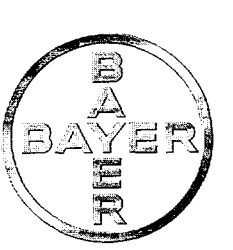
Bayer HealthCare
Pharmaceuticals



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06-13053-04
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John Nicholson
Nuclear Materials Safety Branch 2
Division of Nuclear Materials Safety
United States Nuclear Regulatory Commission
Region I
475 Allendale Road
King of Prussia, PA 19406-1415

Dear Mr. Nicholson,

Enclosed please find Bayer Pharmaceutical Corporation's Decontamination and Decommissioning Plan prepared by Philotechnics. Philotechnics completed their work on February 2, 2007. We should have a final report within a few weeks. At that time, we will send a copy to you and request our license to be terminated.

Also, we would like to appoint Peter Babin as Radiation Safety Officer. Peter has been in the Radiation Safety group at Bayer since 1997 and worked in the Radiation Safety group at University of Connecticut health Center prior to Bayer. He has extensive experience and will work with you to terminate Bayer's License 06-13053-04. Enclosed please find Peter Babin's c.v. for your records.

If you have any questions, please do not hesitate to call.

Sincerely,

William Galdenzi

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Bayer Pharmaceuticals Corporation
West Haven, CT Facility
Decontamination and Decommissioning Plan

Bayer Pharmaceuticals Corporation
400 Morgan Lane
West Haven, CT 06516

U.S. Nuclear Regulatory Commission
Radioactive Materials License No. 06-13053-04

January 2007

Prepared by:
Philotechnics, Ltd.
201 Renovare Blvd.
Oak Ridge, TN 37830

TABLE OF CONTENTS

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
HSA	Historical Site Assessment
HVAC	Heating , Ventilation, Air Conditioning
MARSSIM	Multi-Agency Radiation Survey and Site Investigation Manual
MDC	Minimum Detectable Concentration
NMSS	Nuclear Materials Safety and Safegaurds
NRC	U.S. Nuclear Regulatory Commission
NUREG	Nuclear Regulatory Commission Guidance Document
QAPP	Quality Assurance Project Plan
RSO	Radiation Safety Officer
RSC	Radiation Safety Committee
TEDE	Total Effective Dose Equivalent

1.0 Introduction

Bayer Pharmaceutical Corporation (Bayer) is planning to perform a radiological decontamination and decommissioning (D&D) of their pharmaceutical research facilities located at 400 Morgan Lane, West Haven, CT. The pharmaceutical research laboratories were contained in Buildings A21, B24, B31 and B36.

The goal of decommissioning is to achieve unrestricted release of the site. Bayer has contracted Philotechnics Ltd. to perform the decommissioning activities including characterization, remediation, final status surveys and development of a final report.

Radioactive materials used at the West Haven facility consisted of a variety of radionuclides used in pharmaceutical research. These included H-3, C-14, P-32, P-33, S-35 and I-125.

This plan was developed using the guidance provided in 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, Volume 2, Appendix H 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 a fraction of the release criteria for unrestricted use specified in 10 CFR 20 Subpart E, 25 mrem/yr. Bayer has an internal administrative goal of an average Total Effective Dose Equivalent less than 1 mrem/yr to the average member of the critical group.

1.1 General Facility Description

The Bayer property in West Haven, Connecticut consists of approximately 130 acres containing 19 buildings. Pharmaceutical research utilizing radioactive materials was performed in specific laboratories located in Buildings A21, B24, B31 and B36 only.

2.0 Historical Site Assessment

The purpose of the historical site assessment (HSA) is to determine the current 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.

Philotechnics conducted extensive reviews of facility records during the week of December 14-18, 2006. The records review included: radioactive materials licenses, license applications, amendment requests, radiological surveys, radionuclide receipt and distribution records, incident reports, blueprints, plans and design specifications.

2.1 Radioactive Materials License

The West Haven Facility currently operates under U.S. Nuclear Regulatory Commission Radioactive Materials License Number 06-13053-04, Amendment #11, with an expiration date of July 31, 2014. Radioactive materials usage at the site consisted of pharmaceutical research and development as defined in 10CFR 30.4: animal studies. Current possession limits are provided in Table 2.1.

Table 2.1 –Current License Possession Limits

Isotope	Physical Form	Possession Limit
Any byproduct material with atomic numbers 1 through 83 with a physical half-life less than or equal to 120 days	Any	Not to exceed 100 millicuries per radionuclide and 1 curie total
Hydrogen-3	Any	5 curies
Carbon-14	Any	5 curies
Phosphorous-32	Any	10 curies
Phosphorous-33	Any	10 curies
Sulfer-35	Any	10 curies
Chlorine-36	Any	10 millicuries
Calcium-45	Any	350 millicuries
Iron-55	Any	100 millicuries
Iodine-125	Any	1 curie
Iodine-131	Any	1 curie
Gadolinium-153	Any	10 millicuries
Nickel-63	Sealed Sources	500 millicuries

2.2 Potential Contaminants

Based on the HSA a list of potential contaminants was determined. Table 2.2 – Radionuclides Used in Unsealed Form

Isotope	Half-Life	Last Use
C-14	5730 y	December 2006
H-3	12.3 y	December 2006
I-125	60.2 d	December 2006
P-32	14.3 d	~1997
P-33	25.4 d	December 2006
S-35	87.9 d	December 2006

, is a list of radionuclides used in unsealed form at the West Haven Facility. Deleted:

Table 2.2 – Radionuclides Used in Unsealed Form

Isotope	Half-Life	Last Use
C-14	5730 y	December 2006
H-3	12.3 y	December 2006
I-125	60.2 d	December 2006
P-32	14.3 d	~1997

P-33	25.4 d	December 2006
S-35	87.9 d	December 2006

After considering amounts of radionuclides used, the locations of use, and the impact of radioactive decay, nuclides of concern are C-14, H-3, I-125, P-33 and S-35. P-32 has not been used at the site for approximately 10 years. Based on its short half-life, it was excluded as a nuclide of concern.

Several Ni-63 sealed sources were utilized at the site. The majority of these have been returned to the manufacturer for disposal. The remaining sealed source will be returned to their manufacturer for disposal at the time of the decommissioning activities. A review of sealed source leak tests for the last three years was performed during the HSA. All leak test results were satisfactory.

2.3 Previous Decommissioning Activities

Bayer has performed various decommissioning activities over the years at the West Haven facility. Several commissioned laboratories were decommissioned either by Bayer personnel or outside contractors as needed over the years as needed. These included laboratories in Building A21, B31 and B24. Several of these area will be included as part of this decommissioning plan as verification of the surveys previously performed.

3.0 Release Criteria

The radiological release criteria of NRC 10CFR20 Subpart E for unrestricted use will be adjusted to meet Bayer's administrative goal and used for decommissioning the buildings. Specifically the buildings and facilities being released under this decommissioning effort will be surveyed in accordance with the guidance contained in MARSSIM to demonstrate compliance with a fraction of the criteria specified in 10CFR20.1402 Radiological Criteria for Unrestricted Use. The specified 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).

3.1 Default Screening Values

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 nuclides 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).

The nuclides of concern screening values for surfaces under default conditions (generic screening levels) from the NRC DandD software (or NUREG 1757) are provided in Table 3.1.

Table 3.1 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
S-35	60 days	Beta	1.3E7
P-33	25.4 days	Beta	3.7E7
I-125	60 days	Gamma	6.5E5

3.2 Project Release Criteria

The default screening values are the basis for developing the derived concentration guideline levels (DCGL's) or release criteria for the project. The $DCGL_W$ 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. At Bayer's request, the chosen release criterion has been reduced to values that will result in a TEDE to an average member of the critical group that does not exceed 1 mrem per year.

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. $DCGL_{EMC}$ is not expected to be used for the West Haven Facility decommissioning project since contamination levels throughout the facility are expected to be significantly less than the chosen release criteria.

Table 3.2 – Decommissioning Release Criteria

Isotope	Emission Type	Total Activity $DCGL_W$ ($dpm/100cm^2$)	Removable Activity Limit ($dpm/100cm^2$)
H-3	Beta	4.8E6	4.8E5
C-14	Beta	1.4E5	1.4E4
S-35	Beta	5.2E5	5.2E4
P-33	Beta	1.4E6	1.4E5
I-125	Gamma	2.6E4	2.6E3

Additionally, a reasonable effort shall be made to decontaminate any detectable contamination in support of the ALARA principle.

4.0 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.

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.

5.0 Planned Decommissioning Activities

As 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.

5.1 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.

5.2 Contaminated Systems and Equipment

Ventilation 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.

6.0 Survey Instrumentation

6.1 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.

6.2 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.

6.3 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:

6.3.1 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 for beta emitters or 0.5 for gamma emitters)
A	=	detector probe area in cm^2

6.3.2 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 for beta emitters or 0.5 for gamma emitters)
A = detector probe area in cm^2

6.3.3 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

6.4 Counting Uncertainty

The counting uncertainty for both total and removable measurements will be calculated using equation 6-15 from MARSSIM:

$$\sigma = 1.96\sqrt{\frac{C_{s+b}}{T_{s+b}^2} + \frac{C_b}{T_b^2}}$$

Where:

σ = uncertainty
1.96 = multiplier to achieve 95% confidence level
C_{s+b} = gross counts of the sample (cpm)
T_{s+b} = Sample time (minutes)
C_b = Gross background counts (cpm)
T_b = Background count time (minutes)

6.5 Instrumentation Specifications

The instrumentation used for facility decommissioning surveys is summarized in the following tables. Table 6.1 lists the standard features of each instrument such as probe size and efficiency. Table 6.2 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.

Deleted:

Table 6.1 – Instrumentation Specifications

Detector Model	Detector Type	Detector Area	Meter Model	Window Thickness	Typical Total Efficiency
NE BP19DD IBP19DD	Beta Scintillation	100 cm^2	NE Electra NE Selectra	0.6 mg/cm^2	4 % (C-14)
NE GP13A IGP13A	Gamma Scintillation	100 cm^2	NE Electra NE Selectra	0.6 mg/cm^2	17 % (I-125)
Ludlum 43-37 Floor Monitor	Gas Flow Proportional	582 cm^2	Ludlum 2221	0.6 mg/cm^2	7 % (C-14)
Packard TriCarb	Liquid Scintillation	N/A	N/A	N/A	60% (H-3) 80% (C-14)

Table 6.2 – Typical Instrument Operating Parameters and Sensitivities

Measurement Type	Detector Model	Meter Model	Scan Rate	Count Time	Background (cpm)	MDC ($dpm/100cm^2$)
Surface Scans	BP19DD IBP19DD	NE Electra NE Selectra	4 in./sec.	N/A	500	10,406 (C-14)
Surface Scans	GP13A IGP13A	NE Electra NE Selectra	4 in./sec.	N/A	3000	5,998 (I-125)
Surface Scans	Ludlum 43-37 Floor Monitor	Ludlum 2350-1	10 in./sec.	N/A	1000	2,285 (C-14)
Total Surface Activity	BP19DD IBP19DD	NE Electra NE Selectra	N/A	60 sec.	500	3,828 (C-14)
Total Surface Activity	GP13A IGP13A	NE Electra NE Selectra	N/A	60 sec.	3000	2,155 (I-125)
Removable Beta Activity	Packard TriCarb	N/A	N/A	60 sec.	25 (H-3) 15 (C-14)	44 (H-3) 26 (C-14)

7.0 Characterization Surveys

The survey protocol for building surfaces will consist of performing the scanning portion of the final status survey, with judgmental smears and static measurements on the highest probability areas for residual radioactivity. Judgmental static measurements and smears shall also be taken on vertical surfaces as part of the modified Class 2 and Class 3 final status survey protocols described in Section 9.6.

The purpose of scanning is to identify locations of elevated activity. Where elevated activity is identified, a static measurement and smear will be taken at the location of highest activity identified during the scan. Where elevated activity is identified, the boundary of the elevated area will be marked to aid in locating the area for remedial actions. Based on contamination potential, at least five locations in each survey unit will be judgmentally selected to perform static measurements and removable contamination measurements.

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

For areas that are partially contaminated, the characterization survey data can be used as part of the final status survey measurements provided the data used is only from areas with contamination levels below the release criteria, and decontamination work is controlled such that the survey location could not have become cross-contaminated.

Each survey 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

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.

8.0 Remedial Action Surveys

Remediation will be conducted in a such a manner to control the spread of contamination and keep personnel exposures ALARA. Remedial action surveys are conducted in support of remediation activities to help determine when the area is ready for a final status survey and to provide updated estimates for final status survey planning. Remedial action surveys serve to monitor the effectiveness of decontamination efforts and ensure that surrounding areas are not cross-contaminated from remediation actions.

Remedial action surveys will consist of scan surveys, direct measurements and removable contamination measurements. These will be conducted following remediation activities to establish the success or failure of the efforts to decontaminate the applicable survey area. Results of the survey will be the decision basis for continued remediation or conduct of final status surveys.

Remedial action surveys will be designed to meet the objectives of the final status surveys. To the extent allowed by MARSSIM, the results of the remedial action surveys will be used to supplement the final status survey.

9.0 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.

9.1 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. These background measurements will generally be taken within the survey unit in locations away from surfaces where residual contamination is likely to exist. Typical background values for each type of instrument will be provided to the survey technicians as reference. In areas where ambient background varies significantly due to construction materials, multiple background measurements may be collected and applied to the applicable survey measurements.

9.2 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 10% of the DCGLs.
- Scanning will be conducted at a rate to achieve an MDC_{scan} of less than 20% of the DCGLs.
- 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. Bayer reserves the right to modify the β decision error.
- 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.

9.3 Area Classifications

Based on the results of the historical site assessment and previous survey results, facility areas have been classified as impacted areas or non-impacted areas.

9.3.1 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, a 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 characterization and will provide adequate assurance that any residual contamination is contained within the building structure.

9.3.2 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:

9.3.3 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.

9.3.4 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.

9.3.5 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.

9.4 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 units will be established for the impacted areas of the facility. Only areas in buildings A21, B24, B36 and B36 are considered to be impacted. Initially, all actively commissioned use areas will be considered Impacted-Class 2 survey units. Class 3 areas will be established for areas adjacent to the Class 2 areas as well as areas that were previously decommissioned.

9.5 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 9.1 summarizes the percentage of accessible building structural surfaces to be scanned based on classification.

Deleted: Table 9.1

Table 9.1 – Scan Survey Coverage by Classification

Structure	Class 1	Class 2	Class 3
Floors	100%	100%	50%
Other Structures	100%	50%	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 will be taken to quantify the activity. However, total surface activity measurements are in addition to the static measurements required for the statistical test.

9.6 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.

9.6.1 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.

9.6.2 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

9.6.3 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.

9.6.4 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.

9.6.5 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.

The guidance in MARSSIM recommends simple random measurement patterns for Class 3 survey units to ensure that the measurements are independent and support the assumptions of the statistical tests. However, for the purposes of this plan, Bayer will choose measurements locations on a judgmental basis. Bayer feels that selecting measurement locations in areas of higher contamination potential will better assess residual contamination in Class 3 areas (high traffic areas, potential spill areas, areas with limited housekeeping and collection points, such as floor cracks or crevices). The survey technician will choose these locations at the time of the survey.

For Class 2 and Class 3 survey units, the sensitivity for scanning techniques is not tied to the area between measurement locations as they are for Class 1 areas. The scanning techniques selected will represent the best reasonable effort based on the survey data quality objectives.

Table 9.2 – 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	Judgmental
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.

9.6.5.1 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.

9.6.5.2 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 floor surfaces and applicable permanent equipment and/or furnishings. Sample locations will be chosen on floor, lower wall (<2m) and permanent equipment surfaces at the discretion of the survey technician. Measurement locations will be biased towards areas with the highest potential of residual contamination. Each chosen location will be plotted on the applicable survey map.

9.7 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.

9.8 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.

9.8.1 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 initial survey requirements are summarized in Table 9.3.

Table 9.3 – 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.

9.8.2 Vacuum System

Surveys of building vacuum system internals will consist of removable contamination measurements of 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 9.4.

Table 9.4 – 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
General ventilation and fume hood exhaust ducts	Class 1	N/A[1]	At least one smear/swipe on the internal surfaces of 100% of the existing vacuum inlet points[2]
	Class 2	N/A[1]	At least one smear/swipe on the internal surfaces of 50% of the existing vacuum inlet points[2]
	Class 3	N/A[1]	At least one smear/swipe on the internal surfaces of 20% of the existing vacuum inlet points[2]
Collection points within ventilation fan units	All	N/A[1]	At least one smear/swipe 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.

9.8.3 Drain Systems

Surveys of building drain system internals will consist of surveys of accessible sink drains, sink drain traps, floor drains and collection points such as sumps and outfalls. Removable contamination surveys of sink drains, sink drain traps 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 9.5.

Table 9.5 – 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, sink drain traps and floor drains[2].
	Class 2	N/A[1]	At least one smear on the internal surfaces of 50% of the existing sink drains, sink drain traps and floor drains[2].
	Class 3	N/A[1]	At least one smear on the internal surfaces of 10% of the existing sink drains, sink drain traps and floor drains[2].
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.

9.9 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 are listed by classification in Table 9.6.

Deleted:

Table 9.6 – 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	> 50% of DCGL	> 50% of DCGL	> 1000 dpm/100cm^2
Class 2	> 20% of DCGL	> 20% of DCGL	> 1000 dpm/100cm^2
Class 3	>MDC	>MDC	> 1000 dpm/100cm^2

9.10 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

9.11 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.

9.12 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.

10.0 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.

10.1 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.

10.2 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 Project Manager 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. If any removable contamination is detected which exceeds a removable contamination limit, 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 using a unity calculation of 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).

Table 10.1 – 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 • Results of applicable unity rules ≤ 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

10.3 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.

11.0 Final Report

A Final Report summarizing D&D activities performed at the facility shall be prepared and submitted to the U.S. Nuclear Regulatory Commission. The guidance provided in NUREG 1727 will be used to prepare the final report. The Final Report will include, at a minimum:

- An overview of the results of the FSS
- A summary of the screening values for the facility (if screening values are used)
- A discussion of any changes that were made in the FSS from what is proposed in this plan
- A description of the method by which the number of samples was determined for each survey unit
- A summary of the values used to determine the number of samples and a justification for these values
- The survey results for each survey unit including the following:
  - The number of samples taken for the survey unit;
  - A description of the survey unit, including (a) a map or drawing showing the reference system and random start systematic sample locations for Class1 and 2 survey units and reference area, as applicable, the random locations shown for Class 3 survey units and reference areas, (b) discussion of remedial actions and unique features, and (c) areas scanned for Class 3 survey units and reference areas;
  - The measured sample concentrations, in units comparable to the screening values;
  - The statistical evaluation of the measured concentrations;
  - Judgmental and miscellaneous sample data sets reported separately from those samples collected for performing the statistical calculations;
  - A discussion of anomalous data including any areas of elevated activity detected during scan surveys that exceeded the investigation levels or any measurement locations in excess of the screening values; and
  - A statement that a given survey unit statisfies the screening values and the elevated measurement comparison if any sample points exceeded the screening values
- A description of any changes in initial survey unit assumptions relative to the extent of residual activity (e.g., material not accounted for during site characterization)
- A description of how ALARA practices were employed to achieve final activity levels.

12.0 References

- 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 2 "Consolidated NMSS Decommissioning Guidance,"
- Bayer Pharmaceuticals Corporation Radioactive Materials License Number 06-13053-04, Amendment No. 11

PETER D. BABIN

[redacted]

OBJECTIVE: Health physics professional seeking employment in related industry.

SUMMARY OF QUALIFICATIONS:

- Extensive Radiation safety experience in academic and private research facilities.
- Advanced education in occupational safety and environmental health and management.
- Experienced with compliance activities required by a NRC type A broad scope license.
- Familiar with structured process safety programs.
- Knowledgeable of federal and state regulations.

PROFESSIONAL EXPERIENCE:

Bayer Healthcare, Pharmaceuticals Division, West Haven, CT ▪ 1997 – Present

Research Safety Specialist

Served as a member of the Environmental Health and Safety group. Provided support for all environmental health and safety functions regarding the Bayer West Haven site including radiation, biological, and chemical safety, industrial hygiene, and emergency response. Predominantly, ensured that radioactive materials use at the Bayer research center was conducted in a manner that was compliant with NRC and State regulations. Managed all aspects of the radioactive waste program, oversaw laboratory compliance inspection activities, and assisted in radioisotope ordering, package receipt, and inventory tracking.

- All NRC inspections of the Bayer West Haven site were 100% violation free.
- Supported a process safety program that lead Bayer's safety performance to one of the best-in-class.
- Initiated a decay-in-storage program that reduced the radioactive waste disposal costs by 50%.

University of Connecticut Health Center, Farmington, CT ▪ 1990 – 1997

Health Physics Technician II

Provided support for all radiation safety functions related to the UCHC research center and John Dempsey hospital. Performed laboratory compliance surveys, calibrated radiation detection instrumentation, and carried out radioactive waste activities. Supported patient care and diagnostic activities involving the use of radioactive materials.

- Assisted in standardizing gamma spectroscopy operation methods to identify and quantify radioisotopes, and perform bioassays.
- Developed SOP's for instrument calibration and environmental analysis.

PETER D. BABIN

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EDUCATION:

- **Environmental Health and Management** · MS - 2004
  University of New Haven,
  West Haven, CT
- **Industrial Hygiene** · Professional Certificate - 2000
  University of New Haven,
  West Haven, CT
- **Radiation Safety Officer** · 40 hour Training - 2000
  CSI Radiation Safety Academy,
  Gaithersburg, MD
- **HAZWOPER General Site Worker** · 40 hour Training - 1999
  Scientech NES, Inc.
  Danbury, CT
- **Industrial Environmental Management** · Certificate - 1997
  Naugatuck Valley Community Technical College,
  Waterbury, CT
- **Environmental Science** · BA - 1992
  Central Connecticut State University,
  New Britain, CT

VOLUNTEER EXERIENCE AND PROFESSIONAL MEMBERSHIP:

Making Science Make Sense	· Educational outreach program	· Volunteer
Old Lyme Conservation Trust	· Open space organization	· Member of the Board
Health Physics Society	· Scientific and professional organization	· Member since 1999

REFERENCES:

Available upon request

This is to acknowledge the receipt of your letter/application dated

2/2/2007, and to inform you that the initial processing which includes an administrative review has been performed.

☑ AMEND. 06-13053-04
There were no administrative omissions. Your application was assigned to a technical reviewer. Please note that the technical review may identify additional omissions or require additional information.

☐ Please provide to this office within 30 days of your receipt of this card

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A copy of your action has been forwarded to our License Fee & Accounts Receivable Branch, who will contact you separately if there is a fee issue involved.

Your action has been assigned **Mail Control Number** 140051.
When calling to inquire about this action, please refer to this control number.
You may call us on (610) 337-5398, or 337-5260.

NRC FORM 532 (RI)
(6-96)

Sincerely,
Licensing Assistance Team Leader