August 10, 2009

Ryan P. Fahey, Project Manager
Philotechnics Limited
25 Mall Road, Suite 301
Burlington, MA 01803

SUBJECT: NRC INSPECTION REPORT NO. 150-00020/09-04 (DNMS)
PHILOTECHNICS LIMITED

Dear Mr. Fahey:

On July 9, 2009, the U.S. Nuclear Regulatory Commission (NRC) completed an on-site reciprocity inspection of decommissioning activities being performed under your Massachusetts Agreement State Materials License No. 56-0543, at the Sigma-Aldrich Company's Fort Mims Facility, located at 11542 Fort Mims Drive, Maryland Heights, Missouri. At the conclusion of the July 9, 2009, on-site inspection, the NRC inspectors discussed the preliminary findings with you, members of your staff, and representatives of the Sigma Aldrich Chemical Company. On July 24, 2009, the inspectors completed an in-office review of the NRC inspection findings, and held a final exit meeting by telephone with you, members of your staff, and Mr. Thomas Spencer, Radiation Safety Officer, Sigma-Aldrich Company.

This inspection was an examination of decommissioning activities conducted under your license as they relate to radiation safety and to compliance with the Commission's rules and regulations and with the conditions of your license. The inspection included an evaluation of licensing and reciprocity documentation and an examination of project specific procedures, worker training, and interviews with personnel. Additionally, on July 8-9, 2009, NRC inspectors completed a Confirmatory Radiological Survey at the Fort Mims Facility. The purpose of the NRC's Confirmatory Survey was to assess and confirm the effectiveness of the Philotechnic's decommissioning and decontamination activities relating to the Fort Mims Facility. Specifically, the Confirmatory Survey included independent NRC radiological surveys, the collection of wipe samples to test for removable contamination, and a review of the Philotechnics final status survey packages for the Fort Mims Facility. Specific areas examined during the inspection are identified in the enclosed report.

Based on the results of this inspection, no violations of NRC or license requirements were identified. Additionally, based on the NRC's confirmatory survey findings, and NRC review of final status survey packages for the Fort Mims Facility, the NRC has no further questions regarding the unrestricted use of the Fort Mims building. Thus, NRC has no objection to the initiation of Phase 2, which is described in Sigma-Aldrich Company's letter dated October 22, 2008, involving, the characterization, evaluation and final status survey of the site soils following the demolition of the building.

In accordance with 10 CFR 2.390 of the NRC's "Rules of Practice," a copy of this letter and its enclosure will be available electronically in the NRC Public Document Room or from the Publicly Available Records (PARS) component of NRC's Agencywide Documents Access and management System (ADAMS). The NRC's document system is accessible from the NRC Web site at http://www.nrc.gov/reading-rm/adams.html.

We will gladly discuss any questions you may have regarding this NRC Inspection.

Sincerely,

/RA/

Patrick L. Louden, Deputy Director
Division of Nuclear Materials Safety

Massachusetts Agreement State License No. 56-0543
Docket No. 150-00020

Enclosure:
IR 150-00020/09-04 (DNMS)

cc w/encls: R. Walker, Massachusetts Department of Health, Radiation Control Program
J. Langston, Missouri Department of Health and Senior Services (MDHSS)
K. Henke, MDHSS
J. Deel, State Historic Preservation Office
S. Cave, Missouri Department of Conservation

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U.S. NUCLEAR REGULATORY COMMISSION

REGION III

Docket No.:	150-00020
License No.:	56-0543
Report No.:	150-00020/09-04 (DNMS)
Licensee:	Philotechnics Limited
Client:	Sigma-Aldrich Chemical Company
Work Location:	Sigma-Aldrich Chemical Company Fort Mims Facility 11542 Fort Mims Drive Maryland Heights, Missouri
Dates:	May 6, 2009 (In-process Inspection) June 3-4, 2009 (In-process Inspection) July 8-9, 2009 (NRC Confirmatory Survey and Interim Exit) July 24, 2009 (Final Exit by Telephone)
Inspectors:	George McCann, Senior Health Physicist Peter Lee, Ph.D, CHP, Health Physicist Eugenio Bonano, Health Physicist Jeremy Tapp, Health Physicist Katie Streit, Health Physicist Lionel Rodriguez, Reactor Engineer (NSPDP)
Approved By:	Christine Lipa, Chief Material Controls, ISFSI and Decommissioning Branch Division of Nuclear Materials and Safety

EXECUTIVE SUMMARY
Philotechnics Limited
Inspection Report No. 150-00020/09-04 (DNMS)

Philotechnics is an Agreement State licensee working under NRC reciprocity to conduct decontamination and decommissioning (D&D) activities at the Sigma Aldrich Company (SAC) facility located at 11542 Fort Mims Drive, Maryland Heights, Missouri. Philotechnics was allowed to perform these activities in conjunction with SAC's decommissioning plan, which was approved by the NRC on May 12, 2009. The SAC decommissioning plan approved a phased decommissioning approach for the D&D of the facility and site. The first decommissioning phase involved remediation and decontamination of the building to radiological levels below the NRC's radiological unrestricted use limits. The next phase involves the demolition of the building down to the concrete slab, and characterization of the site soils. The initiation of the second phase is contingent on the results of this NRC inspection and confirmatory survey findings.

The NRC inspection focused on evaluating the D&D activities performed by Philotechnics, including: management controls, radiation protection practices, remediation activities, conduct of surveys, and documentation of final status survey reports. During the inspection, the inspectors discussed the status of decommissioning activities with Philotechnics and SAC personnel, examined the Agreement State license, reviewed procedures and final status survey packages, and performed confirmatory surveys of the facility.

The use of radioactive materials at SAC's Fort Mims site consisted of research and development activities as defined in 10 CFR 30.4, and storage, processing and use in the production of labeled compounds for distribution to authorized customers. The licensee used radioactive materials in specific areas of the building since 1975, ceasing production activities on September 30, 2008. The radioactive materials used at the Fort Mims facility that are significant to NRC decommissioning requirements involved curie amounts of carbon-14 and hydrogen-3.

Management Organization and Controls (IP 88005)

- The inspectors concluded that the management organization and controls in place concerning the D&D project of the SAC Fort Mims Facility were adequate. Furthermore, the inspectors determined that a clear separation of responsibilities existed between the SAC and Philotechnics organizations. (Section 1)

Radiation Protection (IP 83822)

- The inspectors concluded that the licensee was in compliance with NRC regulations and Agreement State license requirements relating to radiation protection. The inspectors further determined that the licensee was compliant with SAC's NRC approved decommissioning plan. The inspectors also noted that the SAC personnel were monitoring the licensee's D&D activities pursuant to SAC's approved NRC decommissioning plan. (Section 2)

OSHA Interface Activities (IP 93001)

- The inspectors did not identify any noncompliance issues pertaining to the U.S. Occupational, Safety and Health Administration (OSHA) requirements. (Section 3)

Inspection of Transportation Activities and Radioactive Waste Management (IP 88035 & 86740)

- The inspectors concluded that the licensee complied with NRC and U.S. Department of Transportation (DOT) regulatory requirements for the handling and transportation of radioactive waste. (Section 4)

Closeout Inspection and Survey (IP 83890)

- The inspectors concluded that the licensee complied with NRC regulatory requirements and decommissioning plan requirements for the decommissioning of the Fort Mims Facility, and that the NRC has no objection with the licensee and SAC proceeding with Phase 2 of the decommissioning plan. (Section 5)

Report Details[1]

1.0 Management Organization and Controls (IP 88005)

a. Inspection Scope

The inspectors interviewed Philotechnics and SAC management and observed controls implemented by the two organizations during the conduct of decommissioning activities. The inspectors reviewed audit documents, the Philotechnics license, and associated corporate documents such as the licensee's program operating procedures, and the Sigma-Aldrich, Fort Mims Facility Decontamination and Decommissioning Plan Facility Management and Oversight Agreement.

b. Observations and Findings

The licensee's activities were performed according to the Philotechnics license, and the SAC and Philotechnics contract agreement. The licensee performed decommissioning and survey work using only Philotechnics personnel. The SAC on-site personnel functioned in an audit capacity to ensure compliance with the SAC and Philotechnics Agreement. The licensee required the SAC on-site personnel to complete and comply with Philotechnics training and operating requirements prior to allowing unescorted access to the facility. A clear distinction of responsibilities between SAC and Philotechnics personnel was observed. The inspectors also met with the Philotechnics regional manager, who was in the process of confirming on-site personnel compliance with corporate management oversight requirements.

The Philotechnics corporate management documents, such as radiological training and audit documents, and radiological work permits were completed according to license and operating requirements. Further, personnel resumes for project personnel, such as the project manager and site radiation safety officer (RSO), were compliant with licensee experience and training qualifications. The inspector's interviews with Philotechnics management and technical personnel verified personnel qualifications were consistent with program requirements.

c. Conclusion

The inspectors concluded that the management organization and controls in place concerning the D&D project of the SAC Fort Mims Facility were adequate. Furthermore, the inspectors determined that a clear separation of responsibilities existed between the SAC and Philotechnics organizations.

2.0 Radiation Protection (IP 83822)

a. Inspection Scope

The inspectors observed and evaluated licensee personnel during the conduct of decontamination activities, which included: the demolition of interior structures such as laboratory counters and exhaust hoods, ventilation ducts, sinks, and drains, the conduct

[1] A List of acronyms used in the report is included at the end of the Report Details.

of personnel and area radiological surveys, use of protective clothing, and on-site checks of radiological survey equipment. The inspectors also interviewed licensee personnel to determine understanding and knowledge pertaining to radiation protection requirements and practices.

The inspectors reviewed and evaluated the licensee's documentation, which included radiation protection operating procedures, daily area radiological surveys, worker training records, radiation work permits, instrument calibration and instrument daily check records, air sampling equipment records, personnel monitoring records, and a contractor audit report.

b. Observations and Findings

The licensee conducted D&D work employing the personnel access controls specified in the radiation operating procedures and radiation work permits. The radiation work areas where D&D activities were conducted and radiological wastes were stored were posted and labeled according to NRC and license requirements. The protective equipment and clothing used during D&D activities was appropriate for the work being conducted. The licensee's air sampling activities were performed adequately during D&D activities. Additionally, the licensee's on-site calibration, daily meter checks, and use of radiation survey instrumentation were compliant with operating procedures.

The inspectors noted during interviews that the licensee's health physics personnel demonstrated an adequate understanding of radiation safety training and operational safety procedural requirements. Additionally, the licensee provided NRC inspectors with instructions on the general and site specific RWPs. The licensee's instructions were consistent with operating procedures and license requirements.

A review of personnel monitoring records identified an incident where a bioassay urine sample presented slightly elevated levels of radioactivity compared to other samples collected. The level of contamination was not reportable and when the worker was retested, the results did not present any elevated activity above the nominal value. The licensee's actions were compliant with licensee and NRC requirements.

Pursuant to a contract agreement between the licensee and SAC, SAC is required to performed periodic audits during Philotechnics D&D work. An audit performed by the SAC RSO noted that the licensee was performing daily area surveys to identify any unexpected contamination, which is required by SAC's NRC approved decommissioning plan (DP).

c. Conclusion

The inspectors concluded that the licensee was in compliance with NRC regulations and Agreement State license requirements relating to radiation protection. The inspectors further determined that the licensee was compliant with SAC's NRC approved decommissioning plan. The inspectors also noted that the SAC personnel were monitoring the licensee's D&D activities pursuant to SAC's approved NRC decommissioning plan.

3.0 (OSHA) Occupational, Safety and Health Administration Interface Activities (IP 93001)

a. Inspection Scope

The NRC inspectors observed and evaluated safety practices implemented during the licensee's D&D activities. The inspectors also observed the building's condition, safety systems and practices employed during the D&D activities. The licensee personnel were interviewed to assess staff appreciation and understanding of general safety requirements, and to determine if there had been any incidents which could be considered U.S. Occupational, Safety and Health Administration (OSHA) related. The licensee provided the inspectors with Material Safety Data Sheets (MSDS) for hazardous materials at the site.

b. Observations and Findings

The inspectors noted an open bay door on the second floor of the facility, which had a single bar as a barrier to prevent personnel from falling out the door. The NRC inspectors informed the licensee that the guardrail might not be high enough to prevent an accidental fall through the doorway. Additionally, the licensee was informed that the opening lacked a toe board to prevent objects from falling or rolling out the door onto employees below. The licensee agreed to evaluate the noted issues, and to take action to ensure the safety of the employees.

The licensee's personnel properly used protective gear according to specific work requirements, such as helmets, garments, gloves, shoes and safety glasses. The facilities' stairs had adequate railings, no confined spaces, or imminent slip or trip issues, or improper use of ladders were observed. Additionally, the licensee maintained MSDS sheets, which were adequate for any hazardous materials present at the site. The licensee staff indicated that there had been no OSHA related incidents or injuries at the site.

c. Conclusion

The inspectors did not identify any noncompliance issues pertaining to OSHA requirements.

4.0 Inspection of Radioactive Waste Management and Transportation Activities (IP 88035 & 86740)

a. Inspection Scope

The inspectors observed and evaluated the licensee's activities to package and ship radioactive wastes for disposal. The inspectors also interviewed licensee personnel, and reviewed transport documentation.

b. Observations and Findings

The licensee removed and prepared contaminated equipment and materials for transport according to operating procedures. To ensure that no removable contamination would leave the area when transporting the waste, the components were

double wrapped with a plastic material and care was taken to prevent sharp edges. The components were staged in a secure temporary radioactive waste location with the proper controls and postings. The Philotechnics project manager, health physics personnel, and a shipper transporting the radioactive waste demonstrated adequate knowledge of requirements for the shipment of radioactive material.

The licensee made a radioactive waste shipment on June 3, 2009. The driver possessed a current driver's license and medical certificate as required by the U.S. Department of Transportation (DOT). The driver was knowledgeable regarding the completion and requirements pertaining to NRC Form 540 (Shipping Manifest). The driver also possessed a survey instrument, a Ludlum Model 5. The meter had a current calibration sticker and was adequate for surveys of the transport vehicle. The NRC inspectors performed an external survey of the transport vehicle, with a Canberra UltraRadiac Radiation Monitor, and did not identify any levels greater than the ambient background radiation levels.

Prior to the conduct of the final status surveys on the building, the licensee and SAC had transferred all remaining radiological waste, and any remaining usable byproduct materials to authorized recipients in accordance with NRC regulations.

c. Conclusion

The inspectors concluded that the licensee complied with NRC and U.S. DOT regulatory requirements for the handling and transportation of radioactive waste.

5.0 Closeout Inspection and Survey (IP 83890)

a. Inspection Scope

The NRC inspectors evaluated and observed the licensee's performance in conducting final status surveys for unrestricted release of the facility. The inspectors also reviewed Fort Mims Facility Final Status Survey Reports prepared by Philotechnics for SAC as required by the "Sigma-Aldrich Fort Mims Facility, Maryland Heights, MO, Decontamination and Decommissioning Plan." The licensee health physics personnel were interviewed to ascertain if personnel possessed an adequate level of understanding of the process for the D&D of the facility. Additionally, the NRC inspectors observed licensee activities pertaining to the proper use of survey instrumentation, and the appropriateness of use of characterization, and remediation survey results, in conjunction with the documenting of the final status survey packages.

Following the completion of the Philotechnics final status surveys, the NRC inspectors performed an independent confirmatory radiological survey using NRC gas proportional floor monitors, hand-held gas proportional detectors, large area scintillation detectors, and Geiger Mueller pan-cake detectors. The inspectors daily checked each instrument for operability prior to and during the conduct of surveys. The inspectors also collected wipe samples to test for removable contamination in the areas surveyed. These samples were sent to the NRC's contract laboratory, the Oak Ridge Institute for Science and Education (ORISE), for carbon-14 and hydrogen-3 analysis. The NRC inspectors

performed surveys of the following laboratories and areas: 1) laboratories 1, 2 and 3 (survey units FMF 01, 02, 05, 06, 13 and 14); 2) office areas (survey units FMF 18, 33 and 35); 3) roof (survey units FMF 22 and 34); and 4) front sidewalk and rear of building (Survey Units FMF 24 and 25).

The NRC inspectors observed and evaluated the collection of site soil samples by Philotechnics health physics personnel. The results of the laboratory analysis of these samples will be assessed as part of Phase 2 D&D activities. The NRC inspectors also collected independent surface soil samples from around the building. These samples were sent to the NRC's contract laboratory, ORISE, for carbon-14 and hydrogen-3 analysis.

b. Observations and Findings

The NRC inspectors verified that only two radionuclides (carbon-14 and hydrogen-3) were identified as relevant to the decontamination activities at the Fort Mims site. The areas being released under this decommissioning effort would be surveyed in accordance with the guidance contained in Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM), NUREG–1575 to demonstrate compliance with the criteria specified in Title 10, Code of Federal Regulations, Subpart E, Section 20.1402 "Radiological Criteria for Unrestricted Use." The 10 CFR 20.402 criteria specifies that the Total Effective Dose Equivalent (TEDE) received by an average member of the critical group from residual radioactivity should not exceed 25 mrem per year (mrem/y) and that the residual radioactivity has been reduced to levels that are as low as reasonably achievable (ALARA).

The licensee elected as a decommissioning plan commitment to set an administrative dose limit of 10 mrem/y as the basis for determining the site unrestricted release criteria for decontaminating and decommissioning the building. To achieve this goal the licensee committed to limiting contamination levels on building surfaces to approximately 40 per cent of the NRC default screening values, which are published in the NRC's NUREG-1757, Volume 2, Appendix H, "Acceptable License Termination Screening Values of Common Radionuclides for Building-Surface Contamination." The acceptable screening levels specified in NUREG-1757 for unrestricted release for carbon-14 and hydrogen-3, are 3.7 E+6 and 1.2E+8 disintegrations per minute per one hundred centimeters squared (dpm/100 cm^2), respectively. The licensee set its administrative limits for carbon-14 and hydrogen-3 at 1.48 E+6 and 4.8 E+7 dpm/100 $cm^{2,}$ respectively.

The NRC inspectors verified the licensee's sample locations in different MARSSIM survey units during the NRC in-process inspections and confirmatory survey. A number of the plotted sample locations were measured to ascertain compliance with grid dimension requirements. Except for one location, the measured sampling points agreed with the licensee's final status survey sampling plan. The licensee agreed to verify the sample locations during the conduct of the final status survey. The NRC inspectors also performed side-by-side radiological survey measurements with the licensee's health physics personnel. The licensee and NRC measurements were generally consistent with one another, and the NRC inspectors observed appropriate use of survey instrumentation by licensee health physics personnel. Further, health physics personnel verbalized during NRC interviews, and the inspectors observed during on-going D&D activities, an adequate knowledge by workers of the SAC decommissioning plan requirements as well as a comprehensive understanding of MARSSIM. The NRC

confirmatory survey in the laboratories and office areas consisted of surveying approximately 75 percent of the floor area with floor radiation monitors. Additionally, 15 percent of the walls and horizontal surfaces were surveyed in the laboratories, with a focus on pipes, drains, and vents. Biased surveys were also conducted of wall and horizontal surfaces in office areas. The entire front sidewalk and approximately 20 percent of the facility roof surface were scanned. Static one minute counts and wipes were taken in identified elevated and biased areas identified during the NRC survey. The wipe samples were sent to ORISE for carbon-14 and hydrogen-3 analysis.

The NRC confirmatory surveys identified several areas of elevated activity in the laboratories, which were classified as MARSSIM Class 1 survey units, exceeded the ALARA administrative limits. Additionally, the NRC inspectors identified one small area in Laboratory 3, and three drain pipes, one each in Laboratories 2, 3 and 4, exceeding the licensee's Derived Contamination Guideline Limit ($DCGL_w$). The NRC static measurements of all other elevated areas were found to be below the $DCGL_w$. The inspectors noted that the average residual radioactivity for these laboratories was below the ALARA release criteria. The licensee informed the NRC in a July 22, 2009, letter that the area exceeding the $DCGL_w$ had been remediated to below the $DCGL_w$ and that the drainpipes had been removed.

The NRC received a July 23, 2009, analyses report from ORISE reporting the results of the16 tests for removable contamination collected by the NRC in the Fort Mims Facility. One sample exceeded the licensee's $DCGL_w$ for removable carbon-14 and one sample exceeded the ALARA release criteria for carbon-14. Both of these samples were from the drain pipes discussed above, and were subsequently removed and disposed of as radiological waste. All of the other test results for removable contamination were below the ALARA release criteria.

The ORISE results from the soil samples collected by the NRC were documented in a June 16, 2009, letter. The samples were analyzed for both carbon-14 and hydrogen-3. Of the three samples analyzed; one revealed elevated levels of carbon-14 in excess of the 12 picocuries per gram (pCi/g) specified in the NRC's NUREG-1757, Vol. 1, Table B.2 "Screening Values (pCi/g) of Common Radionuclides for Soil Surface Contamination Levels." The elevated carbon-14 soil sample level was reported as 58 pCi/g. This information was provided to the licensee, and will be evaluated by the licensee and NRC during the conduct of the licensee's Phase 2 decommissioning activities.

c. Conclusion

The inspectors concluded that the licensee complied with NRC regulatory requirements and decommissioning plan requirements for the decommissioning of the Fort Mims Facility, and that the NRC has no objection with the licensee and SAC proceeding with Phase 2 of the decommissioning plan.

6.0 Exit Meeting Summary

The inspectors presented preliminary inspection findings to the licensee's radiation safety staff and project manager at the conclusion of the onsite inspections on May 6, 2009, June 4, 2009, and July 9, 2009, and conducted a telephone exit with the licensee's RSO and project manager on July 24, 2009. The licensee did not identify any documents or processes reviewed by the inspectors as proprietary.

Attachment:
Supplementary Information

Supplementary Information

PARTIAL LIST OF PERSONS CONTACTED

Ryan Fahey, Project Manager, Philotechnics
Gary Nadeau, Radiation Safety Officer, Philotechnics
Tracie Clemons, Senior Health Physicist, Philotechnics
Tom Spencer, Radiation Safety Officer, Sigma Aldrich

INSPECTION PROCEDURES USED

IP 88005	Management Organization and Controls
IP 83822	Radiation Protection
IP 93001	OSHA Interface Activities
IP 88035	Radioactive Waste Management
IP 86740	Inspection of Transportation Activities
IP 83890	Closeout Inspection and Survey
IP 93001	OSHA Interface Activities

ITEMS OPENED, CLOSED, AND DISCUSSED

Opened	None
Closed	None
Discussed	None

LIST OF ACRONYMS USED

ADAMS	Agencywide Documents Access and Management System
ALARA	As Low As Reasonable Achievable
CFR	Code of Federal Regulations
$DCGL_w$	Derived Contamination Guideline Limit
D&D	Decontamination and Decommissioning
DP	Decommissioning Plan
DOT	U.S. Department of Transportation
DNMS	Division of Nuclear Material Safety
dpm/100 cm^2	Disintegrations per minute per one hundred centimeters squared
MARSSIM	Multi-Agency Radiation Survey and Site Investigation Manual
MDHSS	Missouri Department of Health and Senior Services
MSDS	Material Safety Data Sheet
NRC	U.S. Nuclear Regulatory Commission
ORISE	Oak Ridge Institute for Science and Education
OSHA	U.S. Occupational, Safety and Health Administration
pCi/g	Picocuries per gram
PDR	Public Document Room
RSO	Radiation Safety Officer
SAC	Sigma-Aldrich Chemical Company
TEDE	Total Effective Dose Equivalent