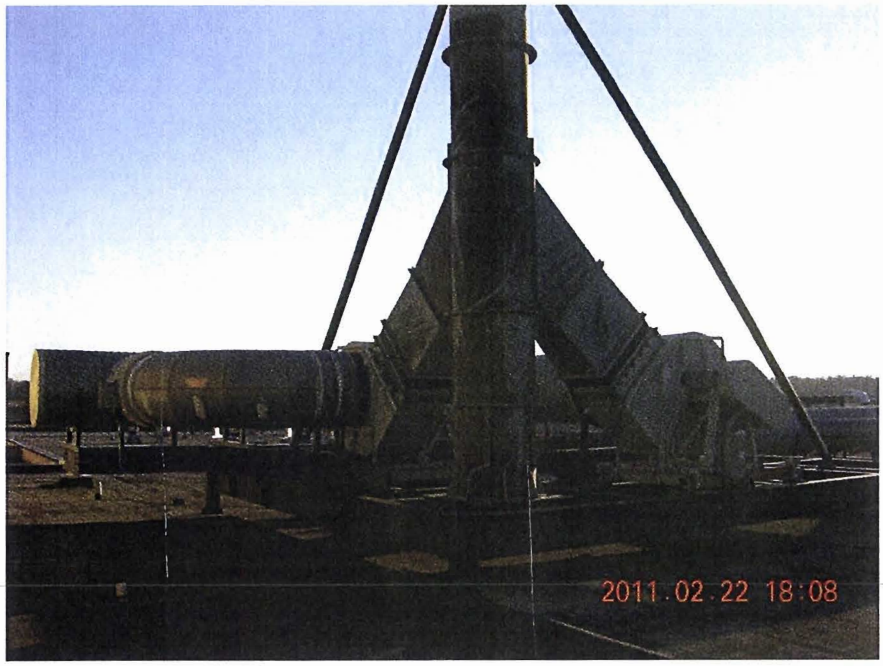
Photo Number: 5

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

Photographic Documentation

Location: Aptuit KCM
10425 Hickman Mills Drive
Kansas City, MO 64134-0708
Client: Aptuit

Shaw Project Number: 144039
Photographer: : Aptuit

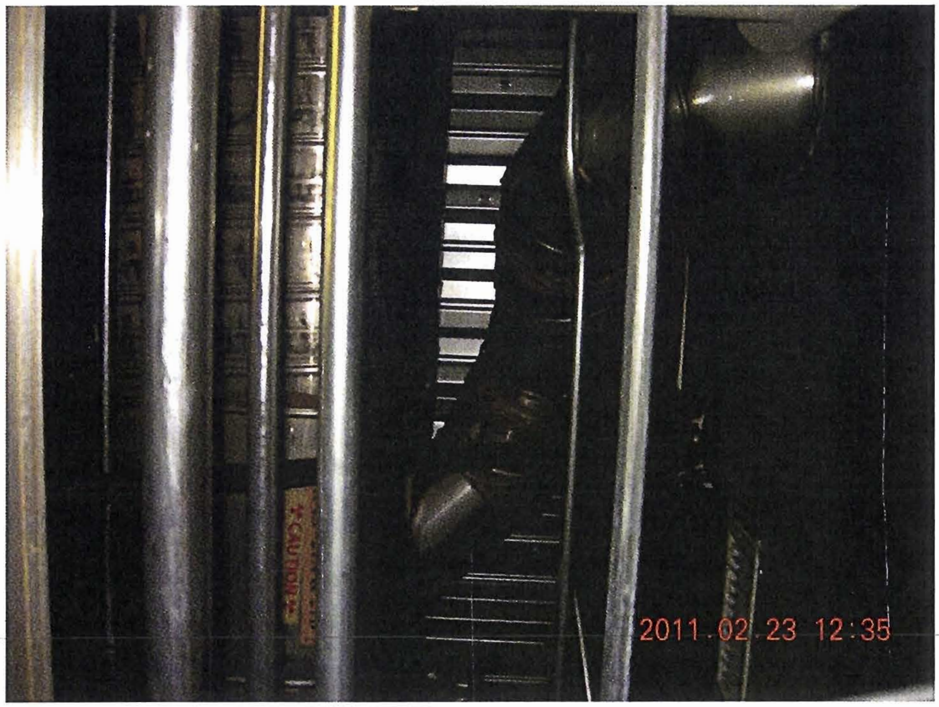


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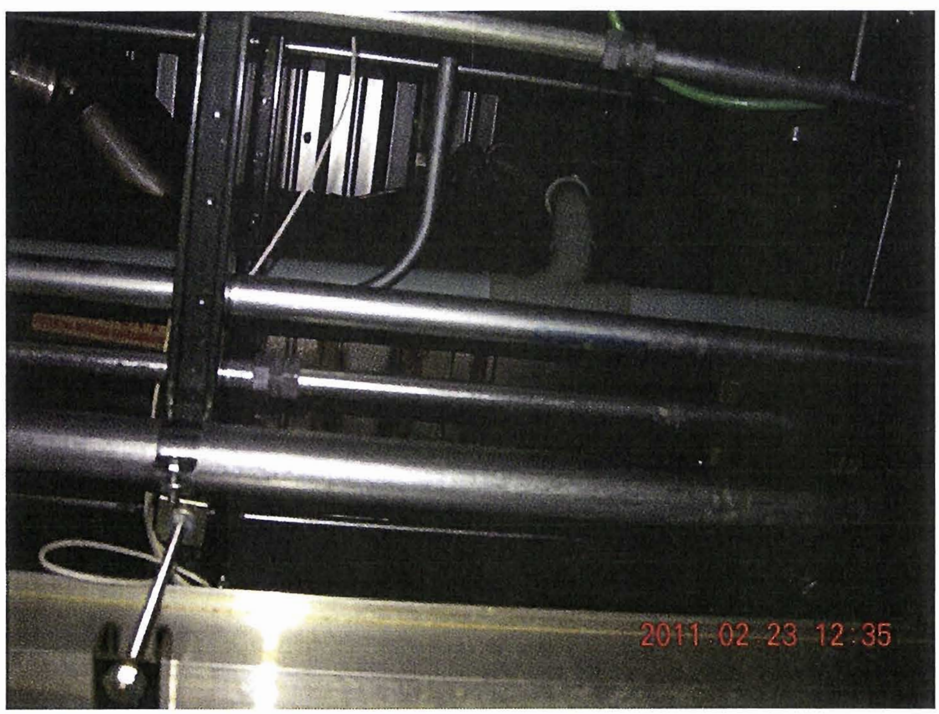
Photo Number: 2



Description: B3-298

Photo Number: 3

APPENDIX F

SURVEY FORMS

Contamination / Radiation Survey Report

CONTAMINATION / RADIATION SURVEY REPORT	PROJECT NUMBER	DATE:	TIME START:	TIME COMPLETE	PAGE _____ OF _____
LOCATION	SURVEYOR:				
	SURVEY NUMBER				
	MAP ID:				

ACCEPTABLE SURFACE CONTAMINATION LEVELS

Loose ________ dpm/100cm² Alpha ________ dpm/100cm² Beta-Gamma

Total ________ dpm/100cm² Alpha ________ dpm/100cm² Beta-Gamma

Source Check Data	Contamination Surveys				Radiation Surveys
	α (LOOSE)	α (TOTAL)	β-γ (LOOSE)	β-γ (TOTAL)	Beta-Gamma
Instrument					
Source Type and I.D.					
Source Strength in dpm					μCi
Efficiency					
MDA in dpm/100 cm²					Sat. ☐ Unsat. ☐
Background in cpm					mrem/hr or μrem/hr

REASON FOR SURVEY
☐ PROCEDURE NO. ____________________
☐ SPECIAL ____________________
☐ ROUTINE ____________________

Contamination ☐ By Shift ☐ Daily ☐ Weekly ☐ Monthly ☐

Radiation ☐ By Shift ☐ Daily ☐ Weekly ☐ Monthly ☐

COMMENTS:

Contamination Survey INSTRUMENT / SERIAL #	ALPHA (LOOSE) /	BETA-GAMMA (LOOSE) /
	ALPHA (TOTAL) /	BETA-GAMMA (TOTAL) /
Radiation Survey INSTRUMENT / SERIAL #	BETA-GAMMA /	BETA-GAMMA /

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

	Alpha		Beta-Gamma		Beta-Gamma ☐ mrem/hr ☐ micro rem/hr ☐ Beta mrads/hr ☐	Item or Location
	Loose	Total	Loose	Total		
Item #	dpm/ 100cm²	dpm/ 100cm²	dpm/ 100cm²	dpm/ 100cm²		
1						
2						
3						
4						
5						
6						
7						
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25						

RCS REVIEW ____________________ DATE ________

Contamination / Radiation Survey Report

CONTAMINATION / RADIATION SURVEY REPORT (CONTINUATION SHEET)		PROJECT NUMBER:	DATE	PAGE ______ OF ______
LOCATION:	SURVEYOR	COMMENTS:		
	SURVEY NUMBER:			
	MAP ID:			
RCS REVIEW ____________________ DATE __________				

	Alpha		Beta-Gamma		Beta-Gamma ☐ mrem/hr ☐ microrem/hr ☐ Bet mrads/hr ☐	Item or Location		Alpha		Beta-Gamma		Beta-Gamma ☐ mrem/hr ☐ micro rem/hr ☐ Beta mrads/hr ☐	Item or Location
	LOOSE	TOTAL	LOOSE	TOTAL				LOOSE	TOTAL	LOOSE	TOTAL		
Item #	dpm/ 100cm²	dpm/ 100cm²	dpm/ 100cm²	dpm/ 100cm²			Item #	dpm/ 100cm²	dpm/ 100cm²	dpm/ 100cm²	dpm/ 100cm²		

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

Contamination / Radiation Survey Report

PROJECT NUMBER:	ACTIVITY / LOCATION:			PAGE OF
COMMENTS:	SURVEYOR:	SURVEY NUMBER:	DATE:	
	NOTE: THE KNOWING AND WILLFUL RECORDING OF FALSE, FICTITIOUS, OR FRAUDULENT STATEMENTS OR ENTRIES ON THIS DOCUMENT MAY BE PUNISHABLE AS A FELONY UNDER FEDERAL STATUTES.			
RCS REVIEW: DATE:				