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

Prepared for:

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

aptuit

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. Stampkowski

Tony Stempkowski Primary Author

ene Rick Greene, CHP

Project Health Physicist

Clinton Gregg Aptuit Radiation Safety Officer

Nav Marcello DiMare

Aptuit Decommissioning Project Manager

January 13, 2012 Date

January 13, 2012 Date

13 Jan Zoiz

Date

130AN 2012 Date

Table of Contents

Page

List of Tables iv					
List of Figuresiv					
Acr	onym	s and Abl	breviationsv		
Def	initio	ns	vii		
Exe	Executive SummaryES-1				
1.0	Intro	oduction.	oduction1-1		
	1.1	Scope and Purpose			
1.2 Operational and License History		onal and License History 1-2			
		1.2.1	License Number and Authorized Activities1-2		
		1.2.2	License History 1-2		
		1.2.3	Previous Investigations and Decommissioning Activities1-3		
			1.2.3.1 GTS Duratek, Inc., 19991-3		
			1.2.3.2 Shaw, 20051-4		
			1.2.3.3 L Building and Lab Animal Resources Historical		
			Site Assessment, 2006 1-4		
			1.2.3.4 Final Status Surveys1-5		
		1.2.4	Incidents/Spills1-5		
	1.3	Facility	Description1-7		
		1.3.1	Site Location and Description1-7		
		1.3.2	Radiological Status of Facility1-9		
			1.3.2.1 B Building Structures, Equipment, and Systems		
			1.3.2.2 Waste Storage Building 1-13		
			1.3.2.3 Surface Soil		
			1.3.2.4 Surface Water and Groundwater		
	1.4	Financi	al Assurance		
		1.4.1	Cost Estimate 1-14		
		1.4.2	Financial Mechanism1-14		
	1.5	Plan Or	ganization1-14		
2.0	Proj	oject Management and Organization			
	2.1	Facility	Radiological Controls Organization		
		2.1.1	Radiation Oversight Committee		
		2.1.2	Radiation Safety Officer		

Table of Contents (continued)_____

Page

	2.2	Task Organization		
3.0	Dec	commissioning Activities		
	3.1	Unrestricted Release Using Screening Criteria		
	3.2	Decom	missioning Field Activities	
		3.2.1	Decommissioning Preparation Activities	
		3.2.2	Materials and Equipment	
		3.2.3	Briefing Requirements	
		3.2.4	Storage Cabinets and Freezers	
		3.2.5	Wall Cabinetry	
		3.2.6	Bench tops and Tables	
		3.2.7	Sink Trap and Strainer Removal	
		3.2.8	Vacuum Line Removal	
		3.2.9	Chemical Fume Hood Removal	
		3.2.10	Exhaust Ductwork Removal	
		3.2.11	Exterior and Rooftop Exhaust Components	
		3.2.12	Incinerator Removal	
		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	
4.0	Radiation Health and Safety Program		alth and Safety Program	
	4.1	Assessment of Radiation Hazards		
	4.2	Radiatio	on Safety Controls and Monitoring for Workers	
		4.2.1	Workplace Air Sampling and Respiratory Protection	
		4.2.2	Internal Exposure Determination	
		4.2.3	Contamination Control Program	
		4.2.4	Instrumentation Program	
	4.3	ALARA	A Program	
	4.4	Training	g	
	4.5	Health I	Physics Audits and Record-Keeping Program	
		4.5.1	Health Physics Audits	
		4.5.2	Record-Keeping Program	

Table of Contents (continued)_

Page

5.0	> Field Data Collections			
	5.1	Facility Radiation Survey		
		5.1.1	Survey Protocols	
		5.1.2	Equipment and Materials	
		5.1.3	Scan Surveys	
		5.1.4	Direct Measurements (Static Counts)	
		5.1.5	Wipe Surveys	
		5.1.6	Final Status Surveys	
	5.2	Docum	entation and Record Keeping5-4	
5.3 Data Quality Assurance		ality Assurance		
		5.3.1	Instrument Calibration and Frequency 5-4	
		5.3.2	Field and Laboratory Calibration Records	
6.0	Was	ste Manag	gement	
	6.1	Remedi	ation-Derived Waste6-1	
		6.1.1	Asbestos-Containing Material6-2	
		6.1.2	Sink Traps and Associated Wastes	
		6.1.3	Radioactive Waste	
			6.1.3.1 Solid Radiological Waste	
			6.1.3.2 Liquid Radiological Waste	
			6.1.3.3 Mixed Waste	
7.0	Fina	l Status F	Report Development	
8.0	Refe	erences		
Tables				
Figures				
Appendix A – Radioactive Materials License				
Appendix B – Incident Reports				
Appendix C – Historical Radioactive Material Use and Storage Areas				
Appendix D – Photographic Documentation				
Appendix E – Ductwork Report				
Appendix F – Survey Forms				

iii

List of Tables

Table	Title	Follows Tab
ES-1	Crosswalk of the Decommissioning Plan against NUREG-175 Appendix D, Decommissioning Plan Checklist	57, Vol. 1, Rev.2,
1-1	Overview of Materials License No. 24-15595-01 and Amendr	nents
1-2	Aptuit Acceptable Surface Contamination Levels	
1-3	Summary of API Scoping Survey	
4-1	General Guidelines for Internal Dose Monitoring	
4-2	Instrumentation for D&D Activities	

List of Figures_

Figure	Title	Follows Tab
1-1	Aptuit Facility Site Drawing	
1-2	Location of Spill, B Building B2	
1-3	Location of Spill, B Building B3	
1-4	Areas of Potential Concern, B Building B2	
1-5	Areas of Potential Concern, B Building B3	
1-6	Areas of Potential Concern, North Hill Staging Building	
1-7	Legacy Ductwork of Potential Concern, B Building B2	
1-8	Legacy Ductwork of Potential Concern, B Building B3	
1-9	API Exhaust Systems of Potential Concern	
1-10	B Roof Exhaust Systems of Potential Concern	
2-1	Aptuit Decommissioning Organization Chart	
3-1	Aptuit SO Decommissioning Fieldwork Schedule	

iv

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

v

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
Ή	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 ³H or ¹⁴C 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 cm².

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.

xi

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 (³H) and carbon-14 (¹⁴C). These preliminary DCGLs are 3.7E5 disintegrations per minute (dpm)/100 square centimeters (cm²) for ¹⁴C total contamination and 3.7E4 dpm/100 cm² for removable contamination for ³H and ¹⁴C 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.

ES-2

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 ³H and ¹⁴C, 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 (³H) and carbon-14 (¹⁴C) 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 ³H, ¹⁴C, and iodine-125 (¹²⁵I).

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 ³H and nickel-63 (⁶³Ni) detector cells for use in chromatographs. By 1980, ⁶³Ni had been eliminated from the License, but the list of radionuclides that could be possessed had grown to seven: ¹⁴C, ³H, phosphorus-32 (³²P), sulfur-35 (³⁵S), ¹²⁵I, iodine-131 (¹³¹I), and cesium-137 (¹³⁷Cs). With the exception of ¹³⁷Cs, 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. ¹³⁷Cs was limited to sealed sources used for calibration. As time passed, ¹³⁷Cs and ³²P were eliminated from the License. Calcium-45 was added and later deleted. Until 2008, the primary use was microcurie to mCi quantities of ³H and ¹⁴C. Currently, the License allows the possession of ³H, ¹⁴C, ³⁵S, and ¹²⁵I 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 ¹³⁷Cs 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 ⁶³Ni 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 ³H and ¹⁴C and authorized synthesis of radiolabeled organic compounds. License limits for ³H and ¹⁴C were increased from 1 and 2 Ci, respectively, to 100 Ci for each. The license limit for ³⁵S was also increased from 70 mCi to 1.5 Ci, although ³⁵S 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 ¹⁴C and ³H. 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 (cm²) was used for 14 C while a flag limit for total removable activity was set at 200 dpm/100 cm² for 3 H and 14 C combined.

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

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

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 cm² for ³H and ¹⁴C. 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 (¹⁴C 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 cm² for total activity and 3.7E+04 dpm/100 cm² 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 ³H and ¹⁴C. 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 cm² for total contamination and 3.7E+05 dpm/100 cm² 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 ³H and ¹⁴C. 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 ³H and ¹⁴C. 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 cm² for total contamination and 3.7E+04 dpm/100 cm² 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 ¹⁴C 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 cm².

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 ¹⁴C and ³H 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 ¹⁴C 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 (ft²).

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 ft² in A Building, 16,940 ft² in B Building, and 9,200 ft² in E Building, for a total potentially impacted area of 38,300 ft². 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 ¹⁴C, ³H, and ¹²⁵I have been used in recent years. The last use of ¹²⁵I occurred in February 2010 and occurred in a CTS laboratory. The low activity used plus the short half-life of ¹²⁵I effectively removed it from consideration as a radionuclide of concern¹.

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

¹ The site inventory of ¹²⁵I in January 2010 was 0.03 mCi. ¹²⁵I has a 60 day half-life. There have been no additions to the inventory or any uses of ¹²⁵I 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 ⁶³Ni and ¹³⁷Cs have only been used in sealed sources, not in open form. Leak tests indicate that the sources have remained intact. Therefore, ⁶³Ni and ¹³⁷Cs can be eliminated as radionuclides of concern.

The remaining two radionuclides (³H and ¹⁴C) 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 cm² total ¹⁴C, 2,350 dpm/100 cm² removable ¹⁴C, and 130 dpm/100 cm² removable ³H. Total ¹⁴C activity measured throughout the systems was generally less than 10,000 dpm/100 cm², with removable ¹⁴C and ³H activity generally less than 1,000 dpm/100 cm² and 100 dpm/100 cm², 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 cm² total activity and 1,000 dpm/100 cm² removable activity (see Table 1-2).

Incinerator (B2-103A). Radioactive waste containing ³H and ¹⁴C 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 cm² 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 cm². 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 cm² total activity and 1,000 dpm/100 cm² 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 ³H and ¹⁴C surface contamination throughout the laboratory, but it is generally maintained below 2,000 dpm/100 cm² 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 ¹⁴C contamination levels (direct measurements) of 7.4E5 dpm/100 cm² and 1.2E5 dpm/100 cm² were found on internal hood surfaces and in sinks, respectively. The highest average removable levels of ³H and ¹⁴C, 7.2E3 dpm/100 cm² and 4.8E4 dpm/100 cm², respectively, were found on internal hood surfaces. Similar removable contamination levels were found in the sinks.

Average ¹⁴C 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 ¹⁴C contamination levels below Aptuit's limits.

Average removable ³H contamination levels on hood surfaces, sinks, and overhead areas exceeded the Aptuit acceptable surface contamination level. Average removable ¹⁴C 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 ³H and ¹⁴C 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 ¹⁴Ccontamination or the further spread of contamination on a lab bench and a section of the floor. Contamination levels of 100,000 dpm/100 cm² were noted from the first spill. The second incident was a release of water into the contaminated area, which resulted in removable contamination levels of up to 8,000 dpm/100 cm². These areas are marked as contaminated, and

there is no known contamination outside of these areas. 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 cm² for removable ³H and ¹⁴C. 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 ¹⁴C.

All ¹⁴C 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.

KN12\Aptuit\DP\Final\F-SO DP.docx\1/13/2012 12:58 PM

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 R\$O 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.

KN12\Aptuit\DP\Final\F-SO DP.docx\1/13/2012 12:58 PM

2-2

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, ³H and ¹⁴C. The screening value for ³H is 1.2E8 dpm/100 cm², and for ¹⁴C, the screening value is 3.7E6 dpm/100 cm². 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. ³H 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 cm², 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 ¹⁴C screening value, or 3.7E+05 dpm/100 cm². 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 cm², is the recommended DCGL for removable activity (³H and ¹⁴C combined).

These DCGLs, $3.7E+05 \text{ dpm}/100 \text{ cm}^2$ for total activity and $3.7E+04 \text{ dpm}/100 \text{ cm}^2$ for removable activity ³H and ¹⁴C 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 nonmercury, 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 noncontaminated 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 ³/₄" 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 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)				
١	'ear	³ H	¹⁴ C	
2	008	0	0.1	
2	009	0.1	0.35	
2	010	0.3	0.08	
2	011	0.6	.04	
T	otal	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 ³H and ¹⁴C. ¹⁴C has ALIs for the chemical forms of carbon monoxide, carbon dioxide, and carbon compounds. The most conservative ALI for ¹⁴C 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 Н	¹⁴ C			
Inventory (Ci) in exhaust system, Q	1.0	0.57			
Potential intake, $I_p (I_p = Q \times 10^{-6})$	1E-6	5.7 E-07			
ALI (Ci)	8E-2	2E-03			
Fraction of ALI, f _{ALI} (I _p /ALI)	1.25E-5	2.85E-04			
Maximum potential dose, D (mrem) (D=f _{ALI} 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 ³H and ¹⁴C 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 ³H and ¹⁴C is by urinalysis. Scheduling of bioassay tests will be coordinated through the RSO. In addition, appropriate bioassay may be performed whenever an internal exposure to radioactive materials is suspected.

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

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 ³H and ¹⁴C 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

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 (³H and ¹⁴C) and total contamination (¹⁴C).

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.

5-2

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 ³H and ¹⁴C 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 cm² (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.

ţ

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 ³H and ¹⁴C, Figure of Merit (E^2/B) and Chi-squared values for both ³H and ¹⁴C. IPA is performed using ¹⁴C and ³H quenched standards and a background standard. Instrument operation must be within pre-established limits. For FSS samples, quality control samples consisting of background and ³H/¹⁴C spikes will be counted with each LSC sample batch. Relative bias will be determined by comparing the results obtained from the ³H/¹⁴C 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:

6-1

- 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 ³H and ¹⁴C. All radionuclide results will be reviewed by the RSO prior to disposition of wastes.
- The removed sink traps and fittings will be monitored for mercury vapor and radioactive contamination. If neither is detected, the sections will disposed of as non-regulated construction debris. Any sections with positive indication of mercury contamination will be segregated and managed as hazardous waste. Additionally, pipe sections with radiological contamination exceeding release criteria in addition to the mercury contamination will be managed as mixed waste. Trap sections with no mercury contamination that exceed radiological release criteria will be managed as radioactive waste.

6.1.3 Radioactive Waste

All known or suspected radioactive waste will be packaged and labeled at the point of generation. Prior to packaging, all required survey data will be obtained to support proper management and characterization for impending disposition. All radioactive material will be handled and managed in accordance with Aptuit's radioactive materials license.

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

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 ¢ontain 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 FS\$R 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.

7-1

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. _

KN12\Aptuit\DP\Final\F-SO DP.docx\1/13/2012 12:58 PM

8.0 References

Aptuit, 2011, Radiation Safety Program Manual, June

Barton, Pam, 2011, email summarizing telephone conservation with Kevin Null of the NRC where he indicated that a DP was not needed for CTS facilities.

GTS Duratek, Inc. (Duratek), 1999a, *Survey Report for Hoechst Marion Roussel, Inc.*, Revision 0, Kansas City, Missouri, prepared by GTS Duratek, Inc., Radiological Engineering and Field Services, Kingston, Tennessee, for Hoechst Marion Roussel, Inc., Kansas City, Missouri, July.

GTS Duratek, Inc. (Duratek), 1999b, *Decontamination and Survey Report, Hoechst Marion Roussel, Inc.*, Revision 0, Kansas City, Missouri, prepared by GTS Duratek, Inc., Radiological Engineering and Field Services, Kingston, Tennessee, for Hoechst Marion Roussel, Inc., Kansas City, Missouri, November,

IT Corporation, 1999, Phase I Environmental Site Assessment.

Shaw Environmental & Infrastructure, Inc. (Shaw), 2011, *Phase I Environmental Site Assessment, Aptuit, Incorporated, Kansas City, Missouri*, prepared by Shaw Environmental, Inc., Lenexa, Kansas for Aptuit, Inc., Kansas City, Missouri, August.

Shaw Environmental & Infrastructure, Inc. (Shaw), 2010a, *Report of the Soil Sampling Conducted for Aptuit, Inc., 10245 Hickman Mills Drive, Kansas City, Missouri*, October 21.

Shaw Environmental & Infrastructure, Inc. (Shaw), 2010b, *Decommissioning Funding Plan for Aptuit, Incorporated, Kansas City, Missouri*, prepared by Shaw Environmental, Inc., Knoxville, Tennessee for Aptuit, Inc., Kansas City, Missouri, May.

Shaw Environmental & Infrastructure, Inc. (Shaw), 2007, *Final Status Survey Report, LAR and L Building, Aptuit, Incorporated, Kansas City, Missouri,* prepared by Shaw Environmental, Inc., Knoxville, Tennessee for Aptuit, Inc., Kansas City, Missouri, January.

Shaw Environmental & Infrastructure, Inc. (Shaw), 2006a, *Historical Site Assessment, LAR and L Building Aptuit, Incorporated, Kansas City, Missouri*, prepared by Shaw Environmental, Inc., Knoxville, Tennessee for Aptuit, Inc., Kansas City, Missouri, August.

Shaw Environmental & Infrastructure, Inc. (Shaw), 2006b, *Final Status Survey Report, Laboratory A3-367 Aptuit, Incorporated, Kansas City, Missouri*, prepared by Shaw Environmental, Inc., Knoxville, Tennessee for Aptuit, Inc., Kansas City, Missouri, May.

Shaw Environmental & Infrastructure, Inc. (Shaw), 2005, *Equipment Release and Decommissioning Survey of Laboratory B2150A*, memorandum from Daniel Williams, Shaw Environmental, Inc., to Michel Sturgeon, Quintiles, Inc., May 9. U.S. Nuclear Regulatory Commission (NRC), 2006, *Consolidated NMSS Decommissioning Guidance: Decommissioning Process for Materials Licensees*, NUREG 1757, Vol. 1, Revision 2, September.

U.S. Nuclear Regulatory Commission (NRC), 2003, *Consolidated NMSS Decommissioning Guidance: Characterization, Survey, and Determination of Radiological Criteria*, NUREG 1757, Vol. 2, September.

U.S. Nuclear Regulatory Commission (NRC), 2000, *Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM), revision 1*, NUREG 1575, EPA 402-2-97-016, U.S. Department of Defense et. al., August.

U.S. Nuclear Regulatory Commission (NRC), 1993, *Air Sampling in the Workplace*, NUREG-1400, September.

KN12\Aptuit\DP\Final\F-SO DP.docx\1/13/2012 12:58 PM

TABLES

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

(Page 1 of 4)

NUREC Decom	G-1757, Vol. 1, Rev. 2, Appendix D, missioning Plan Checklist	Aptuit Decommissioning Plan section						
Site De	Site Description							
1	Executive Summary	Executive Summary						
11.	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						
ll.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						
ll.e.	all previous burials of radioactive material, including those where the material was subsequently exhumed.	NA						
JII.	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						
111.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 Systems1.3.2.2 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						

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

(Page 2 of 4)

NUREG Decom	i-1757, Vol. 1, Rev. 2, Appendix D, missioning 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	n 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			

1

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

(Page 3 of 4)

NUREG Decom	-1757, Vol. 1, Rev. 2, Appendix D, missioning Plan Checklist	Aptuit Decommissioning Plan section			
IX.f.	Contractor support	2.2 Task Organization			
Х.	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			

.

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

(Page 4 of 4)

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

(Page 1 of 4)

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
		-		H-3	Detector cell	150	chromatograph	sources
Neuropher 20, 1078	Marian Laboratorian Jan	10006 Dunker Dides Dd	Amond					New Type C
November 30, 1978	Manon Laboratories, Inc.	Tuzao-buriket Ridge Ru	Ameno o					license?
December 19, 1980	Marion Laboratories, Inc.	10236 Bunker Ridge Rd	New Appl	C-14	Any	100		
				H-3	Any	100	Research and development in the	
				P-32	Any	10	synthesis of labeled pharmaceutical	
				S-35	Any	10	for non-human experimentation and	
				1-125	Any	10	in vivo and/or in vitro animal studies	
				1-131	Алу	10		
				Cs-137	Sealed	1	Calibration material for detection equipment to be purchased.	
. February 6, 1984	Marion Laboratories, Inc.	10236 Bunker Ridge Rd	Amend 8	C-14	Any	100		Use is described
				H-3	Any	100		as being the
				P-32	Any	10	Laboratory research including	bottom floor of a
				S-35	Any	10	animal studies.	two story building
				I-125	Any	10		in a 3 room suite
				I-131	Any	10		(119, 120, 122).
May 25. 1988	Marion Laboratories, Inc.	Marion Park Drive	Amend 10	H-3	Any	1 Curie		
				C-14	Any	1 Curie		
				P-32	Any	20	Perearch and development as	
				S-35	Any	20	defined in 10CEP 30 4(a)	
				I-125	Any	70	denned in TOOPK 30.4(d)	
				I-131 ·	Any	30		
				Ca-45	Any	10		
April 17, 1989	Marion Laboratories. Inc.	Marion Park Drive	Amend 11	Same as above				Changed RSO to Gregory Urbanski
December 14, 1989	Marion Laboratories Inc.	Marion Park Drive	Amend 12	Added Cr-51	Any	20	7	Added Marion site
						20	4	and Cr-51
								Named changed
March 6, 1990	Manon Merrell Dow, Inc.	Marion Park Drive	Amend 13					to Marion Merrel
							4	Dow, Inc.
January 14, 1991	Marion Merrell Dow, Inc.	Marion Park Drive	Amend 14	Added Tc-99m	Any	10	Research and development as	Added 10 mCi 1c-
							defined in 10CFR 30.4(q)	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 Merreli Dow, Inc.	Marion Park Drive	Amend 16					Troost & Marion Park Drive. Corrected error from Amend 12
March 15, 1989	Marion Laboratories, Inc.		Amend Reg				1	

.

Table 1-1

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

(Page 2 of 4)

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	Any Any Any	1 Curie 1 Curie 20	Research and development as defined in 10 CFR Part 30, Section	
		a mana ana ang ang ang ang ang ang ang ang		I-125 I-131	Any Any	70 30	30.4.	
March 2, 1995	Marion Merrell Dow, Inc.	Marion Park Drive	Amend 18	H-3	Any	1 Curie	Percerch and development as	Named Pam Barton as RSO
				C-14	Any	1 Curie	defined in 10 CFR Part 30, Section	
				5-35	Any Any	20	30.4.	
				1-131	Any	30		
biby 12, 1995	Heachst Marion Roussel	Marian Park Drive	Amond 19	H-3	Any	1 Curie	Research and development as	Name changed to Hoechst Marion
501y 12, 1995	Hoberist Marion Rousser		Amend to	C-14 S-35 I-125	Any Any Any	1 Curie 20 70	Research and development as defined in 10 CFR Part 30, Section 30.4.	100356
				I-131	Any	30		
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		10245 Hickman Mills Drive	Amend 22	H-3	Any	1 Curie		RSO changed to
531152ry 3, 2002			Amend 22	C-14 S-35 I-125 I-131	Any Any Any Any	1 Curie 20 70 <u>30</u>	Research and development as defined in 10 CFR 30.4.	bhan Gugbhi
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
.

.

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

(Page 3 of 4)

Date	Company	Address	New/Amend	Rad	Form	Limit (mCi)	Uses	Comments
			Amend 24					
A	6 4 Ch F -		(amended in	H-3	Any	1 Curie		C-14 limit raised
August 30, 2005	Aptuit, inc.	10245 Hickman Mills Unve	entirety)	C-14	Δny	2 Curies	Research and development as	10 2 CI
				S-35	Any	20	animal studies.	
		-		I-125	Any	70		
				1-131	Any	30		
July 17, 2007	Aptuit, Inc.	10245 Hickman Mills Drive	Amend 25	H-3	Any	1 Curie		
				C-14	Any	2 Curies	Research and development as	
				S-35	Any	20	defined in 10 CFR 30.4.	
				I-125	Any	70		Pam Barton
			A	1-131	Any	30		named RSO
			Amend 26	มา	6 m. r	1 Curio		
January 23, 2008	Anluit Inc	10245 Hickman Mills Drive	(amenueu in entirety)	n-o	Any	i Cune ,		
buildary 20, 2000	reptort, inc.	10240 Flickman Mills Drive	Griffory)	C-14	Anv	2 Curies	Research and development as	
				S-35	Anv	20	defined in 10 CFR 30.4.	
				I-125	Any	70		Clint Greag
				1-131	Any	30		named RSO
April 8, 2008	Aptuit, Inc.	10245 Hickman Mills Drive	Amend 27	H-3	Any	100 Curies	Percentration and development as	
				C-14	Any	100 Curies	defined in 10 CER 30.4 and	
				S-35	Any	1.5 Curies	radiosynthesis of radiolabeled	Increased license
				1-125	Any	70	organic compounds. Sealed	limits, added AUs,
				Ba-133	Sealed source	20	sources is in LSCs	and added areas
				Cs-137	Sealed source	90 microcuries		of use.
May 1, 2009	Aptuit, Inc.	10245 Hickman Mills Drive	Amend 28	H-3	Any	100 Curies	Research and development as	
				C-14	Any	100 Curles	defined in 10 CFR 30.4 and	
				5-30	Any	1.5 Curies	radiosynthesis of radiolabeled	
				Ba-133	Sealed source	20	organic compounds. Sealed	Added rad
				Cs-137	Sealed source	90 microcuries	sources is in LSCs.	support rooms
August 10, 2009	Aptuit, Inc.	10245 Hickman Mills Drive	Amend 29	H-3	Anv	100 Curies		capport rooma.
	- m			C-14	Any	100 Curies	Research and development as	
				S-35	Any	1.5 Curies	defined in 10 CFR 30.4 and	
				1-125	Any	70	radiosynthesis of radiolabeled	
				Ba-133	Sealed source	20	organic compounds. Sealed	
				Cs-137	Sealed source	90 microcuries	Sources is in LOUS.	Revised AU list.
November 17, 2009	Aptuit, Inc.	10245 Hickman Mills Drive	Amend 30	H-3	Any	100 Curies	Research and development as	
				C-14	Any	100 Curies	defined in 10 CFR 30.4 and	
				S-35	Any	1.5 Curies	radiosynthesis of radiolabeled	
				I-125	Any	70	organic compounds. Sealed	
				Ba-133	Sealed source	20	sources is in LSCs.	De local ALL
				US-13/	Sealed source	an wictochties		Revised AU list.

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

(Page 4 of 4)

Date	Company	Address	New/Amend	Rad	Form	Limit (mCi)	Uses	Comments
June 9, 2010	Aptuit, Inc.	10245 Hickman Mills Drive	Amend 31	H-3	Any	100 Curies	Persersh and development as	
				C-14	Any	100 Curies	defined in 10 CER 20 4 and	Revised AU list,
				S-35	Any	1.5 Curies	radioaunthosis of radiolabolad	added the Rad
				1-125	Any	70	radiosynthesis of radiolabeled	Waste Storage
				Ba-133	Sealed source	20	organic compounds. Sealed	Area (the Hill),
-		u na paper much		Cs-137	Sealed source	90 microcuries	Sources is in Lacs.	removed LSC.
February 11, 2011	Aptuit, Inc.	10245 Hickman Mills Drive	Amend 32	H-3	Any	100 Curies	Research and dovelopment as	
				C-14	Any	100 Curies	defined in 10 CEP 30.4 and	
				S-35	Any	1.5 Curies	redienunthesis of redielabeled	
				I-125	Any	70	property approved a Societ	
				Ba-133	Sealed source	20	organic compoditus. Sealed	Added B2-195
				<u>Cs-137</u>	Sealed source	90 microcuries	Sources is in Lacs.	pipe chase.
January 4, 2012	Aptuit, LLC.	10245 Hickman Mills Drive	Amend 33	H-3	Any	100 Curies	Possarsh and development as	
				C-14	Any	100 Curies	defined in 10 CEP 20 4 and	
				S-35	Any	1.5 Curies	redienverthenie of redieleholed	Change in
				1-125	Any	70		ownership from
				Ba-133	Sealed source	20	rourses is in LSCs	Aptuit. Inc to
				Cs-137	Sealed source	90 microcuries	Sources is in Lous.	Aptuit, LLC

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 ¹⁴C, using published efficiency for a PGM detector (5%) with a 15 cm² probe and a background count rate of 40 cpm, it is possible to detect <5000 dpm/100 cm² with the probe stationary and <13,000 dpm/100 cm² while scanning. Under these conditions, a reading of 2X background is approximately 5000 dpm/100 cm².

^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 cm².

^d The amount of removable radioactive material per 100 cm² 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

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

	То	tal (dpm/	100 cm ²)	Rem	iovable ³ H (d	ipm/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	
	Monoxide	>50 Ci ²	Mithin 24 to 72 hours		
¹⁴ C	Dioxide	> 5 Ci ²	following use	Urinalysis	
	Compounds	> 50 mCi ²	lonowing use		

¹The 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 ³ H and ¹⁴ C contamination	<30 dpm/100 cm ²	NA

¹Based 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.

Ì

FIGURES





















....

Figure 2-1 Aptuit Decommissioning Organization Chart



											Aptuit :	SO Dec	Fi commis:	gure 3-1 sioning l	Fieldwo	ork Schee	dule										
10		0	Task Name Laboratory D&D	Dur 3	ation 5 days	Week -1	1	Week 1	T w	Veek 2	Wee	<u>k3</u>	Week 4	Week	5	Week 6	Week 7) We	ok 8	Week 9	V I	veek 10	Wee	k11	Week 12	2	Week 13
2			Ventilation System Remov	al 1	0 days		- L. - 1 - 1											1	: ^		ł		- - -	i		:	
		a	Fan & Stack Removal	1	0 days				1												1					:	
4		a	Incinerator Removal	1	0 days													_					,				
6		2	Characterization Surveys	1	0 days		,											Ł			հ						
e			D&D Fieldwork Complete		0 days		•														↓						
-7		(or	Final Status Survey	1	5 days																<u>+</u>			······		Ъ.	
			FSS Fieldwork Complete		0 days																		*			♦	
				٩.																							
Pro	ect: A	pluit t	SO Decommissioning	Task	Ľ			Progress				Summ	nary	-	_	External Ta	sks		De	adline	Ŷ						
				Split		91 11 + 5-811 40-964	415 + 1	Milestone		•		Projec	ct Summary			External Mi	lestone 🗇										·····
														Page 1													

APPENDIX A

RADIOACTIVE MATERIALS LICENSE

KN12\Aptuit\DP\Final\F-SO DP.docx\1/13/2012 12:58 PM

****				۲۰۰۰ ۲۰۰۰ ۲۰۰۰ ۲۰۰۰ ۲۰۰۰ ۲۰۰۰ ۲۰۰۰ ۲۰۰						
		U.Q. NUULLAN NEGU	LATURE COMMISSION	Albenument No. 39						
		MATERIALS								
Pu	rsuant to the Atomic Energy Act	of 1954, as amended, the Ene	rgy Reorganization Act of	1974 (Public Law 93-438), and Title						
rep	de of Federal Regulations, Una resentations heretofore made by	ipter 1, Pans 30, 31, 32, 33, the licensee, a license is hereb	34, 35, 36, 39, 40, and by issued authorizing the lic	censee to receive, acquire, possess,						
tra	nsfer byproduct, source, and spec	al nuclear material designated	below; to use such mater	ial for the purpose(s) and at the plac						
ap	blicable Part(s). This license shall	be deemed to contain the cond	litions specified in Section	183 of the Atomic Energy Act of 1954						
am and	ended, and is subject to all applic; to any conditions specified below	ble rules regulations, and orde	rs of the Nuclear Regulato	ry Commission now or hereafter in el						
	License	e ACEDON	In accordance with t	he letter dated						
			October 20, 2011,							
1.	Aptuit, LLC		3. License number 24-1 entirety to read as	5595-01 is amended in its follows:						
2.	10245 Hickman Mills Drive		4. Expiration date Septe	ember 30, 2014						
	Kansas City, MO 64134-07	08	5. Docket No. 030-094	15						
			Reterence No.	· · · · · · · · · · · · · · · · · · ·						
5.	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-Garbon-14	B. Any		B. 100 curies						
	Ç₂∞Şulfur-35	C. Any	• • • • • •	C. 1.5 curies						
	D. lodine-125	D. Any		D. 70 millicuries						
	E. Barium-133	E. Sealed so IND 1401)	ource (Model No. E. 20 millicuries 1)							
	F ^{*,4} Cesium-137	F. Sealed so	urce	F. 90 microcuries						
Э.	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 resear	ch and development as de	afined in 10 CFR 30.4.							
	E. To be used in a Perkir	Elmer Tricarb 2900TR lic	quid scintillation count	er.						
	F. To be used in a Beckn	nan Model 100C, 3801, or	r 6500 or equivalent lic	quid scintillation counter.						
		CONDIT	IONS							
0.	Licensed material shall be Kansas City, Missouri.	used only at the licensee	's facilities located at	10245 Hickman Mills Drive,						
1	The Radiation Safety Offic	er for this license is Clint	Grego							

N	Lister of the All States of th		
	MATERIAL	S LICENSE	24-15595-01 Docket or Reference Number
	SUPPLEMEN	TARY SHEET	Amendment No. 33
12	Licensed material listed in following individuals and u	i Item 6 above is only auti uses indicated:	norized for use by, or under the supervision of, the
	Authorized User	Materials and Use	- :
	Clint Gregg	ltems 6.E. and 6.F.	
	Mike Marx, Ph.D.	Hydrogen-3 and Carb radiosynthesis, and It	on-14 for research and development and ems 6.E. and 6.F.
	John Goehl	Hydrogen-3 and Carb radiosynthesis, and Ite	on-14 for research and development and ems 6.E. and 6.F.
	David Leuck	Hydrogen-3 and Carb radiosynthesis, and Ite	on-14 for research and development and ems 6.E. and 6.F.
	Hari Pennaka	Hydrogen-3 and Carb radiosynthesis, and Ite	on-14 for research and development and the second sec
	Murali Ukkalam	Hydrogen-3 and Carb radiosynthesis, and Ite	on-14 for research and development and ems 6.E. and 6.F.
	Andrew Damon	Hydrogen-3 and Carb 6.E. and 6.F.	on-14 for research and development, and Items
	Jim Windels	Hydrogen-3 and Carbo 6.E. and 6.F.	on-14 for research and development, and Items
	Kevin W. Carter, Ph.D.	Hydrogen-3, Carbon-1 development,	4, Sulfur-35, and lodine-125 for research and
13.	The licensee shall not use specific condition of this lic	licensed material in or on ense.	human beings except as provided otherwise by
14.	The licensee shall not use provided otherwise by spec	licensed material in field cific condition of this licen	applications where activity is released except as se.
15.	A. Sealed sources shall intervals specified in Commission under 10	be tested for leakage and the certificate of registrati D CFR 32.210 or under ed	d/or contamination at intervals not to exceed the on issued by the U.S. Nuclear Regulatory quivalent regulations of an Agreement State.
	B. In the absence of a content of the intervals specified in 10 Commission under 10 the transfer, a sealed the test results received	ertificate from a transfero the certificate of registrati 0 CFR 32.210 or under ed source received from an ed.	r indicating that a leak test has been made, within th on issued by the U.S. Nuclear Regulatory juivalent regulations of an Agreement state, prior to other person shall not be put into use until tested an

	M# 274A	HIS NHOLEAD DECHLATORY COL	
			24-15595-01
	MAT	ERIALS LICENSE	Docket or Reference Number
	SUPP	LEMENTARY SHEET	030-09415
			Amendment No. 33
,			
C.	Sealed sourc radioactive g microcuries c emitting mate	es need not be leak tested if as; or the half-life of the isotop of beta and/or gamma emitting erial.	they contain only hydrogen-3; or they contain only a pe is 30 days or less; or they contain no more than 100 g material or not more than 10 microcuries of alpha
D.	Sealed sourc they are remo within the req shall be store contamination	es need not be tested if they oved from storage for use or t juired leak test interval, they s d for a period of more than 10	are in storage, and are not being used. However, when ransferred to another person, and have not been tested shall be tested before use or transfer. No sealed source 0 years without being tested for leakage and/or
E.	The leak test radioactive m becquerels) o Regulatory C immediately fi Commission r	shall be capable of detecting aterial on the test sample. If t or more of removable contami ommission in accordance with rom service and decontamina regulations.	the presence of 0.005 microcurie (185 becquerels) of he test reveals the presence of 0.005 microcurie (185 nation, a report shall be filed with the U.S. Nuclear h 10 CFR 30.50(c)(2), and the source shall be removed ated, repaired, or disposed of in accordance with
<u>, 1</u> 1	e e e e e e e e e e e e e e e e e e e		
P.	the licensee c or an Agreem	age and/or contamination, lim or by other persons specificall ent State to perform such ser	vices.
₽ G ,	Records of lea	ak test results shall be kept in	o units of microcuries and shall be maintained for 3 years
6. The 120	licensee is auti days for decay-	norized to hold radioactive ma -in-storage before disposal in	aterial with a physical half-life of less than or equal to ordinary trash provided:
A .	Before dispos with the approd determine that be removed of	al as ordinary trash, byproduc priate survey meter set on its t its radioactivity cannot be di r obliterated.	ct material shall be surveyed at the container surface s most sensitive scale and with no interposed shielding to stinguished from background. All radiation labels shall
В.	A record of ea The record mu in storage, the dose rate mea performed the	Ich disposal permitted under t ust include the date of disposa radionuclides disposed, the asured at the surface of each disposal	inis License Condition shall be retained for three years, al, the date on which the byproduct material was placed survey instrument used, the background dose rate, the waste container, and the name of the individual who
7. The CFR	licensee is auth Part 71, "Pack	orized to transport licensed n aging and Transportation of F	naterial only in accordance with the provisions of 10 Radioactive Material."
			· ·
			· · · · · ·

NRC FORM 374A II S NII	LI FAR REGIII ATORY COMMISSION	аналанан алан алан алан алан алан алан	
		24-15595-01	
MATERIALS	LICENSE	Docket or Reference Number	
SUPPLEMENT	ARY SHEET	030-09415	
		Amendment No. 33	
 18. Except as specifically provide accordance with the statem any enclosures, listed below statements, representations restrictive than the regulation. A. Applications dated Octor Diagrams."), and April 1 B. Letters dated April 7, 20 2010, June 2, 2010, Octor 2010, June 2, 2010, J	ded otherwise in this license, ents, representations, and pr v. The Nuclear Regulatory Co s, and procedures in the licen ons. ber 25, 2007 (limited to the ci 2008; and 08, February 2, 2009, June 8 ober 8, 2010, January 21, 20	the licensee shall conduct ocedures contained in the ommissions's regulations sl see's application and corre hange in the RSO and Atta , 2009, July 2, 2009, March 11, and October 20, 2011.	its program in documents, including hall govern unless the spondence are more chment 5, "Facility i 29, 2010, May 21,
i and the second se			. contraction of the
	en e		•
in the second	and the second	· · · · · · · · · · · · · · · · · · ·	·
		, ,	
, , , , , , , , , , , , , , , , , , ,			
			· · · ·
	· · · · · ·		Z = f
	FOR THE I	J.S. NUCLEAR REGULATI	ORY COMMISSION
Date <u>JAN 0 4 2012</u>	By <u>Viel</u> Will Mate Reg	iam P. Reichhold erials Licensing Branch ion III	lel -

ļ

APPENDIX B

INCIDENT REPORTS

KN12\Aptuit\DP\Final\F-SO DP.docx\1/13/2012 12:58 PM

i

ſ

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 <u>Astuit</u> Project Number <u>120089</u>

DATE	SURVEY DESCRIPTION	SURVEY NUMBER
4/12/07	Survey of Area (case unk/ Floor) in B3.298	041207-1
·····		
		/
	/	
·		
	N/AU	
		·

Radiation/Contamination Survey Report

X

CONTAMUSATION (RADIATION SURVEY REPORT			PROJECT NUMBER: 120089			DATE: 4/1	2/07	TRAE START.	300	TIME COMPLETE: 2	400	PAGE OF
LOCATION: M. J. Fuit B3.298 SURVEYOR: M. M.				M. Martiacol S. Brungardt			·····	upha	Berg	-Gamma	Bora-Gamma 🛛	
SURVEY NUMBER. 14/120					/		Loose	Total	Loove	Total	ուստոն։ D Պաշերոն։ D	τωσικός Γεορογίας
MAP 10 Bottached					tam x	signu' 100cm²	dµn√ 100cm²	dpriv t00cm ¹	dpm/ 100cm ¹	Beta mizdshi D		
ACCEPTABLE SURFACE CONTAMINATION LEVELS						t	NIA	NIA	SADS	NIA	NIA	BKG LSC
$\frac{10056}{100} \frac{M}{R} \frac{M}{R$						2	,	1	1	CATE	1	- South Wall Coroum
Source Check Oats	Contamination Surveys			Radalan	3			1-1	0,00		FLOOR	
					Surveys	4		<u> </u>			+	1-1002
	٩	u	ρ.γ	βiγ	Bala-Gamma	\$			1-1-	J	W	Casework side
	(LOOSE)	(TOTAL)	(LDOSE)	(TOTAL)		6						,
Vistoment	NIA	NA	LSC 6000	2360/43.68	NIA	7		1-1				
Source Type and I.D.	1)	c14/43	C14	1	8			1			/
Source Strength in dam			JADS	48,369	у исі	9						
Eticnony 2:45% - Fotal E				3849/0962		10						
MDA vi donv100 em ⁷				454	Sat. D Unsat D	11						
Background in com	a.	N/		121.8	N / miemons of pressions	12						(
REASON FOR O PROCEDUR	E NO.					13						·
SURVEY X SPECIAL	Post De	con S	urvey	ing —		14						
D ROUTINE				anna ann an a		15					NA	
Contamination 🗖	Oy Shihi 🖸 Daily	10 Washiy D	Monthly D			16		<u> </u>				
Radanoh C	By Shit O Daily	C Waxkay D	Monthly ()	••••••••••••••••••••••••••••••••••••••		17					1/	
COMMENTS: Scan ut	100%	access	tible a	uas-		18	ļļ_	<u> </u>		ļ	4	
SADS = S	EL At	Hacher	<u>d Da</u>	ta Suc	ets	19		+ +		ţ/		
<u> </u>	sas Pr	wort.	mal	Data	Sheet	20	<u> </u> -	_		ļ/		ļ
						21	╞╼╼╸┤╼	┿╾┥──	+	ļ_/	<u> </u>	
					22		<u> </u>		₩			
UNSTRUMENT / SERIAL	WA	\$	LSC	5000 17	-060380	23		<u> </u>		<u> </u>		<u> </u>
ALPHA	TOTAL NI	[BETA GALINA (TOT)	237229 14	3.68/PR190298	24		+	ļ/	ļ		
Reducen Burny BETA-	CANNUA NI	1	BETA GAMAIA	NIK		25	<u> </u>	V	LE	<u> </u>		
THE KNOWINI) & WILLFUL RECORDING OF UNDER FEDERAL STATUTES.	FALSE, FICTITIOUS, C	DR FRAUDULENT STA	TEMENTS OR ENTRIES C	IN THIS DOCUMENT MAY	BE PUNISHABLE AS A FELONY	ACS REVIEW	_lu	thing	Mast	hig DATE	4-12-07	

Radiation/Contamination Survey Report Form, May 2003

Post-Decon Survey	B3-298	Casework/	Floor Survey	Survey # 0	41207-1	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: Q. Marting 4-12-07

Shaw[®] Shaw Environmental & Infrastructure, Inc.

By SCB Date 4/12/07 Subject Survey of Arca Post Decon B3.298 Sheet No. ____ of ____ Chkd. By Am Date 4-12-07 Jurvey # 041207-1 Proj. No. 1200F9 .25 in. X .25 in. 43.68/PR190298 1) LSC BKG material BKG: cross static Counts Painted Metal: 120.70 2) 14,795 Post Decon Survey 3) 11,422 South Wall Case work 4) 1478 and Floor 5) 14,587 Resin Coated Floor: 132.20



LTD * CO- USER:10 PRESET TI DATA CALC COUNT BLA TWO PHASE SCINTILLA LOW LEVEL	- I A C ME C NK E TOR:	EL4 DL DF N N LIGUI	DOMI 22 24 34 10 201 10 2	NENT:SURVEY :YES SAM : NO REF :YES CYO EX: NO LOU F LIFE CORM	(† 041207 MPLE REPE PLICATES CLE REPEA ↓ SAMPLE RECTION D	-1 315: 1 15: 1 26J: 3 ATE:	17 PRIN RS23 none	APP 200 N'ER 32	97 08:€4 : STD : STD		
ISOTOPE 1	e t	3H - %	EPROR:	0.01 FAC	fGR:1.000	0 EKG. S	3UB:	!Zi			
ISOTOPE 2	97 14	140 %	ERNIR:	0.01 FAC	FOR:1.000	Ø BKG. 9	SUB :	0			
CHAN: Ø	.9 - 100	12.0 %	ERROR:	0.01 FAC	FOR: 1.000	Ø BKG. S	sue:	19			
BACKGROUN	D QUENCH	I CURVE	: Off	COLI	DR QUENCH	CORRECTI	ION: Of	Ŧ			
Guench Li	n i te	Lovi	5.218	Hight	:313,56						
BUM DUS ND	time Hin	日件	190	CORRECTED CPM	XERROR	DibW	EFF-1	EFF-2	RATIO	LUMEX %	ELAPSED TIME
SAM POS ND 1 **-1	TIME HIN 1.80	H#	19D 3H	CORRECTED CPM 22. 20	XERROR	DIPM 30.00	EFF-1	EFF-2	RATI0	LUMEX % 0.75	ELAPSED TINE
SAN POS ND 1 **-1	TIME HIN 1.00	H#	190 	CORRECTED CPM 22.20 14.00	XERROR 42.64 53.45	DPN 30,00 17,98	EFF-1 49,26	8.73 0.73 75.04	RATIO 2.113	LUMEX % Ø. 75	ELAPSED TIME 1.54
SAM PD8 ND 1 ↔*-1	TIME HIN 1.00	日朝 67, 9	190 3H 40 20101	CORRECTED CPM 22.20 14.00 65.00	42.64 53.45 24.81	DPM 30.00 17.98	EFF-1 49, 28 13, 20	0.70 75.26	RATIO 2.113	LUMEX % 0.75	ELAPSED TIME 1.54
SAN PDS ND 1 **-1 2 **-2	TIME HIN 1.00	H# 67.9 59.0	190 3H 140 2H 2H 3H	CORRECTED CPM 22.20 14.00 65.00 53.00	*ERROR 42.64 53.45 24.81 25.04	DPM 30,00 17,98 54,73	EFF-1 49, 26 10, 20 48, 93	8.70 9.70 75.04	RATIO 2.113 0.316	LUMEX % Ø. 75 9. 48	ELAPSED TIME 1.54 3.09
800 PD8 ND 1 **-1 2 **-2	TIME HIN 1.00 1.00	Н# 67.9 69.0	190 38 140 21001 34 140	CORRECTED CPM 22.20 14.00 65.00 50.00 135.00	XERROR 42.64 53.45 24.41 26.04 17.21	DPM 38.00 17.98 54.73 176.39	EFF-1 49,26 19,20 48,93 18,25	9.73 75.74 0.70 75.32	RATIO 2.113 0.316	LUMEX % 0.75 9.48	ELAPSED TIME 1.54 3.09
SAM PD8 ND 1 **-1 2 **-2	TIME HIN 1.00 1.00	₩# 67.9 69.0	190 38 140 21%01 38 140 41%01	CORRECTED CPM 22.20 14.00 65.00 59.00 135.00 231.00	XERROR 42.64 53.45 24.01 26.04 17.21 13.15	DPM 38.00 17.98 54.73 176.39	EFF-1 49,25 10,20 48,93 18,25	9.73 75.04 3.70 75.32	RATIO 2.113 3.316	LUMEX % 0.75 9.48	ELAPSED TIME 1.54 3.09
SAN PDS ND 1 **-1 2 **-2 3 **-3	TIME HIN 1.00 1.00	H₩ 67.9 69.0 66.9	190 3H 140 2H 140 2H 140 41ND1 38	CORRECTED CPM 22.20 14.00 65.00 53.00 135.00 231.00 44.02	XERROR 42. 64 53. 45 24. 81 26. 84 17. 21 13. 15 38. 15	DPM 38.20 17.98 54.73 176.39 63.53	EFF-1 49,26 13,20 48,93 16,25 49,59	EFF-2 9.73 75.04 9.79 75.32 9.7 3	RATIO 2.112 0.310 0.926	LUMEX % 0.75 9.48 0.49	ELAPSED TINE 1.54 3.09 4.69
SAN PDS ND 1 **-1 2 **-2 3 **-3	TIME HIN 1.00 1.00 1.00	₩₩ 67.9 69.0 66.9	190 (3H 140 2H 140 2H 140 4IND1 3H 3H 140	CORRECTED CPM 22.20 14.00 65.00 23.00 135.00 231.00 44.00 53.00	XERROR 42.64 53.45 24.01 26.04 17.21 13.15 30.15 27.47	DPM 30.20 17.96 54.73 176.39 63.53 68.79	EFF-1 49.28 13.20 48.93 18.25 49.50 18.25	EFF-2 0.70 75.00 75.32 0.70 76.40	RATIO 2.112 0.316 0.924	LUMEX % 0.75 9.48 0.49	ELAPSED TINE 1.54 3.09 4.69
SAN PDS NO 1 **-1 2 **-2 3 **-3	TIME HIN 1.00 1.00	₩₩ 67.9 69.0 66.9	190 (38 (34) (37) (37) (37) (37) (37) (37) (37) (37	CORRECTED CPM 22.20 14.00 65.00 135.00 231.00 44.00 53.00 127.00	XERROR 42.64 53.45 24.01 25.04 17.21 13.15 30.15 27.47 17.75	DPM 30.00 17.96 54.73 176.39 63.53 68.79	EFF-1 49.25 13.20 48.93 18.25 49.50 16.25	8.73 75.04 3.70 75.32 8.73 76.40	RATIO 2.112 0.310 0.924	LUMEX % 0.75 0.48 0.49	ELAPSED TINE 1.54 3.09 4.69
SAN POS NO 1 **-1 2 **-2 3 **-3 4 **-4	TIME MIN 1.00 1.00 1.00	₩ 67.9 69.0 66.9	190 3H 140 2H 140 2H 140 UND1 3H 140 UND1 3H 140 UND1 3H	CORRECTED CPM 22.20 14.00 65.00 135.00 231.00 44.00 53.00 127.00 25.00	XERROR 42.64 53.45 24.41 26.04 17.21 13.15 30.15 27.47 17.75 40.00	DPM 38, 00 17, 96 54, 73 176, 39 63, 53 68, 79 39, 47	EFF-1 49,25 13,20 49,93 18,25 49,59 16,25 49,50	EFF-2 0.70 75.06 0.70 75.32 0.70 76.40 0.70	RATIO 2.112 2.316 2.924 1.327	LUMEX % 0, 75 0, 48 0, 49 2, 72	ELAPSED TINE 1.54 3.09 4.69 6.23
SAN POS NO 1 **-1 2 **-2 3 **-3 4 **-4	TIME HIN 1.00 1.00 1.00	₩ 67.9 69.0 66.9	190 3H 140 21001 3H 140 41ND1 3H 140 01N01 3H 140 40	CORRECTED CPM 22.20 14.00 65.00 135.00 231.00 44.00 53.00 127.00 127.00 25.00 23.00	XERROR 42.64 53.45 24.41 26.04 17.21 13.15 36.15 27.47 17.75 40.00 41.70	DPM 38, 20 17, 96 54, 73 176, 39 63, 53 68, 79 39, 47 29, 74	EFF-1 49.25 13.20 48.93 18.25 49.59 16.25 49.30 18.24	EFF-2 0.70 75.06 0.70 75.32 0.70 76.40 0.70 76.41	RATIO 2.112 0.310 0.920 1.327	LUMEX % 0, 75 0, 48 0, 49 0, 72	ELAPSED TINE 1.54 3.09 4.69 6.23
SAN POS NO 1 %*-1 2 **-2 3 **-3 4 **-4	TIME HIN 1.00 1.00 1.00	₩ 67.9 39.0 66.9 66.5	190 3H 140 2H 140 3H 140 4IND1 3H 140 WIND1 3H 140 WIND1 3M 140 WIND1	CORRECTED CPM 22.20 14.00 65.00 135.00 231.00 44.00 53.00 127.00 25.00 23.00 23.00 72.00	XERROR 42.64 53.45 24.01 26.04 17.21 13.15 36.15 27.47 17.75 40.00 41.70 23.57	DPM 30.00 17.96 54.73 176.39 63.53 68.79 39.47 29.74	EFF-1 49.25 13.20 48.93 18.25 49.59 18.25 49.50 18.24	EFF-2 0.70 75.04 0.70 75.32 0.70 76.40 0.70 76.41	RATIO 2.112 0.310 0.924 1.327	LUMEX % Ø. 75 Ø. 48 Ø. 49 Ø. 72	ELAPSED TINE 1.54 3.09 4.69 6.23
SAN POS NO 1 **-1 2 **-2 3 **-3 4 **-3 4 **-4 5 **-5	TIME MIN 1.00 1.00 1.00 1.00	N₩ 67.9 65.9 66.5 66.5	190 3H 140 2H 140 2H 140 40 3H 140 40 3H 140 3H 3H 3H 3H 3H 3H 3H 3H 3H 3H 3H 3H 3H	CORRECTED CPM 22.20 14.00 65.00 135.00 135.00 231.00 44.00 53.00 127.00 25.00 23.00 72.00 26.00	XERROR 42.64 53.45 24.01 26.04 17.21 13.15 27.47 17.75 40.20 41.70 23.57 39,22	DPM 30, 00 17, 98 54, 73 176, 39 63, 53 68, 79 39, 47 29, 74 39, 62	EFF-1 49.25 13.20 48.93 18.25 49.52 18.25 49.50 18.24 49.51	 2.73 75.04 75.32 76.40 76.41 70.70 	RATIO 2.112 2.316 2.926 1.327 1.132	LUMEX % Ø. 75 Ø. 48 Ø. 49 Ø. 72 Ø. 67	ELAPSED TINE 1.54 3.09 4.69 6.23 7.82
SAN POS NO 1 **-1 2 **-2 3 **-3 4 **-4 5 **-5	TIME MIN 1.00 1.00 1.00 1.00	NN 67.9 65.9 66.5 66.5	190 3H 140 2H 140 2H 140 40 3H 140 40 3H 140 3H 140 3H 140 40 40 40 40 40 40 40 40 40 40 40 40 4	CORRECTED CPM 22.20 14.00 65.00 23.00 231.00 44.00 53.00 127.00 25.00 23.00 72.00 26.00 27.00	XERROR 42.64 53.45 24.01 26.04 17.21 13.15 27.47 17.75 40.00 41.70 23.57 39.22 30.49	DPM 30.00 17.98 54.73 176.39 63.53 68.79 39.47 29.74 39.62 34.98	EFF-1 49.25 13.20 48.93 18.25 49.50 18.25 49.50 18.24 49.51 10.25	EFF-2 0.70 75.04 0.70 75.32 0.70 76.40 0.70 76.41 0.70 76.43	RATIO 2.112 2.316 2.926 1.327 1.132	LUMEX % Ø. 75 Ø. 48 Ø. 49 Ø. 57	ELAPSED TINE 1.54 3.09 4.69 6.23 7.82

PAGE: 1

Incident in B2 API on November 2, 2008

3 ගැන ම

aptuit ENVIRONMENTAL HEALTH AND SAFETY INCIDENT FORM

Description of Incident:

Potable water leak from reflux condenser in radio-lab resulted in the release of water contaminated with ¹⁴C and ³H. 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 in	cident	\$17,000				
Additional Shaw involvement		\$10,000				
New NMR Computer and revalidation		\$22,000				
Ancillary workers (carpet layer/Team Office)						
Estimated Aptuit Employce 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	\$ <u>23,600</u>				
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

6 ess (e

- aptult							
Empioyee 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 8:15am (11/2)	1.0 P.M.0					
Person Injury Was Reported To NA							
Type Of Incident Water leakage-property damage	(□Near Miss □Injur	y □Property Damage	□Spills)				
B2 Room 166 and out into Room 167 and hallway							
A reaction was started at 7 pm on Saturday (11 the water hoses. At 8pm, all was secure and the the chemist found some water on the floors in popped off the condenser, resulting in the water (RSO) was called and informed about the wate telp of Shawn Earll (Maintenance department).	-01-2008) using a water chemist left for the nigh the hallway and a lot of leak onto floor of fume r leak. The water was m	reflux condenser with cop t. The next morning at 8.15 f water on the laboratory f hood and out onto the lab t opped/vacuumed up by the	per wire to secure 5 am (11-02-2008) loors. A hose had floor. Clint Gregg e chemist with the				
Do You Know of any Other Witnesses? (Yes Not Not	 Do You Know of any No 	Injuries? (Yes⊡ No⊡)					
If Yes, List Names							
How Do You Think The Incident Occurred (Unsafe C	ondition Or Act. Root Caus	e)					
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 \square No \square) 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 co contained recirculating chillers for overnight reactions	l? opper wire could ensure the s (contains -2 gallons of flu	hose stays secured. We can id).	n/will also use self-				
	97		J				

Char 11/28/08

aptuit

EH&S INCIDENT REPORT FORM

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

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

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

Name: Hari K Pennaka	Job Title: Senior Scientist
Supervisor/Manager: John Goehl	Department: Radiochemistry-APJ
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: 1 started my reaction at 7 pm on Saturday (11-(to tighten water hose joints and I was inspected control and left it for overnight experiment. I 8.15 am (11-02-2008) and found some water laboratory floors. I called Mr.Clinton Gregg cleaned up all the water in the hallway and lab department).	01-2008) using water reflux condenser with copper wire ed the experiment at 8 pm, seems everything was under left the place at 8 pm and came back next morning at on the floors in the hall way and lot of water on the (RSO) and reported about the water leak accident. I poratory with the help of Mr.Shawn Earll (Maintenance
In your opinion, what was/were the root cause(s) of the inciden	1? (e.g., condition or act that caused the incident)
Over tightening of the copper wire at the water during the night. At that point, the hose came o	hose connections led to the wire breaking sometime ff from reflux condenser and water leaked.
What corrective action(s) were taken or should be taken to prev	ent a reoccurrence of the incident?
Either using chillers (self contained cooling unit should prevent this kind of water leakage accide	ts) or employing hose clamps instead of copper wire ents in the future.
Report prepared by: Hari K. Pennaka	Date: 11-18-2008
Distribution: Facilities Environmental Health & Safety Departm	nent, Human Resources Office, Employee's Supervisor/Manager

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

Cfr 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.





7/26/2010 3:27:00 PM

Protocol# 2 - WIPES.lsa

Page # 1

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 $\mathbf{L}\mathbf{L}$ UL Bkg Subtract А 0.0 12.0 lst Vial в 12.0 156.0 lst Vial С 0.0 0.0 lst 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 Α В С Cycle 1 Results S# Count Time CPMA CPMB DPM1 DPM2 369.72-Bkg moj water 361.41-mop inker 1 328.36 SIS tSIE MESSAGES Missing vial 1. 2 1.00 13 14 28.86 32 16 3 1.00 7 4 - 9 8 25.02 328.36 - mop bucket 2 4 1.00 13 29 29 35 51.02 322.71- counts of water tro-5 1.00 846 6306 0 7809 56,00 Missing vial 6. bog Missing vial 7. 469.32 _ vipe under ledge 8 1.00 162 526 49.72 205 626 9 1.00 62 · 173 92 206 44.29 441.63-

7/26/2010 3:27:00 PM			Quanta	aSmart (!	FM) - 2.0)3 - Seri	al# 061925	Page # 2
Protocol#	2 - WIPES	.lsa						User: CLINDT
10	1.00	51	133	82	157	44.33	433.12	
11 Missing	1.00 vial 12.	1857	6792	2362	8188	45.51	393.96	
Missing	vial 13.							
14	1.00	13	14	24	16	35.93	517.65	



Shaw[®] Shaw Environmental & Infrastructure, Inc.

By SCB Date 4/12/07 Subject Survey of Arca Post Decon B3.298 Sheet No. ____ of ____ Chkd. By Am Date 4-12-07 Jurvey # 041207-1 Proj. No. 1200F9 .25 in. X .25 in. 43.68/PR190298 1) WC BKG matuial BKG: Gross static County Painted Metal: 120.70 2) 14,795 3) 11,422 2) 19,773 13 st Decon Survey 3) 11,422 South Wall Case work 4) 1478 and Floor 5) 14,587 Resin Losted Floor: 132.20



Incident in B2 API on September 20, 2011

l



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"

Elegent to the second second

Name of person making repor Clint Gregg	t:	Job Til Radiat	Number of Years at Aptu 15	
Department: EH&S		Aptuit Site Location: KCM	Time of Incident: 1600	Date of near miss incident/condition:
Near Miss type: Incident Condition	Spill		General Location at Site: (Area/) or Room) B2 outside B2-166	Lab

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.

Environment (fillin)

Equipment	Material	People
Arrangement	Placement	□ Placement
□ Use of	🔀 Handling	□ Process
□ Maintenance	D 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 Randy Press/QKAN/Quintiles@Quintiles

bcc

Subject Notification of Radioactive Spill in B2-119

At approximately 4:30 p.m. bn 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 ¹⁴C-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

15-6500	Beckind	ion						PAGE:	1
ID:DC	SE 9	spril.					φ	DEC 2004	10:09
USER: 5		E.o.	COMMENT	:RM#119					
PRESET TI	ME :	5.00							
DATA CALC	2	SL DPM	日排 :人	ES SAMP	LE REPEAT	S: 1	PRIN	TER .	: STD
COUNT BLA	NK ;	NO	IC# :	NO REPL	ICATES	z 1 .	RS23	2	: OFF
TWO PHASE	19 19	NO	AQC :	NO CYCL	E REPEATS	; 1	DISK		:EDIT
SCINTILLA	TOR :	LIGUID	LUMEX :	NO LOW	SAMPLE RE	ð: 0	RWM	LIST	: OFF
LOW LEVEL	а н	NO	HALF LI	FE CORRE	CTION DAT	E 2	none		
ISOTOPE 1	9 14	14C %EF	ROR: 0.0	O FACTO	R: 1.00	0000 B	KG. SUB	; O	
BACKGROUN	D QUENCH	CURVE:	0##	COLOR	OUENCH C	ORRECTI	ON 8 0	'n	
Quench Li	mits	Low:13	5.031	High:3	25.00				,
Quench Li	nits TIME	Low:13 H#	5.031 T	High:3	25.00 14C	14C	LUMEX	ELAPSED	v
Guench Li SAM POS NO	nits TIME MIN	Low:13	5.031 <u>1</u> CPM	High∶3 <mark>4C</mark> %ERROR	25.00 14C DPM	14C EFF-1	LUMEX	ELAPSED TIME	,
Quench Li SAM POS NO	nits TIME MIN	Low:13	5.031 <u>1</u> CPM	High:3 4C %ERROR	25.00 14C DPM	14C EFF-1	LUMEX %	ELAPSED TIME	
Guench Li SAM POS NO 1 53-1	mits TIME MIN 5.00	Low:13 H#	5.031 <u>1</u> CPM 26.20	High:3 - 4 (ZERROR 17.47	14C DPM 27.61	14C EFF-1 94,89	LUMEX % 0.25	ELAPSED TIME 5.61	Bika
Guench Li SAM POS NO 1 53-1 MISSING	nits TIME MIN 5.00 SAMPLE	Low:13	5.031 <u>1</u> CPM 26.20	High:3 <u>4 C</u> ZERROR 17.47	14C 14C DPM 27.61	14C EFF-1 94.89	LUMEX % 0.25	ELAPSED TIME 5.61	skg
Guench Li SAM POS NO 1 53-1 MISSING 3 53-3	nits TIME MIN S.00 SAMPLE 5.00	Low:13 H# 49.6 48.3	5.031 <u>1</u> CFM 26.20 77.60	High:3 <u>4 C</u> XERROR 17.47 10.15	25.00 14C DPM 27.61 81.73	14C EFF-1 94.89 94.95	LUMEX % 0.25 0.09	ELAPSED TIME 5.61 7	Bkg Drog 1
Guench Li SAM POS NO 1 53-1 MISSING 3 53-3 4 53-4	nits TIME MIN S.00 SAMPLE 5.00 5.00	Low:13 H# 49.6 48.3 45.2	5.031 CPM 26.20 77.60 48.60	High:3 <u>4 C</u> <u>ZERROR</u> 17.47 10.15 12.83	25.00 14C DPM 27.61 81.73 51.12	14C EFF-1 94.89 94.95 95.08	LUMEX % 0.25 0.09 0.11	ELAPSED TIME 5.61 11.18 16.85	BKg Drop 1 Drop 2
Guench Li SAM POS NO 1 53-1 MISSING 3 53-3 4 53-4 5 53-5	nits TIME MIN 5.00 SAMPLE 5.00 5.00 5.00	Low:13 H# 49.6 48.3 45.2 49.5	5.031 CPM 26.20 77.60 48.60 80.20	High:3 <u>4 C</u> <u>ZERROR</u> 17.47 10.15 12.83 9.99	25.00 14C DPM 27.61 81.73 51.12 84.51	14C EFF-1 94.89 94.95 95.08 94.90	LUMEX % 0.25 0.09 0.11 0.07	ELAPSED TIME 5.61 11.18 16.85 22.52	BKg Droz 1 Drokz Floor 1
Guench Li SAM POS NO 1 53-1 MISSING 3 53-3 4 53-4 5 53-5 6 53-6	mits TIME MIN 5.00 SAMPLE 5.00 5.00 5.00 5.00	Low:13 H# 49.6 48.3 45.2 49.5 47.5	5.031 CPM 26.20 77.60 48.60 80.20 152.00	High:3 AC ZERROR 17.47 10.15 12.83 9.99 7.25	14C DPM 27.61 81.73 51.12 84.51 160.03	14C EFF-1 94.89 94.95 95.08 94.90 94.90	LUMEX 7 0.25 0.09 0.11 0.07 0.03	ELAPSED TIME 5.61 11.18 16.85 22.52 28.19	Bkg Drop 1 Drop 2 Floor 1 1 - 2
Guench Li SAM POS NO 1 53-1 MISSING 3 53-3 4 53-4 5 53-5 6 53-6 7 53-7	mits TIME MIN 5.00 SAMPLE 5.00 5.00 5.00 5.00 5.00 5.00	Low:13 H# 49.6 45.2 49.5 47.5 45.3	5.031 CPM 26.20 77.60 48.60 80.20 152.00 48.00	High:3 /4 CC /ERROR 17.47 10.15 12.83 9.99 7.25 12.91	25.00 14C DPM 27.61 81.73 51.12 84.51 160.03 50.49	14C EFF-1 94.89 94.95 95.08 94.90 94.98 95.08	LUMEX Z 0.25 0.09 0.11 0.07 0.03 0.11	ELAPSED TIME 5.61 11.18 16.85 22.52 28.19 33.77	Bkg Drop 1 Drop 2 Floor 1 - 2 - 3
Guench Li SAM POS NO 1 53-1 MISSING 3 53-3 4 53-4 5 53-5 6 53-6 7 53-7 8 53-8	mits TIME MIN S.00 SAMPLE 5.00 5.00 5.00 5.00 5.00 5.00 5.00	Low:13 H# 49.6 45.2 49.5 47.5 45.3 45.3 45.3	5.031 CPM 26.20 77.60 48.60 80.20 152.00 48.00 48.00 44.20	High:3 4 C ZERROR 17.47 10.15 12.83 9.99 7.25 12.91 13.45	14C DPM 27.61 81.73 51.12 84.51 160.03 50.49 46.50	14C EFF-1 94.89 94.95 95.08 94.90 94.98 95.08 95.08	LUMEX 2 0.25 0.09 0.11 0.07 0.03 0.11 0.12	ELAPSED TIME 5.61 11.18 16.85 22.52 28.19 33.77 39.33	BKg Drop 1 Drop 1 Floop 1 - 3 - 4
Guench Li SAM POS NO 1 53-1 MISSING 3 53-3 4 53-4 5 53-5 6 53-6 7 53-7 8 53-8 9 53-9	mits TIME MIN 5.00 SAMPLE 5.00 5.00 5.00 5.00 5.00 5.00 5.00 5.0	Low:13 H# 49.6 48.3 45.2 49.5 47.5 45.3 45.3 45.3 45.7	5.031 CPM 26.20 77.60 48.60 80.20 152.00 48.00 48.00 48.00 38.80	High:3 4 C ZERROR 17.47 10.15 12.83 9.99 7.25 12.91 13.45 14.36	14C DPM 27.61 81.73 51.12 84.51 160.03 50.49 46.50 40.82	14C EFF-1 94.89 94.95 95.08 94.90 94.98 95.08 95.08 95.05	LUMEX 2 0.25 0.09 0.11 0.07 0.03 0.11 0.12 0.10	ELAPSED TIME 5.61 11.18 16.85 22.52 28.19 33.77 39.33 44.90	Bkg Drop 1 Drop 2 Floor 1 - 3 - 4 - 5

Kevin, here is the LSC data for the rad. spill and re-swipe.

John x 6708

09 Decou Run

L'S 6500 Packenan	i		PAGE: 1
ID:DÓSE S USER: 5 PRESET TIME -	SPILL 5 00	COMMENT:RM#119	9 DEC 2004 13:46
DATA CALC : COUNT BLANK : TWO PHASE : SCINTILLATOR: LOW LEVEL ;	SL DPM NO NO LIQUID NO	H# :YES SAMPLE REPEATS: 1 IC# : NO REPLICATES : 1 AGC : NO CYCLE REPEATS : 1 LUMEX: NO LOW SAMPLE REJ: 0 HALF LIFE CORRECTION DATE:	PRINTER : STD RS232 : OFF DISK :EDIT RWM LIST : OFF none
ISOTOPE 1:	14C ZERF	OR: 0.00 FACTOR: 1.000000 BKG.	SUB: O
BACKGROUND QUENCH	CURVE :	Off COLOR DUENCH CORRECTION:	: On
Quench Limits	Low:13.	031 High:325.00	
SAM POS TIME NO MIN	H#	14C 14C 14C LL CPM %ERROR DPM EFF-1	JMEX ELAPSED % TIME
1 46-1 5.00	51.7	27.00 17.21 28.48 94.80 c	The server Rus

MISSING	SAMPLE	ъл. µ /	at 7 a 010	1.7 . 21	28.48	94.80	0.35	5.62 Big
3 46-3	5.00	41.1	41.60	13.87	43.67	95.25	2.28	11.24 - RI
4 46-4	5.00	42.1	91.60	9.35	96.21	95.21	0.87	16.82 - R2

29 Der Dri Run

110 1

March 15, 1996

SUBJECT: Radiation Safety Incident

Two times during the month of February, 1996, animal studies were done using Carbon-14 (¹⁴C) Allervax Cedar. Allervax Cedar is a peptide. In the first study, approximately 60% of the ¹⁴C-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 ¹⁴C-Carbon Dioxide. These animals were in the autopsy room, and except for 4 animals no precautions were taken to capture the Carbon Dioxide (CO₂). Based on this, an investigation into the amount of airborne ¹⁴C-CO₂ 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-CO₂. (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 12μ Ci in the 6 hour timeframe. The Annual Limit of Intake for ¹⁴C-CO₂ per the Nuclear Regulatory Commission is 2000µCi/year. [10CFR20.1201(d), 10CFRPart 20 Appendix B]

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 8 B/ow-by Based on info 5-7-96

This was per stude And 2 studies were don Therefore total potential dose could have been 24uli

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	Preliminary MARSSIM
A3-320	СТЅ	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.		Classification
			Inactive	Class 3
A3-323	СТЅ	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	стѕ	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	СТ5	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	СТS	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.		Non impacted or Class 3 impacted.
			Active	

Aptuit Radioactive Material Use and Storage Areas

a series and a series of the s

Area	Owner	Notes	Active - area is in use Inactive - area is not is use Active radio - area is still	Preliminary MARSSIM Classification
A3-367	стѕ	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	СТЅ	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)	СТЅ	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.	A	Class 2
A Mezzanine (loft)	ст s	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	стѕ	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
Bidg A-East end tornado sheiter 300E	стѕ	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

-

Aptuit Radioactive Material Use and Storage Areas

~~~~

| Area                    | Owner    | Notes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Active - area is in use       | Preliminary    |
|-------------------------|----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------|----------------|
|                         |          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Inactive - area is not is use | MARSSIM        |
|                         |          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Active radio - area is still  | Classification |
| B2-103A                 | SO       | C-14, H-3, I-125. Old incinerator room currently used for rad waste accumulation.<br>Incinerator and incinerator stack are still present. There are elevated readings on the<br>refractory lining of the incinerator (probably NORM). The incinerator and stack have<br>been surveyed and the ash has been analyzed. Survey numbers 121306-01 & 121306-03.<br>Survey 121306-01 is the incinerator survey. Direct readings on the refractory brick were<br>elevated (up to 5000 dpm/100 cm <sup>2</sup> total). Removable contamination surveys were<br>performed in access port and roof under access port for incinerator stack (<30 dpm).<br>The incinerator room was also surveyed in 1999 by GTS Duratek ( <i>Hoechst Marion<br/>Roussel, Inc., Kansas City, Missouri, Decontamination and Survey Report</i> , Revison 0,<br>November 1999, GTS Duratek). The floor was found to have a consistent activity of<br>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<br>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.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                               |                |
|                         | <u> </u> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 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        |

#### Aptuit Radioactive Material Use and Storage Areas

| Area    | Owner | Notes                                                                                     | Active - area is in use       | Preliminary    |
|---------|-------|-------------------------------------------------------------------------------------------|-------------------------------|----------------|
|         |       |                                                                                           | Inactive - area is not is use | MARSSIM        |
|         |       |                                                                                           | Active radio - area is still  | 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  | 50    |                                                                                           | Active radio                  | Class 1        |
| B2-167A | 50    | Room added in access/egress Room 167 was solid to technically the costs are included      |                               |                |
| 02-10/A | 10    | in the DEP but it is not called out there as a separate area. A simple fix would be to    |                               |                |
|         |       | correct the DEP to show 167/167A as the area                                              |                               |                |
|         |       |                                                                                           | Active radio                  | Class 1        |
| 92 170  | 50    | This is the NBAD seem. It is within the "synthesis" feathclist that was submitted to the  | Active fauld                  |                |
| 52-170  | 30    | NPC with Amondment 27. Typical use 2 mGi to 1 Gi of C 14                                  |                               |                |
|         |       | NRC with Amenument 27. Typical use 2 micr to 1 Croi 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    |                               | · · ·          |
| 1       |       | simpler. Work with I-125 was completed in February 2010. Everything used for I-125        |                               |                |
| 1       |       | work (M&E) was moved into B2-181 for storage.                                             |                               |                |
|         |       |                                                                                           | Active                        | Class 3        |

Aptuit Radioactive Material Use and Storage Areas

| Area                  | Owner | Notes                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Active - area is in use<br>Inactive - area is not is use<br>Active radio - area is still | Preliminary<br>MARSSIM<br>Classification |
|-----------------------|-------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|------------------------------------------|
| 82-181                | стѕ   | C-14, I-125. Plates set up & counted. If only I-125 used then FSS will be much simpler.<br>Work with I-125 was completed in February 2010. All M&E from B2-180 that was used<br>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-<br>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-<br>270) | CT5   | 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                                                                                                                            | Activo                                                                                   | Close 3                                  |
| B3-268                | CTS   | Listed as a "use area" in the QKAN Report of Monthly Radiation Contamination Swipe<br>Sampling Report - November 2004. Submitted to the NRC with Amendment 27 as a<br>"use" area. Drawing RD-103. Former location of the LSC. Shaw performed a<br>characterization survey in B3-268 in 2004 with no contamination found. Shaw surveyed<br>the floor and equipment surfaces in April 2010 (scan, directs, survey 041910-01). No<br>contamination found.                             | Active                                                                                   | Class 3                                  |
| B3-268 (F)            | CTS   | Listed as a "use area" in the QKAN Report of Monthly Radiation Contamination Swipe<br>Sampling Report - November 2004. Submitted to the NRC with Amendment 27 as a<br>"use" area. Drawing RD-103. This is a walkin freezer where rad materials are stored.<br>The floor was found to be contaminated and it was painted. Floor will need to be<br>replaced or decontaminated. Facilities currently has 3 quotes for replacing the freezer.<br>Rad materials are still stored here. | Active radio                                                                             | Class 2                                  |

۰,

e. = .

Aptuit Radioactive Material Use and Storage Areas

| Area                  | Owner | Notes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Active - area is in use       | Preliminary    |
|-----------------------|-------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------|----------------|
|                       |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Inactive - area is not is use | MARSSIM        |
|                       |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Active radio - area is still  | 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<br>(cafeteria) | СТS   | Former use indicated during interviews and mentioned in 1991 NRC inspection report.<br>Daily survey indicated use with Ca-45 & I-125. Areas may have been demo'ed around<br>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                | стя   | Some indication of rad use.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Active                        | Class 3        |
| в3-298                | SO    | HPLC & hood used for C-14 project. Spill from HPLC contaminated casework & floor.<br>Drawing RD-103. Currently used for QC work for API (cold work) using HPLC. API use is<br>expected until January. Interviews indicate that rad use was throughout the laboratory<br>with the exception of the glovebox (maybe). A 2007 Shaw survey shows<br>contamination on floor and side of cabinet. Two incidents have been reported in this<br>area.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Active                        | Class 2        |
| Building B - Dock     | so    | Shipping/receiving of rad                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                               |                |
| 5                     |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Active                        | pending        |

Aptuit Radioactive Material Use and Storage Areas

~

| Area                                                                                     | Owner | Notes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Active - area is in use      | Preliminary      |
|------------------------------------------------------------------------------------------|-------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|------------------|
|                                                                                          |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Active radio - area is still | Classification   |
| B Building<br>Potentially<br>contaminated<br>legacy ducts<br>(from B2-119<br>and B3-274) | СТ    | 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-<br>119)                                                                   | SO    | This was referred to as E-119 in the Duratek reports.                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Active radio                 | Class 3          |
| E-205                                                                                    | СТЅ   | 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.                                                                                                                                                                                   |                              |                  |
| 5 200                                                                                    | CTC   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Active                       | Class 3          |
| e 208<br>(warehouse)                                                                     | CIS   | 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                                                                                    | CIS   | 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.                                                                                                                                                                                                                                                                                                                                                  |                              |                  |
| 5.250                                                                                    | CTE   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Active                       | Class 3          |
| C-20U                                                                                    |       | Former use. Use in this area has been called into question.                                                                                                                                                                                                                                                                                                                                                                                                                                            | Active                       | impacted         |

.

.

Aptuit Radioactive Material Use and Storage Areas

| Area                                                                                                                                                                                                                                                                                         | Owner | Notes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Active - area is in use<br>Inactive - area is not is use | Preliminary<br>MARSSIM |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------|------------------------|
|                                                                                                                                                                                                                                                                                              |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Active radio - area is still                             | Classification         |
| Lab Animal<br>Resources (LAR) -<br>B2-111, 112,<br>114, 115, 116,<br>117, 119, 123,<br>124, 125, 126,<br>127, 128, 129,<br>130, 131, 132,<br>136, 137A, 137B,<br>140, 142, 143,<br>148, 150A, 150B,<br>153, 155, 156,<br>158, 159, 160,<br>161, 162, 163,<br>164, 165, 166,<br>157, 158, 169 | 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). |                                                          | Classification         |
| 170, 171                                                                                                                                                                                                                                                                                     |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | NA                                                       | NA                     |
| L Building - L3-<br>321, L3-322, L3-<br>323, L3-324, L3-<br>325, L3-326A, L3-<br>326B, L3-327, L4-<br>419, L4-420, L4-<br>421a, L4-422a,                                                                                                                                                     | NA    | L Building was decommissioned and sold. FSSP were conducted as follows: Lab L4-422 -<br>FSSR May 2005; Lab L5-526 – F5SR June 2006; L Building – FSSR January 2007                                                                                                                                                                                                                                                                                                                                               | NA                                                       | NA                     |
| Rad Waste<br>Storage (The<br>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

.

C:\Documents and Settings\rick.greene\My Documents\Aptuit (Quintiles)\Aptuit KC Decommissioning\CTS\CTS HSA (pieces for final)\[File]

----- · 1

1

## **APPENDIX D**

į

## PHOTOGRAPHIC DOCUMENTATION

ļ



Shaw Project Number: 144040 Photographer: Zach Peckham



**Description**: B3-103A incinerator

Photo Number: 1

Description: B2-112 HEPA Housing



Shaw Project Number: 144040 Photographer: Zach Peckham



**Description**: B2-119 – HP Support

Photo Number: 3



Description: B2-116 - LSC



Shaw Project Number: 144040 Photographer: Zach Peckham





**Description**: B2-117 – LSC Waste

Photo Number: 5

Description: B2 Cubicles

## 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

ĺ



**Description**: B2-166 – view from cubicle hallway



Shaw Project Number: 144040 Photographer: Zach Peckham



**Description**: B2-166 – view from cubicle hallway

Photo Number: 9



**Description**: B2-166 – view from cubicle hallway



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



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



Shaw Project Number: 144040 Photographer: Zach Peckham





**Description**: Entrance to Waste Storage (The Hill)

Photo Number: 15

**Description**: B2-103A – Incinerator stack looking northeast

### 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



Shaw Project Number: 144040 Photographer: Zach Peckham



**Description**: B3-298 lab bench and floor

Photo Number: 19

(

Description: B3-298 bench


Shaw Project Number: 144040 Photographer: Zach Peckham



Description: Legacy ductwork

Photo Number: 21

(

Description: Legacy ductwork

## 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<br>in A3-340 and A3-341. Non<br>radiological use hoods also tie<br>into this exhaust system. These<br>fans are the only exhaust<br>associated with A3-340 and A3-<br>341. |  |  |  |  |  |
| A3-367            | AR-EF 30A and AR-EF 30B | This laboratory was<br>decommissioned in 2006. The<br>fans identified used to provide<br>room exhaust for A3-367 and<br>multiple non-radiological<br>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 | BR-EF 24                | General Room Exhaust for B2-     |  |  |  |  |  |  |
| Laboratories                |                         | 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<sup>2</sup> (<sup>14</sup>C) total, and 10 dpm/100 cm<sup>2</sup> (<sup>14</sup>C) removable (No <sup>3</sup>H removable contamination was identified). Two samples were collected at a point past the combined line with the highest total count of 413 dpm/100 cm<sup>2</sup> (<sup>14</sup>C), and 4 dpm/100 cm<sup>2</sup> (<sup>14</sup>C) removable (No <sup>3</sup>H removable contamination was identified). Samples were also collected on the inside of the fan port opening and blower for AR-EF 17 with the highest total results of 754 dmp/100 cm<sup>2</sup> (<sup>14</sup>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<sup>2</sup> (<sup>14</sup>C) (No <sup>3</sup>H 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<sup>2</sup> (<sup>14</sup>C) was collected in this line on the roof, and two removable with the highest results of 7 dpm/100 cm<sup>2</sup> (<sup>14</sup>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<sup>2</sup> (<sup>14</sup>C)/28 dpm/100 cm<sup>2</sup> (<sup>3</sup>H). The exhaust line is currently capped in an adjacent pipe chase room B2-195. The exhaust line continues from B2-195 into an adjacent radiological storage room B2-194 where a noise dampener is installed before the exhaust line goes vertical to the roof. Two samples were collected before the noise dampener with the highest results of 8841 dpm/100 cm<sup>2</sup> (<sup>14</sup>C) total, and 2348 dpm/100 cm<sup>2</sup> (<sup>14</sup>C)/128 dpm/100 cm<sup>2</sup> (<sup>3</sup>H) removable. Two samples were also collected at the point where the exhaust line goes vertical to the roof with the highest results of 937 dpm/100 cm<sup>2</sup> (<sup>14</sup>C) total, and 56 dpm/100 cm<sup>2</sup> (<sup>14</sup>C)/14 dpm/100 cm<sup>2</sup> (<sup>3</sup>H) removable. One total count was collected on the blower access point for BR-EF 23 with a result of 246 dpm/100 cm<sup>2</sup> (<sup>14</sup>C). Two removable samples were collected on the blower access port/blower blades with the highest count of 98 dpm/100 cm<sup>2</sup> (<sup>14</sup>C){No <sup>3</sup>H removable contamination was identified).

Data from the scoping surveys indicate the need to remove the exhaust line from B2-195 to after the noise dampener in B2-194. No further investigation has been identified for BR-EF 23 fan and exhaust line.

#### BR-EF 24 Fan (B2-119)

BR-EF 24 provides general room exhaust for B2-116/117/119 and non-radiological laboratories B2-114/115. Two samples were collected on the roof vent in each of the radiological laboratories with the highest result of 8135 dpm/100 cm<sup>2</sup> (<sup>14</sup>C) total, and 327 dpm/100 cm<sup>2</sup> (<sup>14</sup>C)/140 dpm/100 cm<sup>2</sup> (<sup>3</sup>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<sup>2</sup> (<sup>14</sup>C) (No <sup>3</sup>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<sup>2</sup> (<sup>14</sup>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<sup>2</sup> ( $^{14}$ C) total, and 11 dpm/100 cm<sup>2</sup> (<sup>14</sup>C) removable (No <sup>3</sup>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<sup>2</sup> (<sup>14</sup>C)/9 dpm/100 cm<sup>2</sup> (<sup>3</sup>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<sup>2</sup> (<sup>14</sup>C) and 87 dpm/100cm<sup>2</sup>  $(^{14}C)$  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<sup>2</sup> (<sup>14</sup>C)/1 dpm/100 cm<sup>2</sup> (<sup>3</sup>H) removable. One final swipe sample was collected at the stack drain port with a result of 2 dpm/100 cm<sup>2</sup> (<sup>14</sup>C) (No <sup>3</sup>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<sup>2</sup> (<sup>14</sup>C)/12 dpm/100 cm<sup>2</sup> (<sup>3</sup>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<sup>2</sup> (<sup>14</sup>C) total, and 741 dpm/100 cm<sup>2</sup> (<sup>14</sup>C)/258 dpm/100 cm<sup>2</sup> (<sup>3</sup>H) removable. One total count was collected on the blower access point for BR-EF 26 with a result of 4683 dpm/100 cm<sup>2</sup> (<sup>14</sup>C). Two removable samples were

collected on the blower access port/blower blades with the highest count of 205 dpm/100 cm<sup>2</sup> (<sup>14</sup>C)(No <sup>3</sup>H removable contamination was identified).

Data from the scoping surveys indicate the need to remove the entire exhaust line for this fan. No further investigation has been identified for BR-EF 26 fan and exhaust line.

#### BR-EF 29A and BR-EF 29B (B2-182, B2-183, B2-189)

The exhaust line for BR-EF 29A and BR-EF 29B runs from non-radiological laboratories to B2-189 and then to B2-182 where it turns vertical and goes to the roof. This exhaust line provides air flow for one hood in both B2-189 and B2-182 laboratories. Historically B2-189 was used for the storage of radiological materials; this hood was not identified as potentially impacted. One sample was collected at the inlet of the exhaust from the laboratory hood in B2-182 with a result of 270 dpm/100 cm<sup>2</sup> (<sup>14</sup>C) total, and 3 dpm/100 cm<sup>2</sup> (<sup>14</sup>C)/18 dpm/100 cm<sup>2</sup> (<sup>3</sup>H) removable. One total sample was collected on each of the blower ports of BR-EF 29A and BR-EF 29B with no <sup>14</sup>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<sup>2</sup> (<sup>14</sup>C) (No <sup>3</sup>H removable contamination was identified). <u>All survey results are below Aptuit's unrestricted release limits.</u>

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 <sup>14</sup>C (total) identified, and 26 dpm/100 cm<sup>2</sup> (<sup>14</sup>C) (No <sup>3</sup>H removable contamination was identified) removable. This exhaust line joins a large exhaust line on the roof that supplies air flow for multiple non-radiological laboratories. Five samples were collected in this combined exhaust line on the roof with the highest results of 1675 dpm/100 cm<sup>2</sup> (<sup>14</sup>C) total, and 12 dpm/100 cm<sup>2</sup> (<sup>14</sup>C) (No <sup>3</sup>H removable contamination was identified). One total sample was collected on each of the blower ports of BR-EF 71A and BR-EF 71B with no <sup>14</sup>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<sup>2</sup> (<sup>14</sup>C) (No <sup>3</sup>H removable contamination was identified). All survey results are below Aptuit's unrestricted release limits.

Based upon the scoping surveys results, no further investigation or exhaust removal has been identified.



Shaw Project Number: 144039 Photographer: Aptuit



**Description**: A3-340 & 341 – exhaust system.

Photo Number: 1



**Description:** A3-340 & 341 – exhaust system



Shaw Project Number: 144039 Photographer: Aptuit



Description: A3-340 & 341 - exhaust system.

Photo Number: 3



**Description**: A3-340 & 341 – exhaust system.

## 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: 5



**Description**: A3-340 & 341 – exhaust system.



Shaw Project Number: 144039 Photographer: Aptuit





**Description**: A3-340 & 341 – exhaust system.

Photo Number: 7

Description: A3-340 & 341 - exhaust system.

### 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: 9

Description: B2-189



Shaw Project Number: 144039 Photographer: Aptuit



Description: B2-189

Photo Number: 2



Description: B2-189



Shaw Project Number: 144039 Photographer: Aptuit





Description: B2-189

Photo Number: 4

Description: B2-189



Shaw Project Number: 144039 Photographer: Aptuit



Description: B2-189

Photo Number: 6

1



Description: B2-189



,

Shaw Project Number: 144039 Photographer: Aptuit



Description: B2-189

Photo Number: 8



Description: B2-189



Shaw Project Number: 144039 Photographer: Aptuit





Photo Number: 10



Description: B2-189



Shaw Project Number: 144039 Photographer: Aptuit



Description: B3-274

Photo Number: 1

2011.02.22 17:05



Description: B3-274

## Photographic Documentation



Location: Aptuit KCM 10425 Hickman Mills Drive Kansas City, MO 64134-0708 Client: Aptuit Shaw Project Number: 144039 Photographer: Aptuit





Photo Number: 3



Description: B3-274

### Photographic Documentation



Shaw Project Number: 144039 Photographer: Aptuit

Sh



Description: B3-274

Photo Number: 5



Description: B3-274



Shaw Project Number: 144039 Photographer: Aptuit



Description: B3-274

Photo Number: 7

(



Description: B3-298

Photo Number: 1

2011.02.23 12:27



{

Shaw Project Number: 144039 Photographer: Aptuit



Description: B3-298

Photo Number: 2



Description: B3-298

## APPENDIX F

## SURVEY FORMS

ŝ

(



## Contamination / Radiation Survey Report

| CONTAMINATION / RADIATION<br>SURVEY REPORT                                                                     |                        |            | PROJECT NUMBER              |         |                    | OATE, YIME<br>START, |       | TIME          |                            |                            | PAGE OF          |          |
|----------------------------------------------------------------------------------------------------------------|------------------------|------------|-----------------------------|---------|--------------------|----------------------|-------|---------------|----------------------------|----------------------------|------------------|----------|
| LOCATION SURVEYOR.                                                                                             |                        |            |                             |         | Algha              |                      | Joha  | Bela-Gamma    |                            | Bela-Gamma 🖸               |                  |          |
|                                                                                                                |                        |            | SURVEY NUMBER               |         |                    | 10034                | Terol | L0030         | Tolai                      | micenvitr G                | Item of Location |          |
|                                                                                                                | MAP IQ.                |            |                             |         |                    |                      |       | dpm/<br>100cm | dpmV<br>t00em <sup>1</sup> | dpm/<br>100cm <sup>2</sup> | Bela meads/hr D  |          |
| ACCEPTABLE SURFACE CONTAMINATION LEVELS                                                                        |                        |            |                             |         |                    |                      |       |               |                            |                            |                  |          |
| Loose dpm/100cm <sup>2</sup> Alpha dpm/100cm <sup>3</sup> Beta-Gamma                                           |                        |            |                             |         |                    |                      |       | <u> </u>      |                            |                            |                  |          |
| Total dpm/100                                                                                                  | cm' Alpha              | dpm/10     | Com <sup>a</sup> Bela-Gamma |         | Distriction        |                      | -     |               |                            |                            |                  |          |
| Source Check Qate Contamination Surveys Radiation                                                              |                        |            |                             |         |                    | ,<br>,               |       | ļ             |                            | ļ                          |                  |          |
| NUMBER OF THE OWNER |                        | I          | 1                           | ······  | Surveys            |                      |       | ļ             |                            |                            |                  |          |
|                                                                                                                |                        | 11         | try β⊧r Beta-Gamma          |         |                    | 5                    |       |               |                            |                            |                  |          |
|                                                                                                                | (LOOSE)                | (TOTAL)    | (LOOSE)                     | (TOTAL) |                    | 5                    |       |               |                            |                            |                  |          |
| losirumant                                                                                                     |                        |            |                             |         |                    | 7                    |       |               |                            |                            |                  |          |
| Source Type and I O                                                                                            |                        |            |                             |         |                    |                      |       |               |                            |                            |                  |          |
| Source Strangth in dom                                                                                         |                        |            |                             |         | iD.u               | 9                    |       | 1             |                            |                            |                  |          |
| Efficiency                                                                                                     |                        |            |                             |         |                    | 10                   | ····· |               |                            |                            |                  |          |
| MDA in dam/100 cm <sup>2</sup>                                                                                 |                        |            |                             |         | Sat. O Univat. D   | 11                   |       | 1             |                            |                            |                  |          |
| Background in Spm                                                                                              |                        |            |                             |         | meanibe or promite | 12                   |       |               |                            |                            |                  |          |
| REASON FOR DPR                                                                                                 | OCEDURE NO.            |            |                             |         |                    | 13                   |       |               |                            |                            |                  |          |
| SURVEY C SP                                                                                                    | ECIAL                  |            |                             | •       |                    | 19                   |       |               |                            |                            |                  |          |
| OR D                                                                                                           |                        |            |                             |         |                    | 15                   |       |               |                            |                            |                  |          |
| Contormation D                                                                                                 | By Shirk 🖒 Daly        | J Weekiy Q | Monthly D                   |         |                    | 15                   |       |               |                            |                            |                  |          |
| Radiation C                                                                                                    | By Shift C. Only       | J Weekky D | Monthly D                   |         |                    | 17                   |       |               |                            |                            |                  |          |
| COMMENTS                                                                                                       |                        |            | <del> </del>                |         | ······             | TB                   |       |               |                            |                            |                  |          |
|                                                                                                                |                        |            |                             |         |                    | 19                   |       |               |                            | i                          |                  |          |
|                                                                                                                |                        |            |                             |         |                    | 20                   |       | 1             |                            |                            |                  | <u> </u> |
|                                                                                                                |                        |            |                             |         |                    |                      |       | <u> </u>      |                            |                            | <u> </u>         |          |
|                                                                                                                |                        |            |                             |         |                    |                      |       | +             |                            |                            |                  |          |
| Consernation Survey ALPHA (LOOSE) BETA-GAMMA (LOOSE) / / / / / / / / / / / / / / / / / / /                     |                        |            |                             |         |                    | 21                   |       |               |                            |                            |                  | <u> </u> |
|                                                                                                                |                        |            |                             |         |                    |                      |       |               |                            |                            |                  |          |
| Ratislon Survey BETA-GAMMA BETA-GAMMA                                                                          |                        |            |                             |         | 24                 |                      |       | <br>          |                            |                            |                  |          |
| INSTRUMENT / SERIAL                                                                                            | NSTRUMENT / SERIAL / , |            |                             |         |                    | 23<br>               |       |               |                            |                            |                  |          |
| UNDER FEDERAL STATUTES.                                                                                        |                        |            |                             |         | RCS REVIEW         |                      |       | ***)          | OATE                       | ,                          |                  |          |



### Contamination / Radiation Survey Report

\_\_\_\_

| CONTAMINATION / RADIATION SURVEY REPORT (CONTINUATION SHEET) |                                                                                                                                                                  |       |       |                  | PROJECT NUMBER. CATE PAGE OF |                |         |        | PAGE OF |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |       |                 |                 |
|--------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|-------|------------------|------------------------------|----------------|---------|--------|---------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|-----------------|-----------------|
| LOCATION SURVEYOR                                            |                                                                                                                                                                  |       |       |                  | COMMENTS                     |                |         |        |         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |       |                 |                 |
| SURVEY NUMBER                                                |                                                                                                                                                                  |       |       |                  |                              |                |         |        |         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |       |                 |                 |
| CI 94/1                                                      |                                                                                                                                                                  |       |       |                  |                              |                |         |        |         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |       |                 |                 |
| RCS REVIEW DATE                                              |                                                                                                                                                                  |       |       |                  |                              |                |         |        |         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |       |                 |                 |
|                                                              | Alg                                                                                                                                                              | ma    | Bers- | Garma            | Bala-Gamma D                 |                |         | Alpha  |         | Beta-C                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | iamma | Bola-Gamma 🔲    |                 |
|                                                              | LOOSE                                                                                                                                                            | TOTAL | LOOSE | TOTAL            | mramor D                     | Dem auf anthra |         | LOOSE  | TOTAL   | LOOSE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | TOTAL | mianvhr D       |                 |
| item #                                                       | épm/                                                                                                                                                             | 40 TV | dom/  | dprivi<br>120ami | merarentihi D                | inter cocaton  | ltern a | 10~    | dom     | dpmV<br>199-mi                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | dpmv  | misio remini D  | Norr of Cocales |
|                                                              |                                                                                                                                                                  | ivuçm | 10000 |                  | Bei mysdsihr 🖸               |                |         | 100646 | Iguem   | 1000%                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 10067 | Bela mrads/hr 🖸 |                 |
|                                                              |                                                                                                                                                                  |       |       |                  |                              |                |         |        |         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |       |                 | ·               |
|                                                              |                                                                                                                                                                  |       |       |                  |                              |                |         |        |         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |       |                 |                 |
|                                                              |                                                                                                                                                                  |       |       |                  |                              |                |         |        |         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |       |                 |                 |
|                                                              |                                                                                                                                                                  |       |       |                  |                              |                |         |        |         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |       |                 |                 |
|                                                              |                                                                                                                                                                  |       |       |                  |                              |                |         |        |         | _                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |       |                 |                 |
|                                                              | -                                                                                                                                                                |       |       |                  |                              |                |         |        |         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |       |                 |                 |
|                                                              |                                                                                                                                                                  |       |       |                  |                              |                |         |        | -       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |       | ·····           |                 |
|                                                              |                                                                                                                                                                  |       |       |                  |                              |                |         |        |         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |       |                 |                 |
|                                                              |                                                                                                                                                                  |       |       |                  |                              |                |         |        |         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |       |                 |                 |
|                                                              |                                                                                                                                                                  |       |       | ļ                |                              |                |         |        |         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |       |                 |                 |
| ļ                                                            |                                                                                                                                                                  |       |       |                  |                              |                |         |        |         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |       |                 |                 |
|                                                              |                                                                                                                                                                  |       |       |                  |                              |                |         |        |         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |       |                 |                 |
|                                                              |                                                                                                                                                                  |       |       |                  |                              |                |         |        |         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |       |                 |                 |
|                                                              |                                                                                                                                                                  |       |       |                  |                              |                |         |        |         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |       |                 |                 |
|                                                              |                                                                                                                                                                  |       |       |                  |                              |                |         |        |         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | ,     |                 |                 |
|                                                              |                                                                                                                                                                  |       |       |                  |                              |                |         |        |         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |       |                 |                 |
|                                                              |                                                                                                                                                                  |       |       |                  | 6                            |                |         |        |         | ····                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |       |                 |                 |
|                                                              |                                                                                                                                                                  |       |       |                  |                              |                |         |        |         | ha hà đ <sub>a s</sub> a ang da ng |       |                 |                 |
|                                                              |                                                                                                                                                                  |       |       |                  |                              |                |         |        |         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |       |                 |                 |
|                                                              |                                                                                                                                                                  |       |       |                  |                              |                |         |        |         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |       |                 |                 |
|                                                              |                                                                                                                                                                  |       |       |                  |                              |                |         |        |         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |       |                 |                 |
|                                                              |                                                                                                                                                                  |       |       |                  |                              | ······         |         |        |         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |       |                 |                 |
|                                                              |                                                                                                                                                                  |       |       |                  |                              |                |         |        |         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | L     |                 |                 |
| ļļ                                                           |                                                                                                                                                                  |       |       |                  |                              |                |         |        |         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |       |                 |                 |
|                                                              |                                                                                                                                                                  |       | [     |                  |                              |                |         |        |         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |       |                 |                 |
|                                                              |                                                                                                                                                                  |       |       |                  |                              |                |         |        |         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |       |                 |                 |
| THE KNOWING S                                                | THE KNOWING & WILLFUL RECORDING OF FALSE, FICTITIOUS, OR FRAUDULENT STATEMENTS OR ENTRIES ON THIS DOCUMENT MAY BE PUNISHABLE AS A FELONY UNDER FEDERAL STATUTES. |       |       |                  |                              |                |         |        |         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |       |                 |                 |

----

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

. . <u>.</u> . . . .