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April 8, 2008

Mr. William Snell
Decommissioning Branch
Nuclear Regulatory Commission, Region III
2443 Warrenville Road STE 210
Lisle, IL 60532-4352

Subject: Submission of the Decontamination and Decommissioning (D&D) Plan for Building 267 at the 333 Portage Street facility under License No. 21-00182-03, Pharmacia and Upjohn Company LLC.

Dear Mr. Snell:

This letter is a follow-up to my March 25, 2008 letter sent to the NRC acknowledging that Pfizer has ceased use of radioactive materials and intends to decommission Building # 267 (B267) in 2008.

Accompanying this letter is our proposed D&D Plan, two copies. As stated in my 03/25/2008 letter, a formal approved D&D Plan is not required based on the information gathered during the historical site assessment and scoping surveys. However, we would appreciate any comments in regards to its adequacy to meet the NRC's expectations to properly decontaminate and decommission this facility. Pfizer will start preparing for the D&D process in accordance with the "Plan" in 30 days from the date of this letter unless the NRC contacts me to recommend any changes to the Plan.

Pfizer has procured Safety & Ecology Corporation (SEC) to manage this D&D project; perform necessary surveys in accordance with MARRISM guidelines and document the process in a "Final Report." Upon completion of the D&D process Pfizer will submit the D&D Final Report and an amendment request to the NRC for approval in order to release B267 for "unrestricted use."

The decommissioning activities by Pfizer/SEC are tentatively scheduled for a week near the end of April, 2008. I will contact you as soon as a mobilization/survey date is confirmed. In addition Andy Lombardo from SEC, lead CHP for this project, may contact you to discuss our D&D.

Thank you in advance for your assistance with the decommissioning of B267.

Sincerely,

Dee L. Clement Radiation Safety Officer - Kalamazoo Site

Kalamazoo Facilities
Decontamination and Decommissioning Plan Addendum

Building 267

NRC License No. 21-00182-03

Pfizer Global Research and Development
333 Portage Street
Kalamazoo, MI 49007

April 2008

Prepared by:
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APPENDICES

ACRONYM LIST

ALARA	As Low As Reasonably Achievable
CFR	Code of Federal Regulations
D&D	Decontamination and Decommissioning
$DCGL_{EMC}$	Derived Concentration Guideline Level – Elevated Measurement Comparison
$DCGL_W$	Derived Concentration Guideline Level – Wilcoxon Rank Sum
DQO	Data Quality Objective
DSV	Default Screening Value
FDA	Food and Drug Administration
GSF	Gross Square Feet
HSA	Historical Site Assessment
HVAC	Heating , Ventilation, Air Conditioning
MARSSIM	Multi-Agency Radiation Survey and Site Investigation Manual
MDC	Minimum Detectable Concentration
NRC	U.S. Nuclear Regulatory Commission
PGRD	Pfizer Global Research and Development
QAPP	Quality Assurance Project Plan
RDRC	FDA Approved Radioactive Drug Research Committee
RSO	Radiation Safety Officer
RSC	Radiation Safety Committee
TEDE	Total Effective Dose Equivalent

1.0 Introduction

Pfizer Global Research and Development (PGRD), a unit of Pfizer, Inc. is planning to perform decontamination and decommissioning (D&D) of the Building 267 at the research campus located at 333 Portage Street, Kalamazoo, MI. The 333 Portage Street campus is a 39 acre pharmaceutical research and development campus consisting of a complex of buildings including office facilities, laboratory facilities, and animal facilities located in downtown Kalamazoo.

In previous decommissioning work at the 333 Portage Street campus Pfizer had decommissioned and achieved unrestricted release of Buildings 18, 25, 126, and approximately two-thirds of Building 209 in 2004. Approximately one-third of Building 209 remained on the license. The remaining portion of Building 209 is known as the Portage Road wing or, alternately, Building 267A as it abuts Building 267. Building 267A was decommissioned and achieved unrestricted release in 2005. This plan addendum addresses the decommissioning of Building 267. Detailed information concerning facility history and radionuclide use throughout the site is contained in the Decommissioning Plan prepared in November 2003. This document describes the facilities in Building 267 and the planned approach to decommissioning and final status survey of these facilities.

Radioactive materials used in Building 267 consisted of small quantities (up to 10's of mCi) of a variety of radionuclides for research. These included H-3, C-14, I-125, P-32, P-33 and S-35.

Building 267 construction was completed in 1982, providing additional laboratories and research facilities at the Downtown site.

Based on an analysis of the radionuclides and quantities used, their physical forms and their half-lives, and receipt and distribution records, H-3 and C-14 are the only nuclides of concern with respect to the scope of the Building 267 decommissioning detailed in this plan addendum.

This plan addendum was developed using the guidance provided in NUREG 1727, "NMSS Decommissioning Standard Review Plan"; NUREG 1757, "Consolidated NMSS Decommissioning Guidance"; and NUREG 1575, "Multi-Agency Radiation Survey and Site Investigation Manual" (MARSSIM). It provides the approach, methods, and techniques for the radiological D&D of impacted areas of the facility. Final status surveys are designed to implement the protocols and guidance provided in MARSSIM to demonstrate compliance with the default screening values specified in NUREG 1757, or generated using the default scenarios and parameters of the DandD code v.2.1. These methods ensure technically defensible data is generated to aid in determining whether or not these facilities meet the release criteria for unrestricted use specified in 10 CFR 20 Subpart E.

A facility historical site assessment (HSA) was performed in February and March of 2008 in order to classify impacted areas, estimate decommissioning costs and develop this plan addendum. PGRD will retain a qualified D&D contractor to characterize,

remediate, perform final status surveys and produce a final status report for submittal along with a license amendment request to remove Building 267 from the license. D&D activities will be performed in accordance with this plan addendum, Pfizer's Radiation Protection Program and Pfizer's USNRC Radioactive Materials License(s).

2.0 Site Description

The Pfizer Downtown campus, located at 333 Portage Street, Kalamazoo, MI is a 39 acre pharmaceutical research and development campus consisting of a complex of buildings including offices, laboratories and animal research facilities. Facility history is provided in the D&D Plan.

Figure 2.1 Pfizer Downtown Site Aerial View

The site area is bound by Portage Street to the North-East, Lovell Street to the South, Henrietta Street to the West and South Street to the North-West.

In the previous decommissioning plan, Building 267 was classified as an Impacted Area.

3.0 Building 267 History

Between 1982 and 1985, Building 267 was constructed adjacent to the Portage Wing of Building 209 (Bldg. 267A) to provide more laboratory space as well as a site library containing some office space.

Only limited quantities of radioactive materials were used in Building 267. Laboratory limits by isotope are listed in Table 3.1

333 Portage St. Site HSA

A Historical Site Assessment (HSA) was performed in February and March of 2008. The purpose of the historical site assessment was to determine status of the site including potential, likely, or known sources of radioactive contamination by gathering data from various sources. This data includes physical characteristics and location of the site as well as information found in site operating records, including radiological surveys.

The records review included: commissioning and decommissioning survey records. Personnel interviews included the site radiation officer.

3.1 Potential Contaminants – Building 267

Table 3.1 is a list of radionuclides and quantities used, or authorized for use, in unsealed form at the building. This list was compiled through review of Radiation Safety Committee authorizations for radioactive material use (isotope and quantity) in individual laboratories and review of radionuclide receipt and distribution records.

The majority of these potential contaminants have very short half-lives. Calculations of possible remaining activity were performed based on the quantities of radionuclides used and date of distribution to each laboratory/area utilizing the information in the PGRD radionuclide receipt and distribution databases. These calculations were then used to eliminate survey requirements for these short lived isotopes by providing empirical evidence to support that there is no potential to exceed the established DSV after accounting for radioactive decay.

Nuclides were evaluated by 1) decaying each radionuclide delivery to each room to present activity levels, then, 2) summing the remaining activity as if it all of it was still present in the room, and 3) dividing the summed activity over a one square meter area. The resulting calculated surface activity was then compared to the Default Screening Values (DSV's) contained in NUREG 1757 or generated from a screening analysis using the default parameters contained in the DandD code v.2.1. Those nuclides whose possible remaining activities were greater than or equal to the DSV are carried forward as "nuclides of concern" for purposes of performing decommissioning surveys.

Table 3.1 Radionuclides Used in Building 267 in Unsealed Form

Isotope	Half-Life	Quantity (mCi)	DSV (dpm/100 cm^2)	DSV Basis
H-3	12.3 y	20	1.2E8	NUREG 1757
C-14	5730 y	5	3.7E6	NUREG 1757
P-32	14.3 d	1	9.5E6	DandD[1]
P-33	24.4 d	1	4.1E7	DandD
S-35	87.9 d	1	1.3E7	NUREG 1757
I-125	60.2 d	3.0	6.6E5	DandD

Note 1: These values were generated using DandD v.2.1; Bldg. Occupancy scenario and default parameters; 0.9 quantile $\leq$25 mrem/y.

After considering amounts of radionuclides used, the locations of use, and the impact of radioactive decay as described above, nuclides of concern are H-3 and C-14.

3.2 License History

The facility license history is described in detail in the November 2003 decommissioning plan.

3.3 Previous Decommissioning Activities

Over the years, many labs were decommissioned under the facility closeout procedure. Typically this involved removal of all radioactive material and equipment from the laboratory, followed by final surveys performed by the authorized researcher. After certification by the authorized researcher that all radioactive materials had been removed and the lab was decontaminated, detailed confirmatory surveys were performed by the radiation safety staff and the laboratory was formally decommissioned from radioactive material use.

In 2004, a substantial portion of the Henrietta Street site was decommissioned. This included Buildings 18, 25, 126 and approximately two-thirds of Building 209. In 2005, the remainder of Building 209 (267A) was decommissioned. These facilities were removed from the radioactive materials license in 2005.

4.0 Current Use

At this time PGRD has ceased all licensed activities in Building 267. PGRD intends to remove this building from the license by unrestricted release per 10 CFR30.36. PGRD intends to re-utilize the building for other research purposes. Research and production operations will continue under PGRD's radioactive material license in other areas of the Downtown site (e.g., Building 300).

Laboratories and areas that radioactive materials were used in are listed in Table 4.1.

Table 4.1 Bldg. 267 Radioactive Materials Use Areas

Elevation	Area	Use	Status
Floor 0	011-1, 012, 038	Storage	Closed Out
Floor 1	118, 118-1, 118-2, 118-3, 118A, 118B, 118C, 118E, 118F, 118H, 118J, 118L, 118N, 118Q, 118R, 118S, 131, 132, 133	Research Lab	Closed Out
Floor 3	301, 302, 303, 304, 305, 306, 307, 308-1,310, 311, 312, 315, 316, 317, 318, 319, 320, 324, 328-1, 331-2, 333-2,	Research Lab	Closed Out
Floor 4	401, 401-3, 402, 402A 403, 403A, 403B, 404, 404A, 404B 405, 405A, 405B 406, 406-A, 406-B, 407, 409, 409-1, 409-2, 409A, 410,	Research	Closed Out

Elevation	Area	Use	Status
	410-1, 410A, 410B, 411, 411-1, 411A, 411B, 412, 412-1, 412A, 412B, 417, 419, 424, 424-3, 424-4, 429, 434, 434-1, 434-2, 435, 436, 436-1, 436-2, 436-3		
Floor 5	502, 503, 505, 505-1, 505-2A, 505-2B, 506, 506-1, 506-2A, 506-2B, 507, 507-1, 507-2A, 507-2B, 508-1, 509, 509-1, 509-2A, 509-2B, 510, 510-1, 510-2A, 510-2B, 511, 511-1, 511-2A, 511-2B 512, 512-1, 511-2A, 512-2B, 514-2, 531, 531-2A, 532, 532-1, 532-2, 533, 533-2, 508-2, 534, 534-1, 535	Research	Closed Out
Floor 6	601-1, 626-1, 602, 602-1, 602A, 602B 603, 603-1, 603A, 603B 604, 604-1, 604A, 604-B, 606, 606-1, 606A, 607, 607-1, 607A, 607B, 610, 610-1, 610A, 610B, 616, 617, 618, 619, 620, 629, 629-1, 629-2, 630, 630-1, 631, 634	Research	Closed Out

Sealed sources were not used or stored in this building and there is no history of major spills of radioactive material.

5.0 Building 267 Description

This section describes the physical construction of the building and of the associated impacted mechanical systems. Initial survey unit classification is presented in Appendix A. Building floor plan drawings of each elevation, are presented in Appendix B.

Building 267 was constructed in 1982 as a multi-function research facility. The structure consists of seven floors plus basement and penthouse levels.

The exterior consists of a steel frame structure with cast-in-place concrete floors on composite metal decking. The exterior is pre-cast concrete panels with aluminum framed insulating glass windows. The penthouse has insulated metal siding. The roof is 3 or 4 layer built up roofing. The interior walls are masonry and stud/gypsum wallboard partitions. The floors are vinyl composite tile on a rubber base. Ceilings are perforated metal panels and doors are hollow steel in steel frames.

There are separate exhaust ventilation systems serving Building 267. Fume hoods are currently boosted into the main exhaust.

The main vacuum pumps for the Downtown site are housed in the Building 300 penthouse lower level. The exhaust goes directly to the atmosphere through a dedicated vent.

The laboratory drains join the sanitary drain system in the manhole outside Building 267 on the Portage Street side. The sanitary drain system is joined to the laboratory waste system in the process sampling manhole outside Building 267 on the Portage Street side. There are sumps in the basement of Building 267.

Major Additions or Renovations

Originally constructed in 1982, Building 267 was occupied on a rolling basis through 2007. Numerous minor renovations have occurred internally, mostly by replacing older steel prefabricated partitions with stud and gypsum wallboard partitions.

6.0 Radiological Status of Facility

The radiological status of the facility has been determined by a combination of historical survey records, radionuclide use and distribution records, and ongoing radiological surveillance activities. The facility conducts routine periodic surveys and laboratory closeout procedures. Only limited quantities of radioactive materials were used in Building 267. The initial survey unit classification is presented in Appendix A. At present, no areas in the building remain in active use.

Based upon the characterization surveys performed prior to 2007, the limited radionuclide use, and ongoing operational radiological surveillance including laboratory closeout surveys, contamination levels are expected to be below release criteria throughout Building 267.

6.1.1 Vacuum Systems

In 2007 characterization removable contamination surveys were performed at judgmentally selected vacuum nozzles throughout the facility (locations within the scope of work). These were performed using cotton tipped swabs inserted approximately one-inch into the end of the nozzles. Additional surveys will be performed on vacuum system components during final status surveys.

Based upon previous characterization survey mechanical systems are also expected to contain limited amounts of contamination, however this will be verified during laboratory closeout and final status surveys. This includes vacuum systems, ventilation hoods, and lab and building drains.

6.1.2 Drain Systems

The Building 267 primary sanitary effluent line connects with the outside the Building 209/267 dock area. Drains from Building 267 will be investigated at the Process Sampling manhole on the Portage Street side to ensure that drain paths have been identified and surveyed.

7.0 Release Criteria

A MARSSIM based facility final status survey will be performed to support the unrestricted release of the Building 267 facilities.

The radiological release criteria of NRC 10CFR20 Subpart E for unrestricted use will be used for decommissioning the building. Following lab closeout, Building 267 will be surveyed in accordance with the guidance contained in MARSSIM to demonstrate compliance with the criteria of 10CFR20.1402 Radiological Criteria for Unrestricted Use. The criteria is that residual radioactivity results in a TEDE to an average member of the critical group that does not exceed 25 mrem per year and that the residual radioactivity has been released to levels that are as low as reasonably achievable (ALARA).

8.0 Derived Concentration Guideline Levels

The NRC has published default screening values in NUREG 1757 for commonly used radionuclides. DandD v.2.1 software was used to determine default screening values for isotopes not listed in NUREG 1757. Surface contamination limits were derived using the Building Occupancy scenario together with default parameter values. Screening values were selected such that the 0.9 quantile of projected doses was less than or equal to 25 mrem/y (i.e., when probabilistic dose assessment calculations were performed, there was a 90% probability the calculated dose would be less than 25 mrem/y).

Licensees can use the DandD software to determine site-specific screening levels or use the conservative default parameters of DandD v.2.1 that are acceptable to the NRC for essentially all sites. The isotopes of concern screening values for surfaces under default conditions (generic screening levels) from NUREG 1757 are provided in Table 8.1.

Table 8.1 Default Screening Values for Nuclides of Concern

Isotope	Half-life	Radiation Type	Default Screening Value ($dpm/100cm^2$)
H-3	12.3 years	Beta	1.2E8
C-14	5730 years	Beta	3.7E6

The default screening values are the basis for developing the derived concentration guideline levels (DCGL's) for the project. The DCGL is the radionuclide specific surface area concentration that could result in a dose equal to the release criterion. $DCGL_W$ is the concentration limit if the residual activity is essentially evenly distributed over a large area. For this project, $DCGL_W$ is equal to the DSV.

In the case of non-uniform contamination, higher levels of activity are permissible over small areas. The $DCGL_{EMC}$ is derived separately for these small areas. The $DCGL_{EMC}$ is the $DCGL_W$ increased by an area factor depending on the size of the elevated area. For the PGRD Kalamazoo decommissioning project, $DCGL_{EMC}$ will not be used since contamination levels throughout the facility are a small percentage of the DSV.

In the presence of multiple radionuclides, the total of the DCGLs for all radionuclides would exceed the release criterion. Consequently, the unity rule is applied when combinations of radionuclides are present. The unity rule, below, is satisfied when radionuclide mixtures yield a combined fractional concentration limit that is less than or equal to one.

$$\frac{C_1}{DCGL_1} + \frac{C_2}{DCGL_2} + \ldots \frac{C_n}{DCGL_n} \leq 1$$

Where:

C = concentration of nuclide (1,2,..., *n*).
DCGL = guideline value for each radionuclide

Additionally, a reasonable effort shall be made to decontaminate any detectable contamination in support of the ALARA principle. If simple hand wipe/scrub techniques are unsuccessful at removal of the residual contamination, then the RSO may perform a cost vs. risk analysis prior to any aggressive decontamination methods.

9.0 ALARA Analysis

Due to the extremely low doses associated with the release criteria used for this D&D project, a quantitative ALARA analysis is not required. Default screening values are being used to establish DCGLs. Furthermore, PGRD routinely maintains nearly all laboratory areas of the facility to levels less than 1,000 dpm/100 cm^2 total activity and less than 100 dpm/100cm^2 removable activity.

NUREG 1727 states in part: "In light of the conservatism in the building surface and surface soil generic screening levels developed by the NRC staff, the staff presumes, absent information to the contrary, that licensees or responsible parties that remediate building surfaces or soil to the generic screening levels do not need to demonstrate that these levels are ALARA. However, licensees or responsible parties should remediate their facility below these levels through practices such as good housekeeping. In addition, licensees or responsible parties should provide a description in the final status survey report of how these practices were employed to achieve the final activity levels."

Based on scoping surveys, it is anticipated that only limited remedial activities will need to be performed, however, as an additional ALARA measure, locations with residual detectable contamination that is below the release criteria will be at least hand wiped to attempt to further remove contamination.

10.0 Planned Decommissioning Activities

Based upon PGRD's routine radiological surveillance program, strict implementation of low facility contamination limits, and the results of previous decommissioning activities, it is not expected that significant laboratory decontamination will be necessary. Pfizer has performed the laboratory closeout decommissioning procedure in each area where radionuclides have been authorized for use. This procedure includes removable contamination surveys consisting of 100 – 150 wipes counted in a liquid scintillation

counter plus direct radiation level measurements. Laboratories will then be classified as MARSSIM Class 2 or 3 based upon the results of the laboratory closeout survey.

Based on the results of previous characterization surveys and operational radiological surveillance, remediation is not expected to be required. However, if it is required, remediation methods that will be used include simple decontamination (i.e. wet wiping with a mild detergent) and removal of contaminated material by dismantling systems and structures and/or cutting contaminated sections from the material. Cutting may consist of the use reciprocating saws, band saws, high leverage shears, electric snips, tin snips and/or ratcheting cable cutters. HEPA-filtered vacuums may be used to remove loose dry material from surfaces during remediation activities. All remediation activities will be conducted to control the spread of contamination and to maintain personnel exposures ALARA.

10.1 Contaminated Structures

Remediation methods that will be used include simple decontamination (i.e. wet wiping with a mild detergent) and removal of contaminated material. If it is likely that radioactive materials have migrated to inaccessible areas, such as under casework, dismantlement will be required to assess the activity levels in these inaccessible areas.

Contaminated floor surfaces may include asbestos tile. Where required, an approved asbestos abatement contractor trained to the provisions of the PGRD license will remove the asbestos floor tile (including mastic) and all asbestos/radioactive waste will be disposed as radioactively contaminated asbestos.

10.2 Contaminated Systems and Equipment

Ventilation, vacuum, and drain lines will be removed using saws, snips, etc. to a point where contamination levels are below guideline values. In limited cases, such as short runs of ventilation ducts, decontamination of system internals may be performed. Controls will be put in place to prevent the spread of contamination during cutting and removal operations.

10.3 Schedules

PGRD intends to complete these decommissioning activities in the second quarter of 2008.

11.0 Project Management and Organization

Due to the limited scope of remedial actions required and the relative simplicity of the final status survey design, a complex management organization is not required. Decommissioning operations will be conducted under the same PGRD management structure as current licensed activities. Characterization, remedial actions, final status surveys and final status report will be prepared with the assistance of a D&D consultant. The D&D consultant will operate under the direction of the Radiation Safety Committee and Radiation Safety Officer. A PGRD Project Manager will be assigned to coordinate laboratory closeout and survey activities. Additional PGRD oversight will be provided in the areas of Industrial Safety and Industrial Hygiene. Decommissioning tasks will be performed according to written plans and procedures approved by PGRD management to

ensure they provide adequate worker protection and comply with the facility radioactive materials license.

11.1 Training

PGRD will provide all contractors with radiation worker training required by the facility radioactive materials license. The D&D consultant will provide training for D&D-specific programs, plans and procedures. Individuals performing D&D tasks will be trained on all project procedures and plans.

11.2 Contractor Support

PGRD will utilize a D&D consultant to assist in performing characterization, remediation, waste packaging, final status surveys and final status report. The consultant will have experience in successfully performing D&D projects at pharmaceutical research facilities utilizing H-3 and C-14 of similar scope.

12.0 Radiation Safety and Health Program

Radiological work will be performed according to the PGRD radioactive materials license Radiation Safety Program under the management and supervision of the facility Radiation Safety Officer and Radiation Safety Committee.

13.0 Environmental Monitoring Program

The environmental monitoring program for decommissioning activities will be the current program under PGRD's NRC license.

14.0 Radioactive Waste Management

All waste will be packaged in DOT-approved shipping containers for shipment to licensed facilities. Some waste may require sizing for packaging in the appropriate shipping containers. All waste will be stored in approved storage areas at the facility until shipment off-site. Radioactive waste will be subdivided into categories based on types of material and processing methods. Radioactive subdivisions include metals, DAW/Combustible, asbestos, and mixed wastes. All radioactive waste will be transported via DOT approved carriers and manifested by qualified waste shippers and/or brokers to licensed waste processors and disposal sites as appropriate.

15.0 Quality Assurance Program

The D&D Contractor will be required to submit a project-specific Quality Assurance Project Plan (QAPP) utilizing the guidelines of MARSSIM Section 9. The QAPP will be reviewed and approved by PGRD management prior to commencing D&D operations. The QAPP will incorporate at a minimum, the following:

- Description of the Quality Assurance and Quality Control goals, Data Quality Objectives (DQO), procedures, and plans to be implemented for all D&D activities.
- Description of the methodology to ensure that all radiological survey data meet the 95% confidence level.

- Description of the sampling and analysis requirements, and on-site waste packaging and storage location, for each waste stream on site.

The QAPP will be developed and organized with emphasis given to maximizing worker safety, minimizing/eliminating off-site releases and minimizing overall project costs.

The quality control program will control all quality documents during the performance of D&D operations. Quality documents include, but are not limited to:

- Training Records
- Survey Records
- Instrument Records
- Work Permits
- Medical Surveillance Records
- Audit Reports
- Shipping Records
- Work Procedures and Plans

16.0 Survey Instrumentation

16.1 Instrument Calibration

Laboratory and portable field instruments will be calibrated at least annually with National Institute of Standards and Technology (NIST) traceable sources, where feasible, and to radiation emission types and energies that will provide detection capabilities similar to the nuclides of concern.

16.2 Functional Checks

Functional checks will be performed at least daily when in use. The background, source check, and field measurement count times for radiation detection instrumentation will be specified by procedure to ensure measurements are statistically valid. Background readings will be taken as part of the daily instrument check and compared with the acceptance range for instrument and site conditions. If an instrument fails a functional check, all data obtained with the instrument since the last satisfactory check will be invalidated.

16.3 Determination of Counting Times and Minimum Detectable Concentrations

Minimum counting times for background determinations and counting times for measurement of total and removable contamination will be chosen to provide a minimum detectable concentration (MDC) that meets the criteria specified in this Plan. MARSSIM equations relative to building surfaces have been modified to convert to units of dpm/100cm^2. Count times and scanning rates are determined using the following equations:

16.3.1 Static Counting

Static counting Minimum Detectable Concentration at a 95% confidence level is calculated using the following equation, which is an expansion of NUREG 1507,

"Minimum Detectable Concentrations with Typical Radiation Survey Instruments for Various Contaminants and Field Conditions", Table 3.1 (Strom & Stansbury, 1992):

$$MDC_{static} = \frac{3 + 3.29\sqrt{B_r \cdot t_s \cdot (1 + \frac{t_s}{t_b})}}{t_s \cdot E_{tot} \cdot \frac{A}{100cm^2}}$$

Where:

MDC_{static} = minimum detectable concentration level in dpm/100cm^2
B_r = background count rate in counts per minute
t_b = background count time in minutes
t_s = sample count time in minutes
E_{tot} = total detector efficiency for radionuclide emission of interest (includes combination of instrument efficiency and 0.25 surface efficiency)
A = detector probe area in cm^2

16.3.2 Ratemeter Scanning

Scanning Minimum Detectable Concentration at a 95% confidence level is calculated using the following equation which is a combination of MARSSIM equations 6-8, 6-9, and 6-10:

$$MDC_{scan} = \frac{d'\sqrt{b_i}\left(\frac{60}{i}\right)}{\sqrt{p} \cdot E_{tot} \cdot \frac{A}{100cm^2}}$$

Where:

MDC_{scan} = minimum detectable concentration level in dpm/100 cm^2
d' = desired performance variable (1.38)
b_i = background counts during the residence interval
i = residence interval
p = surveyor efficiency (0.5)
E_{tot} = total detector efficiency for radionuclide emission of interest (includes combination of instrument efficiency and 0.25 surface efficiency)
A = detector probe area in cm^2

16.3.3 Smear Counting

Smear counting Minimum Detectable Concentration at a 95% confidence level is calculated using the following equation, which is NUREG 1507, "Minimum Detectable Concentrations with Typical Radiation Survey Instruments for Various Contaminants and Field Conditions", Table 3.1 (Strom & Stansbury, 1992):

$$MDC_{smear} = \frac{3 + 3.29\sqrt{B_r \cdot t_s \cdot (1 + \frac{t_s}{t_b})}}{t_s \cdot E}$$

Where:

MDC_{smear} = minimum detectable concentration level in dpm/smear
B_r = background count rate in counts per minute
t_b = background count time in minutes
t_s = sample count time in minutes
E = instrument efficiency for radionuclide emission of interest

16.4 Instrumentation Specifications

The instrumentation used for facility decommissioning surveys is summarized in the following tables. Table 16.1 lists the standard features of each instrument such as probe size and efficiency. Table 16.2 lists the typical operational parameters such as scan rate, count time, and the associated Minimum Detectable Concentrations (MDC). Alternate or additional instrumentation with similar detection capabilities may be utilized as needed for survey requirements with RSO approval.

Table 16.1 Instrumentation Specifications

Detector Model	Detector Type	Detector Area	Meter Model	Window Thickness	Typical Total Efficiency
Ludlum 43-68	Gas Flow Proportional	126 cm^2	Ludlum 2221	0.8 mg/cm^2	6.5 % (C-14)
Ludlum 43-37 Floor Monitor	Gas Flow Proportional	582 cm^2	Ludlum 2221	0.8 mg/cm^2	7 % (C-14)
Packard TriCarb	Liquid Scintillation	N/A	N/A	N/A	60% (H-3) 80% (C-14)

Table 16.2 Typical Instrument Operating Parameters and Sensitivities

Measurement Type	Detector Model	Meter Model	Scan Rate	Count Time	Background (cpm)	MDC ($dpm/100cm^2$)
Surface Scans	Ludlum 43-68	Ludlum-2350-1	5 in./sec.	N/A	500	6526 (C-14)
Surface Scans	Ludlum 43-37 Floor Monitor	Ludlum 2350-1	20 in./sec.	N/A	1000	2347 (C-14)
Total Surface Activity	Ludlum 43-68	Ludlum 2350-1	N/A	30 sec.	500	1629 (C-14)
Removable Activity	Packard TriCarb	N/A	N/A	120 sec.	25 (H-3) 15 (C-14)	50 (H-3) 15 (C-14)

17.0 Characterization Surveys

The laboratory closeout surveys served as both characterization and, if necessary, remedial action support surveys. The survey protocol for laboratory closeout consisted of performing approximately 100 to 150 wipes for measuring loose surface contamination, total contamination measurements of laboratory surfaces with a 2 inch diameter thin window GM tube, and dose rate measurements. These surveys together with operational radiological surveillance data formed the basis for laboratory classification. Radioactive materials laboratories and storage areas are MARSSIM class 2 areas for the facility final status surveys based on the data gathered during closeout. Final status survey protocols are described in section 18.0.

The survey protocol for building system surveys will consist of performing removable contamination measurements of internal surfaces of ventilation, vacuum and drain systems. The percentage of systems surveyed will be consistent with the final status survey protocols contained in this plan.

If the initial characterization survey results indicate that contamination is not present in excess of the release criteria, then data from the survey may be used as part of the final status survey. For areas that are partially contaminated, the characterization survey data may be used as part of the final status survey measurements provided that 1) the data used is only from areas with contamination levels below the release criteria, and 2) decontamination work is controlled such that the survey location could not have become cross-contaminated.

18.0 Design and Performance of Final Status Surveys

Final status surveys are performed to demonstrate that residual radioactivity in each survey unit satisfies the predetermined criteria for release for unrestricted use. The final status survey will be conducted using the Data Quality Objective (DQO) process. Characterization and remedial action survey data will be used as final status survey data to the maximum extent possible in order to minimize overall project costs.

Final status surveys will be conducted by performing required scan surveys, total direct surveys, removable contamination measurements and solid sampling as discussed further in this section. All survey data shall be documented on survey maps and associated data information sheets.

18.1 Background Determination

The use of reference background areas or paired background comparisons is not necessary for the purposes of this plan. Material and ambient background values are not expected to be present at a significant level in comparison to the DCGLs. Surface background will be determined for each survey to calculate the actual survey MDCs and associated count errors.

18.2 Data Quality Objectives (DQO)

The Data Quality Objective Process as described in MARSSIM is used throughout the design and implementation of survey design. The following is a list of the major DQOs for the survey design described in this plan:

- Static measurements will be taken to achieve an MDC_{static} of less than 50% of DCGL.
- Scanning will be conducted at a rate to achieve an MDC_{scan} of less than 50% of the DCGL in Class 2 areas.
- Scanning will be conducted at a rate to achieve an MDC_{scan} of less than 50% of the DCGL in Class 3 areas.
- Individual measurements will be made to a 95% confidence interval.
- Decision error probability rates will initially be set at 0.05 for both α and β. However, PGRD reserves the right to adjust the value of the β error as deemed necessary.
- The null hypothesis (H_0) and alternate null hypothesis (H_A) are that of NUREG 1505 scenario A:
  H_0 is that the survey unit does not meet the release criteria
  H_A is that the survey unit meets the release criteria
- Characterization and remedial action support surveys will be conducted under the same quality assurance criteria as final status surveys such that the data may be used as final status survey data to the maximum extent possible.

18.3 Area Classifications

Based on the results of the historical site assessment and previous survey results, the floors and lower walls of Building 267 has been classified as an "impacted" area.

18.3.1 Non-Impacted Area

Non-impacted areas are areas without residual radioactivity from licensed activities and are not surveyed during final status surveys. The following areas are classified as non-impacted:

- Surfaces above a two meter height.
- Building exterior walls
- Surface and subsurface soils of outside grounds
- Inaccessible surfaces in renovated areas

Based on historical operations, little potential exists for residual contamination from spills or tracking on surfaces less than two meters in height. Thorough surveys of building entrances/exits and ventilation exhausts will be conducted during the final status survey and will provide adequate assurance that any residual contamination is contained within the building structure. Inaccessible surfaces in renovated areas will not be surveyed due to the small quantities of radioactive materials used and the fact that renovations involved removing the surfaces with a potential for residual radioactivity, such as floor and wall coverings, and replacing them.

18.3.2 Impacted Areas

Impacted areas are those areas that have potential residual radioactivity from licensed activities. Impacted areas are subdivided into Class 1, Class 2 or Class 3 areas. Class 1 areas have the greatest potential for contamination and therefore receive the highest degree of survey effort for the final status survey using a graded approach, followed by Class 2, and then by Class 3. Impacted sub-classifications are defined, for the purposes of this plan, as follows:

18.3.3 Class 1 Area

Areas with the highest potential for contamination, and meet the following criteria: (1) impacted; (2) potential for delivering a dose above the release criterion; (3) potential for small areas of elevated activity; and (4) insufficient evidence to support classification as Class 2 or Class 3.

Based upon laboratory closeout surveys and operational radiological surveillance records, there are no Class 1 areas.

18.3.4 Class 2 Area

Areas that meet the following criteria: (1) impacted; (2) low potential for delivering a dose above the release criterion; and (3) little or no potential for small areas of elevated activity.

Based upon laboratory close out surveys and operational radiological surveillance records, formerly commissioned radioactive materials laboratories and storage areas.

18.3.5 Class 3 Area

Areas that meet the following criteria: (1) impacted; (2) little or no potential for delivering a dose above the release criterion; and (3) little or no potential for small areas of elevated activity.

18.4 Survey Units

A survey unit is a geographical area of specified size and shape for which a separate decision will be made whether or not that area meets the release criteria. A survey unit is normally a portion of a building or site that is surveyed, evaluated, and released as a single unit. For the purposes of this plan, areas of similar construction and composition will be grouped together as survey units and tested individually against the DCGLs and the null hypothesis to show compliance with the release criteria. Survey units will be homogeneous in construction, contamination potential, and contamination distribution.

The number of discrete sampling locations needed to determine if a uniform level of residual radioactivity exists within a survey unit does not depend on the survey unit size. However, the sampling density should reflect the potential for small elevated areas of residual radioactivity. Survey units will be sized according to the potential for small elevated areas of residual radioactivity. Recommended maximum survey unit sizes for building structures, based on floor area, is Class 1: up to 100 m^2 , Class 2: 100 m^2 to 1000 m^2 and Class 3: no limit.

Survey unit classifications and designations have been determined from the laboratory closeout surveys and operational radiological surveillance. Survey unit designations for

final status surveys may be modified to facilitate mapping and determination of sample locations. Changes to survey unit designations shall be identified and explained in the final status report. Survey unit classifications may not be downgraded.

Each unit will have an independent survey package that has specific survey instructions. The survey package will contain, at a minimum:

- Survey Unit number (e.g., Building and Room Number, System Number, etc.)
- Percentage of surface requiring scan surveys
- Number of removable contamination measurements
- Instrumentation to be used with static count times and scan rates
- Any additional specific survey instruction
- Maps of the survey unit surfaces

18.5 Surface Scans

Scanning is used to identify locations within the survey unit that exceed the investigation level. These locations are marked and receive additional investigations to determine the concentration, area, and extent of the contamination. For Class 1 areas, scanning surveys are designed to detect small areas of elevated activity that are not detected by the measurements using the systematic pattern. Table 19.1 summarizes the percentage of accessible building structural surfaces to be scanned based on classification.

Table 19.1 Scan Survey Coverage by Classification

Structure	Class 1	Class 2	Class 3
Floors	100%	50%	20%
Other Structures	100%	25%	10%

The percentage of survey area scan surveyed may be increased based on suspected elevated activity. For Class 2 and Class 3 areas, the surfaces to be scan surveyed will be those with the highest potential to contain residual contamination.

Floor areas near building entrances and exits will receive a 100% scan survey regardless of the area classification. These surveys will provide indications of potential migration of residual contamination to the outside grounds.

If elevated activity is detected during the scan surveys, then the location shall be marked and total and removable surface activity measurements and will be taken to quantify the activity. However, total surface activity measurements are in addition to the static measurements required for the statistical test.

18.6 Total Surface Activity Measurements

Direct surveys (static measurements) will be taken on building surfaces and system internals to the extent practical in impacted areas utilizing instrumentation of the best

geometry based on the surface at the survey location. Additionally, locations of elevated activity identified and marked during the scan survey will require direct survey measurements.

18.6.1 Determining the Number of Samples

A minimum number of samples are needed to obtain sufficient statistical confidence that the conclusions drawn from the samples are correct. The number of samples will depend on the Relative Shift (the ratio of the concentration to be measured relative to the statistical variability of the contaminant concentration).

The minimum number of samples is obtained from MARSSIM tables or calculated using equations in Section 5 of MARSSIM.

18.6.2 Determination of the Relative Shift

The number of required samples will depend on the ratio involving the activity level to be measured relative to the variability in the concentration. The ratio to be used is called the Relative Shift, Δ/σ_S and is defined in MARSSIM as:

$$\Delta / \sigma_S = \frac{DCGL - LBGR}{\sigma_S}$$

Where:

DCGL = derived concentration guideline level
LBGR = concentration at the lower bound of the gray region. The LBGR is the average concentration to which the survey unit should be cleaned in order to have an acceptable probability of passing the test
σ_S = an estimate of the standard deviation of the residual radioactivity in the survey unit

18.6.3 Determination of Acceptable Decision Errors

A decision error is the probability of making an error in the decision on a survey unit by failing a unit that should pass (β decision error) or passing a unit that should fail (α decision error). MARSSIM uses the terminology α and β decision errors; this is the same as the more common terminology of Type I and Type II errors, respectively. The decision errors are 0.05 for Type I errors and 0.05 for Type II errors.

18.6.4 Determination of Number of Data Points (Sign Test)

The number of direct measurements for a particular survey unit, employing the Sign Test, is determined from MARSSIM Table 5.5, which is based on the following equation (MARSSIM equation 5-2):

$$N = \frac{\left(Z_{1-\alpha} + Z_{1-\beta}\right)^2}{4\left(SignP - 0.5\right)^2}$$

Where:

N	=	number of samples needed in the survey unit
$Z_{1-\alpha}$	=	percentile represented by the decision error α
$Z_{1-\beta}$	=	percentile represented by the decision error β
SignP	=	estimated probability that a random measurement will be less than the DCGL when the survey unit median is actually at the LBGR *Note: SignP* is determined from MARSSIM Table 5.4

MARSSIM recommends increasing the calculated number of measurements by 20% to ensure sufficient power of the statistical tests and to allow for possible data losses. MARSSIM Table 5.5 values include an increase of 20% of the calculated value.

18.6.5 Determination of Sample Locations

Determination of Class 1 survey unit sample locations is accomplished by first determining sample spacing and then systematically plotting the sample locations from a randomly generated start location. The random starting point of the grid provides an unbiased method for obtaining measurement locations to be used in the statistical tests. Class 1 survey units have the highest potential for small areas of elevated activity, so the areas between measurement locations may be adjusted to ensure that these areas can be detected by scanning techniques.

Similar systematic spacing methods are used for Class 2 survey units because there is an increased probability of small areas of elevated activity. The use of a systematic grid allows the decision-maker to draw conclusions about the size of the potential areas of elevated activity based on the area between measurement locations.

Class 3 survey locations are determined from computer selected randomly generated x and y coordinates. Survey protocols for all areas are summarized in Table 19.2.

Table 18.2 Survey Sample Placement Overview

Survey Unit Classification		$DCGL_w$ Comparison	Elevated Measurement Comparison	Measurement Locations
Impacted	Class 1	Yes	N/A	Systematic random
	Class 2	Yes	N/A	Systematic random
	Class 3	Yes	N/A	Random
Non-Impacted		None	None	None

In laboratory areas, permanent counter tops and other horizontal surfaces, which block floor surfaces will be included as a replacement to the blocked floor surface. Likewise, fixed cabinetry faces and other permanent equipment will replace blocked wall surfaces. Permanent equipment, which does not actually block floor or wall surfaces, will be folded out 2-dimensionally and attached to the room overview so as to be included in the grid plot.

Internal surfaces of permanent furnishings (i.e., drawer or cabinetry interior surfaces) are not included in the systematic measurement location placement. However, these surfaces will be included in the scan surveys and judgmental measurements may be taken.

Additional totals surface activity measurements will be collected at each area of elevated activity identified during the scan surveys.

18.6.5.1 Determining Class 1 Sample Locations

In Class 1 survey units, the sampling locations are established in a unique pattern beginning with the random start location and the determined sample spacing. After determining the number of samples needed in the survey unit, sample spacing is determined from MARSSIM equation 5-8:

$$L = \sqrt{\frac{A}{N}} \text{ for a square grid}$$

Where:

L = sample spacing interval
A = the survey unit area
N = number of samples needed in the survey unit

Maps will be generated of the survey unit's permanent surfaces included in the statistical tests (floors, walls, ceilings, fixed cabinetry, etc.) and folded out in a 2-dimensional view. A random starting point is determined using computer-generated random numbers coinciding with the x and y coordinates of the total survey unit. A grid is plotted across the survey unit surfaces based on the random start point and the determined sample spacing. A measurement location is plotted at each intersection of the grid plot.

18.6.5.2 Determining Class 2 and Class 3 Sample Locations

Class 1 survey units generally consist of one or two rooms or laboratories. Class 2 and Class 3 survey units generally consist of many rooms. Representing each room in a "fold-out" view to show all surfaces presents a difficult and time-consuming mapping challenge. The process to identify, map and locate measurement coordinates in survey units with many rooms is complicated due to the noncontiguous nature of the survey unit once walls are "folded-out".

For the reasons above, the MARSSIM sample measurement locations (i.e., random static and wipe measurements) for Class 2 and Class 3 survey units will be determined on horizontal surfaces only as determined on overhead floor maps. This protocol will increase the sample density on the surfaces with the highest probability for residual contamination. The appropriate percentage of all survey unit surfaces (including vertical surfaces) will be scanned according to the survey unit classification.

As part of characterization, the survey technician will judgmentally select locations with the highest probability of contamination on vertical surfaces for a static measurement and

smear such as light switches, door knobs, door pulls and push plates, and other locations. These measurements are in addition to and not included in the statistical analysis of the locations selected by MARSSIM protocols.

Determining Class 2 Sample Locations

In Class 2 survey units, the sampling locations are established in a unique pattern beginning with the random start location and the determined sample spacing. After determining the number of samples needed in the survey unit, sample spacing is determined from MARSSIM equation 5-8:

$$L = \sqrt{\frac{A}{N}} \text{ for a square grid}$$

Where:

L	= sample spacing interval
A	= the survey unit floor area
N	= number of samples needed in the survey unit

Maps will be generated of the survey unit's permanent surfaces included in the statistical tests. Only horizontal surfaces (e.g., floors, countertops, etc.) are included in the statistical tests. A random starting point is determined using computer-generated random numbers coinciding with the x and y coordinates of the total survey unit. A grid is plotted across the survey unit surfaces based on the random start point and the determined sample spacing. A measurement location is plotted at each intersection of the grid plot.

Determining Class 3 Sample Locations

For Class 3 areas, maps will be generated of the survey unit horizontal surfaces. Sample locations are determined using computer generated random x and y coordinates for each sample location. Each location is plotted on the applicable survey map.

18.7 Removable Contamination Measurements

Removable contamination measurements (smears) will be collected on building structural surfaces at each sample location. Additionally, removable contamination measurements will be collected for building system internals. An area of approximately 100cm^2 shall be wiped if possible. If an area of less than 100cm^2 is wiped, a comment shall be added to the survey data sheet estimating the surface area wiped to allow for area correction of the results. Swabs may be used when system or component access points are not large enough to allow for a wipe of a 100cm^2 surface area.

18.8 Surveys of Building Mechanical System Internals

Surveys of various building system components will need to be performed. Survey design for these systems is out of the scope of MARSSIM. For the purposes of identifying potential residual contamination within these systems, a survey protocol has been established and is presented in the following sections.

18.8.1 Ventilation Systems

Surveys of building ventilation and fume hood ventilation will consist of scan surveys, total activity measurements and removable contamination measurements of accessible

ventilation exhaust points and at locations of potential collection buildup. The frequency of the survey effort will depend on the classification of the surrounding area. Ventilation system survey requirements are summarized in Table 19.3.

Table 19.3 Ventilation System Survey Requirements

Component(s)	Classification of Area in Which Components Exist	Survey Requirements		
		Scan Surveys	Static (Total Activity) Measurements	Removable Contamination Measurements
General ventilation and fume hood exhaust ducts	Class 1	100% scan survey of accessible[1] internal surfaces of all existing exhaust ducts	At least one static measurement taken on the internal surfaces of 100% of existing exhaust duct openings	One smear taken at each static measurement location
	Class 2	100% scan survey of accessible[1] internal surfaces of at least 50% of existing exhaust ducts	At least one static measurement taken on the internal surfaces 50% of existing exhaust duct openings	One smear taken at each static measurement location
	Class 3	100% scan survey of accessible[1] internal surfaces of at least 10% of the existing exhaust ducts	At least one static measurement taken on the internal surfaces of 10% of the existing exhaust duct openings	One smear taken at each static measurement location
Collection points within ventilation fan units	All	100% scan survey of accessible[1] internal surfaces of all applicable ventilation fan units	At least one static measurement taken on each internal surface of each accessible[1] opening on the units	One smear taken at each static measurement location

[1] Within reach of duct or component opening

Components will be de-energized prior to access. Lock-out/Tag-out procedures will be initiated prior to any access to mechanical or electrical components.

18.8.2 Vacuum Systems

Surveys of building vacuum system internals will consist of removable contamination measurements of selected accessible vacuum inlet points. Scan surveys and static measurements are not practical due to the small geometry of the vacuum inlet points. Additionally, surveys of potential collection points will be performed. The frequency of the survey effort will be dependent on the classification of the surrounding area. Vacuum system initial survey requirements are summarized in Table 19.4.

Table 19.4 Vacuum System Survey Requirements

Component(s)	Classification of Area in Which Components Exist	Survey Requirements	
		Scan Surveys and Static (Total Activity) Measurements	Removable Contamination Measurements
Vacuum system inlets	Class 1	N/A[1]	At least one smear on the internal surfaces of 100% of the

Component(s)	Classification of Area in Which Components Exist	Survey Requirements	
		Scan Surveys and Static (Total Activity) Measurements	Removable Contamination Measurements
			existing vacuum inlet points[2]
	Class 2	N/A[1]	At least one smear on the internal surfaces of 50% of the existing vacuum inlet points[2]
	Class 3	N/A[1]	At least one smear on the internal surfaces of 10% of the existing vacuum inlet points[2]
Collection points within vacuum system moisture accumulators and/or filtration components	All	N/A[1]	At least one smear on the internal surfaces of all accessible locations within the vacuum system moisture accumulator(s) and filtration points.[2]

[1] Scan surveys and static measurements are not practical for these locations due to the small geometry of the vacuum inlet points.
[2] Some disassembly of system components may be necessary to complete these surveys.

Sediment samples may also be collected at these locations if the results of the removable contamination measurements indicate the presence of residual contamination. Components will be de-energized prior to access. Lock-out/Tag-out procedures will be initiated prior to any access to mechanical or electrical components.

18.8.3 Drain Systems

Surveys of building drain system internals will consist of surveys of accessible sink drains, floor drains and collection points such as sumps. Removable contamination surveys of sink drains and floor drains will be collected, since scan surveys and static measurements are not practical due to their small geometry. The frequency of the survey effort will be dependent on the classification of the surrounding area. Drain system initial survey requirements are summarized in Table 19.5.

Table 19.5 Drain System Survey Requirements

Component(s)	Classification of Area in Which Components Exist	Survey Requirements	
		Scan Surveys and Static (Total Activity) Measurements	Removable Contamination Measurements
Drain system inlets	Class 1	N/A[1]	At least one smear on the internal surfaces of 100% of the existing sink drains, and floor drains[2].
	Class 2	N/A[1]	At least one smear on the internal surfaces of 50% of the existing sink drains and floor drains[2].
	Class 3	N/A[1]	At least one smear on the internal surfaces of 10% of the existing sink drains and floor drains[2].

Component(s)	Classification of Area in Which Components Exist	Survey Requirements	
		Scan Surveys and Static (Total Activity) Measurements	Removable Contamination Measurements
Drain system collection points such as accumulator tanks, sumps and outfalls	All	Scan surveys, total surface activity measurements and removable contamination measurements will be collected in sumps and at drain system outfalls as applicable. Sediment samples will be collected at these locations, if possible.	

[1] Scan surveys and static measurements are not practical for these locations due to the small geometry of the drain system components.
[2] Some disassembly of system components may be necessary to complete these surveys.

The mechanical system survey frequencies described above are the minimum survey requirements. Additional surveys may be necessary to adequately access internal contamination levels. If additional survey locations are determined to be necessary, the survey package instructions will provide guidance.

If contamination is detected during the previous survey schemes, then additional surveys or removal of components may be required at various locations. This may require disassembly of components downstream of the affected location. Additional instruction will be provided in the survey package instructions.

18.9 Survey Investigation Levels

Investigation levels are used to flag locations that require special attention and further investigation to ensure areas are properly classified and adequate surveys are performed. These locations are marked and receive additional investigations to determine the concentration, area, and extent of the contamination. The survey investigation levels for each type of measurement is listed by classification in Table 19.6.

Table 19.6 Survey Investigation Levels

Survey Unit Classification	Flag Direct Measurement or Sample Result When:	Flag Scanning Measurement Result When:	Flag Removable Measurement Result When:
Class 1	>5,000 dpm/100cm^2	>MDC	> 1000 dpm/100cm^2
Class 2	>5,000 dpm/100cm^2	>MDC	> 1000 dpm/100cm^2
Class 3	>MDC	>MDC	> 200 dpm/100cm^2

18.10 Survey Documentation

A survey package will be developed for each survey unit containing the following:

- Survey Instruction Sheets
- General survey requirements
- Instrument requirements with associated MDCs, count times and scan rates
- Survey Maps
- Overview maps detailing survey locations and placement methodology

- Survey sub-unit maps with additional sample location information, as needed
- Survey Data Sheets
- Signature of Data Collector and Reviewer

18.11 Data Validation

Field data will be reviewed and validated to ensure:

- Completeness of forms and that the type of survey has correctly been assigned to the survey unit.
- The MDCs for measurements meet the established data quality objectives; independent calculations will be performed for a representative sample of data sheets and survey areas.
- Instrument calibrations and daily functional checks have been performed accurately and at the required frequency.

18.12 Sample Chain-of-Custody

The sample chain-of-custody maintains the integrity of the sample; that is, there is an accurate record of sample collection, transport, analysis, and disposal. This ensures that samples are neither lost nor tampered with, and that the sample analyzed in the laboratory is actually and verifiably the sample taken from a specific location in the field. Samples sent off-site for analysis will use an approved Chain of Custody Procedure.

19.0 Data Quality Assessment (DQA) and Interpretation of Survey Results

The statistical guidance contained in Section 8 of MARSSIM will be used to determine if areas are acceptable for unrestricted release, and whether additional surveys or sample measurements are needed.

19.1 Preliminary Data Review

A preliminary data review will be performed for each survey unit to identify any patterns, relationships or potential anomalies. Additionally, measurement data is reviewed and compared with the DCGLs and investigation levels to identify areas of elevated activity and confirm the correct classification of survey units. If an area is misclassified with a less restrictive classification, the area will be upgraded and surveyed accordingly.

The following preliminary data reviews will be performed for each survey unit:

- Calculations of the survey unit mean, median, maximum, minimum, and standard deviation for each type of reading.
- Comparison of the actual standard deviation to the assumed standard deviation used for calculating the number of measurements. If the actual standard deviation is greater than estimated, the minimum number of samples shall be calculated using the actual standard deviation to ensure a sufficient number of samples have been obtained.
- Comparison of survey data with applicable investigation levels.

19.2 Determining Compliance

For Class 1 areas, if it is determined that all total activity results are less than the applicable DCGL, then no further statistical tests are required. If any of the total activity measurements are greater than the $DCGL_W$, then the survey unit fails and the null hypothesis is not rejected. The survey unit is determined to meet the release criterion provided that the application of any unity rules result in values less than 1.

The Sign test is used to determine the minimum number of sample locations. However, the Sign test is not performed in this survey design because the total activity DCGL is used as a maximum. If all measurements are less than the DCGL, performance of the Sign test is not necessary because the survey unit will pass the Sign test by definition.

For Class 2 and Class 3 areas, data results are initially compared to the investigation levels. These investigation levels are provided to help ensure that survey units have been properly classified. If all data results in Class 2 or 3 areas are less than the investigation levels, then the survey unit is determined to meet the release criterion. If these investigation levels are exceeded, then an investigation is performed to verify the initial assumptions for classification and determine the appropriate resolution (e.g., additional scans or survey unit reclassification).

Class 3 survey units, by definition, are not expected to contain residual activity above a small fraction of the DCGL(s). Therefore, if contamination is detected exceeding the DCGLs, then reclassification is required. However, reclassification of the entire survey unit may or may not be appropriate. The area containing the residual activity may have been an isolated case and reclassification of the entire survey unit would be inappropriate. More appropriately, the affected portion of the survey unit may be separated and only that portion reclassified. The RSO will evaluate the survey results, assign additional scan surveys, as appropriate, and determine the appropriate course of action.

Removable contamination measurements will be compared directly to the applicable DCGL. No contingency is established for elevated removable contamination. Therefore, if any removable contamination is detected which exceeds the removable contamination DCGL, then the survey unit is determined not to meet the release criterion. However, if all removable contamination measurements are less than the removable contamination DCGL, then compliance shall be determined based on total activity measurements.

Compliance will be determined for each applicable type of total activity measurement performed in each survey unit (i.e., gross beta total activity measurements and gross gamma total activity measurements). Locations with multiple isotopes present will be evaluated by the unity rule.

19.3 Mechanical System Survey Data Analysis

If any measurement exceeds the applicable DCGL, then the survey unit does not meet the release criterion and is considered contaminated. Remediation or removal of the affected system components may be required. If all measurements are less than the applicable DCGL, then the system meets the release criterion and is considered releasable. Results of mechanical system surveys will be compared directly with the DCGL. This

comparison will consider the applicable DCGL as a maximum value, rather than an average.

If any measurement exceeds the applicable DCGL, then the survey unit does not meet the release criterion and is considered contaminated. Remediation or removal of the affected system components may be required. If all measurements are less than the applicable DCGL, then the system meets the release criterion and is considered releasable.

Table 19.1 – Building Surfaces and Structures Data Compliance Overview

Classification	Survey Result	Conclusion
Class 1	• All measurements < $DCGL_W$, and • Results of applicable unity rules ≤ 1	Survey unit meets release criterion
	• Any measurement > $DCGL_W$, or • Result of unity rule >1	Survey unit does not meet release criterion
Class 2	• All measurements < applicable investigation levels, and • Results of applicable unity rules ≤ 1	Survey unit meets release criterion
	• Average > applicable investigation levels, and • All measurements < $DCGL_W$	Survey unit may meet release criterion. Perform evaluation of elevated activity and determine if additional surveys and/or reclassification are warranted.
	• Any measurement > $DCGL_W$, or • Results of applicable unity rule >1	Survey unit does not meet release criterion
Class 3	• All measurements < applicable investigation levels, and • Results of applicable unity rules ≤ 1	Survey unit meets release criterion
	• Average > applicable investigation levels, and • All measurements <$DCGL_W$	Survey unit may meet release criterion. Perform evaluation of elevated activity and determine if additional surveys and/or reclassification are warranted.
	• Any measurement >$DCGL_W$, or • Result of unity rule >1	Reclassify survey unit or portion of survey unit, if justification for splitting the survey unit is provided. Survey unit does not meet release criterion as it exists

20.0 Final Report

A Final Report summarizing D&D activities performed at the PGRD facility shall be prepared and submitted to the NRC. The guidance provided in NUREG 1727 will be used to prepare the final report. The following outline is an example of the contents of a Final Status Survey Report.

1.0 INTRODUCTION
- 1.1 Reason for Decommissioning
- 1.2 Management Approach

2.0 DESCRIPTION OF THE SITE
- 2.1 Location
- 2.2 Prior Use
- 2.3 Ownership

21.0 References

- PGRD Kalamazoo Facilities Decontamination and Decommissioning Plan, November 2003
- NRC Regulations 10 CFR 20 Subpart E
- NUREG-1575, "Multi-Agency Radiation Survey and Site Investigation Manual" (MARSSIM)
- NUREG-1505, "A Nonparametric Statistical Methodology for the Design and Analysis of Final Decommissioning Surveys"
- NUREG 1507, "Minimum Detectable Concentrations with Typical Radiation Survey Instruments for Various Contaminants and Field Conditions"
- NUREG 1727, "NMSS Decommissioning Standard Review Plan," September, 2000.
- NUREG 1757, Volume 1 "Consolidated NMSS Decommissioning Guidance," September, 2002
- PGRD Radioactive Materials License Number 21-00182-03

Appendix A

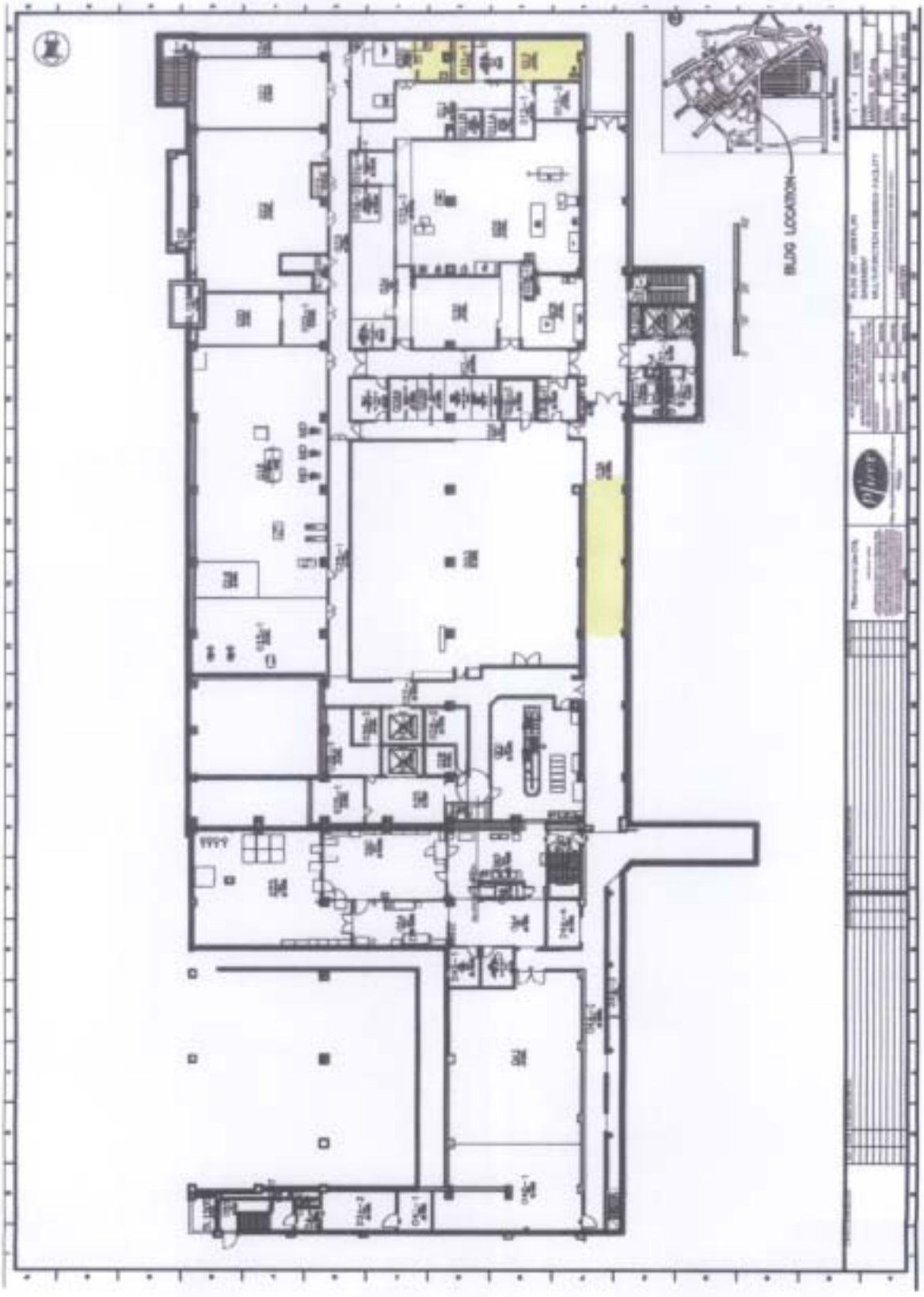
Building 267
Survey Unit Table

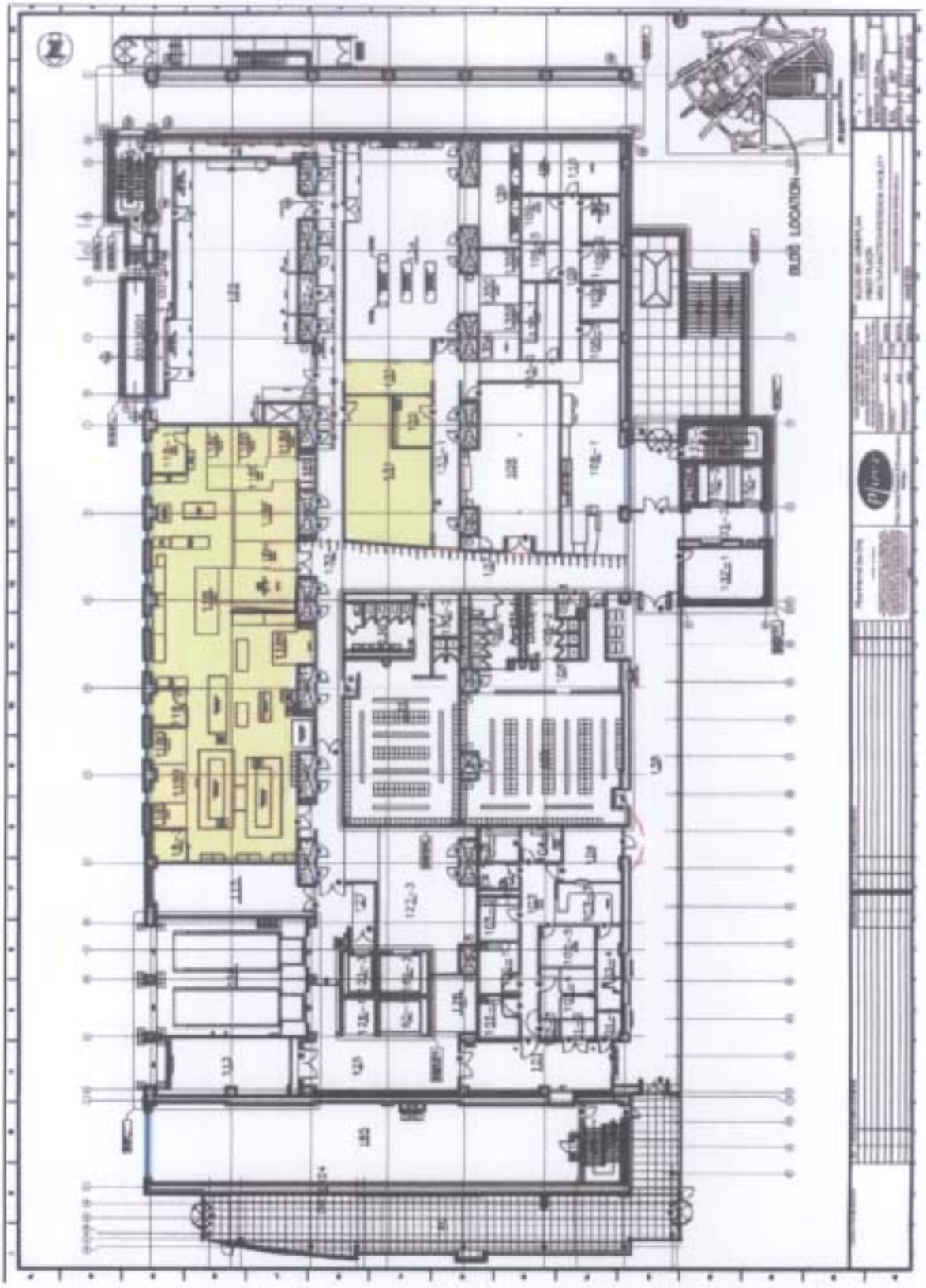
SURVEY UNIT (Bldg,Floor,Unit)	ROOM	CLASS
267-0-001	011-1, 012, 038	2
267-0-002	All others areas of floor 0	3
267-1-001	118, 118-1, 118-2, 118-3, 118A, 118B, 118C 118E, 118F, 118H, 118J, 118L, 118N 118Q, 118R, 118S	2
267-1-002	131, 132, 133	2
267-1-003	All other areas of 1st floor	3
267-2-001	All areas of 2nd floor	Non-Impacted
267-3-001	301, 302, 303, 304, 305, 306, 307	2
267-3-002	308-1,310, 311, 312	2
267-3-003	315, 316, 317, 318, 319, 320	2
267-3-004	324	2
267-3-005	328-1	2
267-3-006	331-2	2
267-3-007	333-2	2
267-3-008	All other areas of 3rd floor	3
267-4-001	401, 401-3, 402, 402A 403, 403A, 403B, 404, 404A, 404B 405, 405A, 405B 406, 406-A, 406-B, 407	2
267-4-002	409, 409-1, 409-2, 409A 410, 410-1, 410A, 410B 411, 411-1, 411A, 411B 412, 412-1, 412A, 412B	2
267-4-003	417	2
267-4-004	419	2
267-4-005	424, 424-3, 424-4	2
267-4-006	429	2
267-4-007	434, 434-1, 434-2, 435, 436, 436-1, 436-2, 436-3	2
267-4-008	All other areas of 4th floor	3
267-5-001	502, 503	2
267-5-002	505, 505-1, 505-2A, 505-2B, 506, 506-1, 506-2A, 506-2B, 507, 507-1, 507-2A, 507-2B	2
267-5-003	508-1, 509, 509-1, 509-2A, 509-2B, 510, 510-1, 510-2A, 510-2B, 511, 511-1, 511-2A, 511-2B 512, 512-1, 511-2A, 512-2B	2
267-5-005	514-2	2
267-5-004	531, 531-2A	2
267-5-005	532, 532-1, 532-2, 533, 533-2, 508-2, 534, 534-1, 535	2
267-5-005	All other areas of 5th floor	3
267-6-001	601-1, 626-1	2
	602, 602-1, 602A, 602B 603, 603-1, 603A, 603B 604, 604-1, 604A, 604-B	

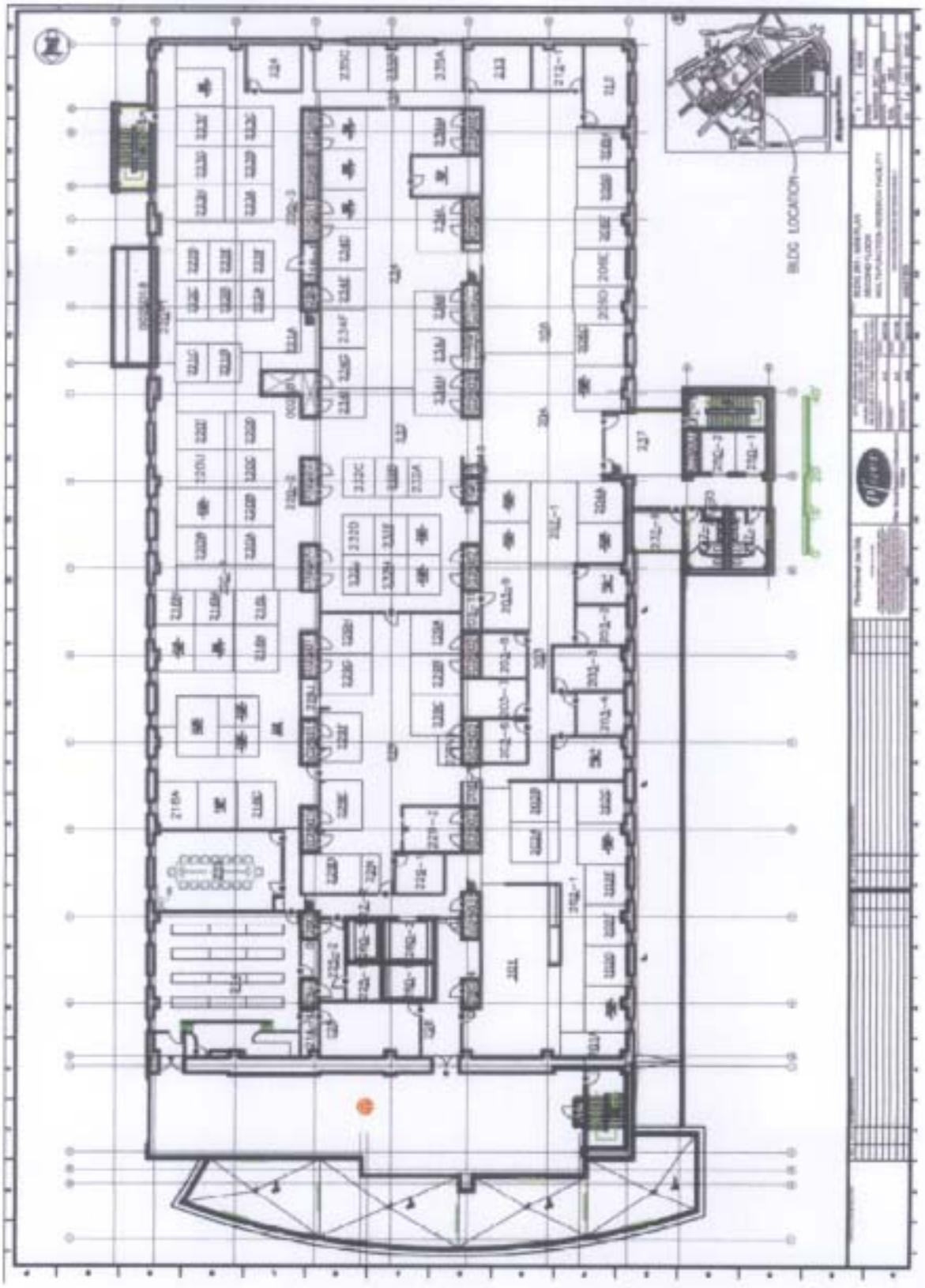
SURVEY UNIT (Bldg,Floor,Unit)	ROOM	CLASS
267-6-002		2
267-6-003	606, 606-1, 606A, 607, 607-1, 607A, 607B	2
267-6-004	610, 610-1, 610A, 610B	2
267-6-006	616, 617, 618, 619, 620	2
267-6-005	629, 629-1, 629-2, 630, 630-1, 631, 634	2
267-6-007	All other areas of 6th floor	3

Appendix B

Building 267
Floor Plan Drawings
Class 2 Survey Units Highlighted


BLDG LOCATION

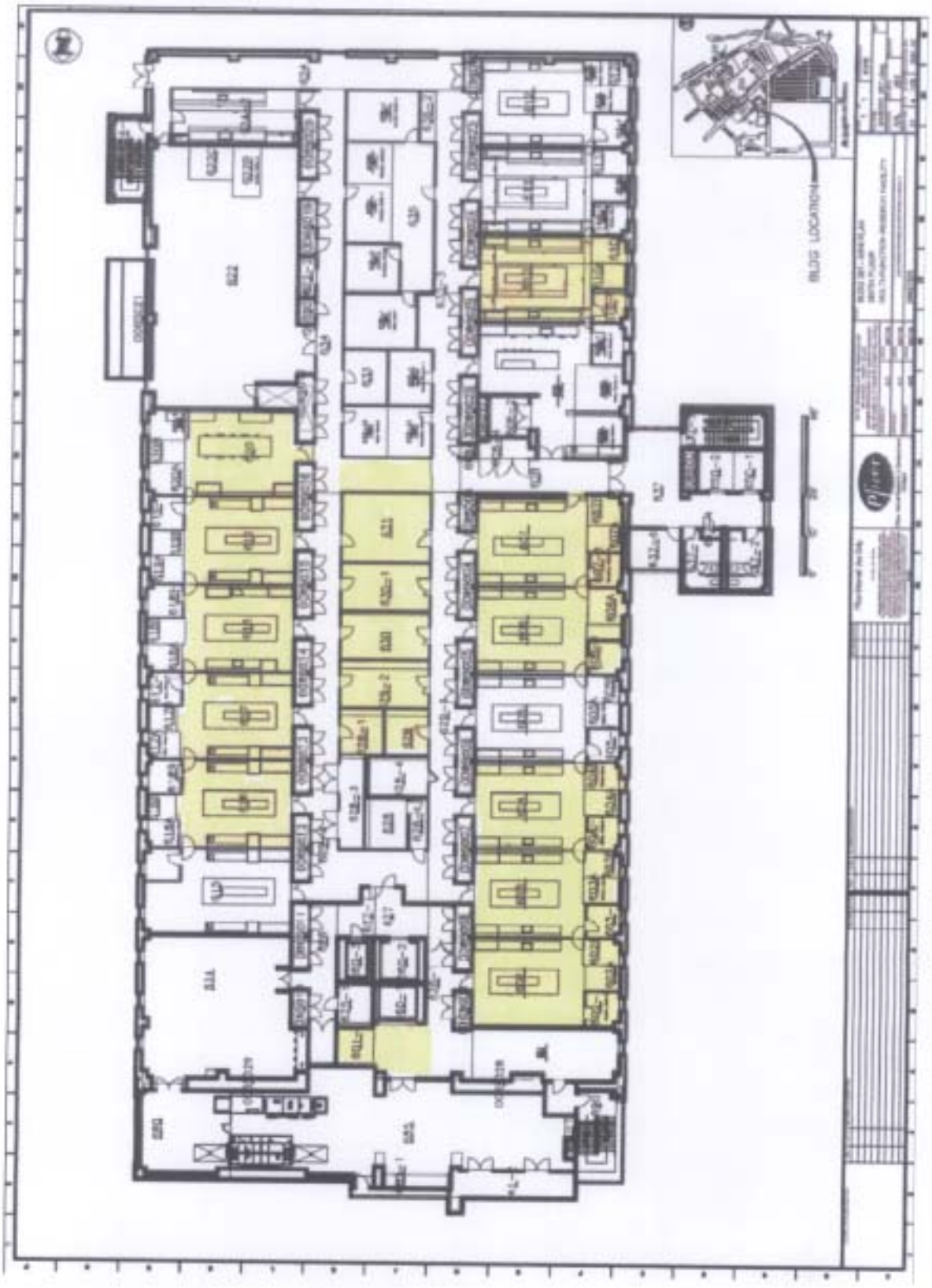

BLDG LOCATION


BLDG LOCATION


BLDG LOCATION


BLDG LOCATION


BLDG LOCATION


BLDG LOCATION