

Decommissioning Plan

**UNC Naval Products
Previously Licensed Facility in New Haven, CT**

June 7, 2005

Revision 1

UNC Naval Products
20 Research Parkway, Unit E
Old Saybrook, CT 06475

Decommissioning Plan
UNC Naval Products, Previously Licensed Facility in New Haven, CT

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I. Background and Site Information

The site that is the subject of this plan is located at 71 Shelton Avenue, New Haven, Connecticut (Figure 1), and consists of a building identified as 3H and 6H (Figure 2), its environs, and a connected sewer system (Figure 3) which is inactive. A utility trench is located on the south side of both buildings and extends past the southeast edge of the property. The site is located at the edge of an industrial park, and the building is used primarily as a warehouse. It is enclosed by a chain link fence and access is controlled by the owner, Mr. Alan Jarman.

The site was once owned by United Nuclear Corporation (UNC) Naval Products and was licensed under NRC License No. SNM-368. Primary activities performed under that license were the fabrication of nuclear fuel components for the United States Government. Nuclear material used for this work consisted primarily of highly enriched uranium. Minor amounts of thorium, depleted uranium, and natural uranium were also used.

The site was decontaminated and decommissioned (D&D) in 1973-76, after the work performed there was transferred to a new facility located in Montville, CT. The New Haven site was officially removed from License SNM-368 on April 22, 1976.¹ License SNM-368 was terminated by the NRC eighteen years later, on June 8, 1994², following UNC's successful D&D of the Montville facility.

In April 1996, UNC Naval Products was contacted by NRC Region I, and informed that a review of old decommissioning files showed a lack of data for the New Haven site relative to soils and the plant sewer line. UNC was told that the NRC was interested in performing some sampling at the site in order to obtain such information.

The NRC made arrangements with the current property owner for a site visit to perform radiation measurements and collect samples. This work was performed on May 29, 1996 and the results reported to the owner in July 1996³.

Based on the results of this inspection and additional information provided by UNC, the NRC determined that more soil testing was necessary. This testing was performed by the NRC and their contractor, ORISE, on September 16 - 17, 1996, and the results reported to UNC on February 12, 1997.⁴ The results of the soil testing showed that a small number of local areas of soil and sediments contained enriched uranium exceeding the soil acceptance criteria established by the NRC in 1981⁵. These areas showed total uranium (U) levels up to 723 pCi/g, exceeding

¹ Letter, NRC (W.T. Crow) to United Nuclear Corporation (Robert J. Pyzel) dated April 22, 1976

² Letter, NRC (John H. Austin) to UNC Naval Products (Robert F. Bonito) dated June 8, 1994

³ NRC Inspection No. 070-00371/96-001, dated July 26, 1996

⁴ NRC Inspection No. 070-00371/97-001, dated February 12, 1997

⁵ NRC Branch Technical Position "Disposal or Onsite Storage of Thorium or Uranium Wastes from Past Operations", published in the October 23, 1981 Federal Register

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the NRC's release criteria limit of 30 pCi/g. At the time of the site D&D, there were no published soil release criteria, other than "as low as reasonably achievable" (ALARA), and meter surveys of the soil by an NRC inspector in 1976 were found to be acceptable.⁶ Based on the new sampling results, the NRC concluded that "there is not an immediate health and safety hazard with respect to the soil and sediment contamination", but requested that UNC perform additional site characterization to determine the extent of remediation that might be necessary.

In response, UNC is submitting to the NRC, with this decommissioning plan, a characterization report which describes the sampling and testing that UNC performed in 2003.⁷ The sampling was conducted to determine the lateral and vertical extent of the enriched uranium in the identified areas of concern. The results of the characterization indicated that additional samples are required during the remediation phase to verify the extent of the uranium in the soil. There were obstacles encountered that precluded the precise delineation of the uranium in subsurface soil. UNC intends to work with the NRC to reach agreement on specific remediation efforts to be implemented in order to bring the site into compliance with Option 1 of the 1981 Branch Technical Position decontamination limits.

II. Description of Planned Decommissioning Activities

A. Decommissioning Objectives and Activities For Identified Areas of Concern

1. Objectives

Decommissioning activities will:

- reduce soil and sewer residue enriched uranium contamination to levels meeting the decontamination limits of Option 1 of the 1981 Branch Technical Position;
- remove all low level radioactive waste (LLRW) from the site to licensed disposal facilities; and
- upon completion of remediation, confirm acceptability.

Performance and completion of these activities will:

- permit "unrestricted" use of the site and facilities;
- maintain ALARA exposures during and after decommissioning; and
- accomplish the work in a safe and environmentally acceptable manner in accordance with applicable federal and state laws and regulations.

2. Activities

Table 1 delineates the major activities and tasks related to decommissioning for the areas which may require remediation. Based on the results of the site characterization, it is not expected that remediation will be required for the layers in the concrete floor or outside soil. Some locations exhibit a double thickness of concrete (e.g. multiple pour) and were characterized to confirm that the presence of radioactive materials is below the release criteria established by the NRC. No elevated radioactivity was measured at the interface of the concrete layers. It is

⁶ NRC Inspection No. 70-371/76-06, dated April 2, 1976

⁷ AAA/IEM, *Radiological Characterization of the Former UNC Manufacturing Facility, New Haven, Connecticut*, IEM Report 2002020/G-1269, May 31, 2005.

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probable that the existing multiple layers predate the UNC operations, as a third layer of concrete was poured in some areas during UNC operations and was removed by UNC during the decommissioning activities in 1976

**TABLE 1
DECOMMISSIONING ACTIVITIES**

Area	Activity
Sub-floor soils	<ol style="list-style-type: none">1. Remove concrete floor slab2. Excavate and package impacted soils for LLRW disposal3. Retest to confirm concentrations are below the release criteria4. Perform additional excavation and testing as necessary
Indoor Residues	<ol style="list-style-type: none">1. Remove and package impacted residues for LLRW disposal2. Remove and package residue on impacted concrete inside the south trench3. Retest to confirm concentrations are below the release criteria4. Perform additional removal and testing as necessary
Sewer residues	<ol style="list-style-type: none">1. Remove impacted residues, using techniques designed to prevent discharge into the main sewer system2. Dewater, solidify, or otherwise treat residues as necessary to meet LLRW disposal criteria for moisture content3. Package residues for LLRW disposal

Methods used to accomplish these activities are expected to be non-exotic, using readily available equipment. Floor removal may utilize equipment such as concrete cutting saws, jack hammers, and back hoes. Soil removal may be performed using both mechanical (e.g. back hoe) and manual (e.g. shovels) techniques. Residue removal may use vacuum equipment or flushing, as well as other manual techniques. Sewer pipe cleanout techniques will be based on contractor knowledge and experience.

As necessary, the sewer pipe will be removed and disposed of as radioactive waste, along with associated soils exceeding the NRC release limits. Based on the currently available information, a preliminary estimate of approximately 19,000 cubic feet of LLRW will require disposal. This is only a preliminary estimate and will be updated as additional information is generated during the decommissioning process.

Wastes that are generated during the remediation phase will be evaluated for hazardous characteristics. If hazardous waste is mixed with radioactive waste, those wastes will be segregated and treated in order to satisfy the waste acceptance criteria of the disposal facility.

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Following the NRC acceptance of the decontamination results, UNC will backfill the remediated areas as necessary with clean fill, and repair the concrete floors.

B. Decommissioning Organization and Responsibilities

While overall responsibility for the D&D work lies with UNC, qualified contractors will be hired to perform the actual work, including maintenance of an acceptable radiation protection program.

C. Training

D&D contractors will be required to provide appropriate training to their personnel to assure that the work is performed in a safe, environmentally responsible manner.

III. Protection of Workers and the Environment Against Radiation Hazards During Decommissioning

A. Radiation Control Programs

Responsible remediation contractors will be required to have acceptable radiation control programs so as to assure that:

- Exposure levels are monitored (e.g. lapel monitors) ;
- Occupational radiation exposures are maintained ALARA;
- Residues from remediation are controlled so as not to spread contamination to other objects or areas of the site; and
- Potentially contaminated tools, vehicles, etc. are tested to confirm that they meet release limits before leaving the site.

Since the radioactive material being dealt with consists of low levels of unirradiated uranium, there is no significant direct radiation hazard to personnel. The specific exposure pathways of concern are those of inhalation and ingestion. At the levels of uranium measured to date, these are not expected to be a major concern, given the relatively short time periods of potential exposure during the D&D process. Responsible contractors will be required to assess the radiation exposure potential under 10 CFR 20, and to base their protection programs on that evaluation.

B. Radioactive Waste Control Programs

Responsible remediation contractors will be required to have acceptable radioactive waste control programs to assure that:

- Radioactive wastes generated during decontamination are properly packaged and controlled; and
- All LLRW packaging, shipment, and disposal meets applicable state, federal, and disposal site requirements.

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IV. *Planned Final Radiation Survey*

A. Surface Surveys

During NRC inspection 070-00371/96-001 the NRC took biased exposure rate, fixed contamination, and removable contamination readings at the site. This inspection report states "All measured exposure rates were consistent with the background radiation exposure rate of 12-14 μ R/hr" and "All fixed and removable measurements met NRC release criteria as described in Attachment 3."⁸

No additional building surface surveys are necessary according to this NRC report. The building and equipment release criteria for fixed and removable contamination are the same as they were in 1976, when the buildings were extensively surveyed by UNC and accepted by the NRC for unrestricted use.⁹.

Radioactive constituents were detected in the South trench in 2003 in concentrations that exceeded the release criteria established by the NRC. The trench will be remediated and surface radiation surveys will be completed after remediation to verify that the trench satisfies the release criteria.

B. Soil and Sediment Surveys

While the usual survey procedures for soil areas, as delineated in NUREG/CR-5849, Section 4.2.3 and Figure 4-4, involve working with a systematic grid, the irregular shape of the areas involved in this remediation do not lend themselves to that configuration. UNC anticipates taking systematic soil samples representative of the depth and breadth of the area(s) involved in the remediation. Those samples will be analyzed by a qualified contractor laboratory to determine their total enriched U content. Isotopic ratio will be established either by using the value determined by ORISE in 1997 by alpha spectrometry (U-234 to U-235 activity ratio of 27), or by independent alpha spectrometry measurement. The isotopic ratio will be used to determine the total enriched U content of samples analyzed by gamma spectrometry, which does not measure the U-234 content directly. Alternatively, alpha spectrometry will be used to verify the concentration of U-234.

Testing by the NRC in 1996 showed that thorium levels were "representative of natural background."¹⁰ This is consistent with the limited quantities of this material used at the site. Based on the NRC results, no additional evaluation will be done for thorium, either indoors or outdoors.

⁸ US Nuclear Regulatory Commission, *Inspection Report*, Report Number 070-00371/96-001, July 26, 1996.

⁹ U.S. Nuclear Regulatory Commission, *Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses for Byproduct, Source, or Special Nuclear Material*, July, 1982.

¹⁰ US Nuclear Regulatory Commission, *Inspection Report*, Report Number 070-00371/96-001, July 26, 1996.

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C. Background

For purposes of this remediation, soil background will not be separately determined. Instead, the value determined for the UNC Naval Products Montville facility will be used, as was done by ORISE in their report on the New Haven facility in 1997. This value is 3.43 pCi/g.¹¹

D. Acceptance Criteria

- Surfaces

The surface release criteria are those established by the USNRC and delineated in Condition 11 of the UNC license, SNM-368.¹² The document is provided in the Attachment to this Plan. These criteria were used for the 1976 release of this facility and the 1994 release of UNC's Montville facility.

- Soils and Sediments

Soil release criteria are those delineated in the NRC's Branch Technical Position "Disposal or Onsite Storage of Thorium or Uranium Wastes From Past Operations" and approved by the NRC for D&D of UNC's Montville, Connecticut site. The criteria, less than 30 pCi/g enriched U above background averaged for a 100 m² area, may be modified for "hot spots" or areas that exhibit localized concentrations of uranium over an area smaller than 100 m². The criteria are limited by the formula:

$$30 \text{ pCi/g} \times (100 / A)^{1/2}$$

where A is the area of the location with the elevated U level, in square meters. Values in excess of 90 pCi/g are not permitted.

E. Documentation

Results of the final survey will be documented and submitted to the NRC, with a request for permanent release of the facility for unrestricted use.

V. Decommissioning Costs

UNC expects that the U.S. Department of Energy will reimburse costs for this D&D effort under the terms of UNC's existing contracts, as they did for the D&D of this facility in the 1970's, and the UNC Montville facility in the 1990's.

¹¹ Figure H-2.3, UNC Naval Products Final Site Decontamination Report, March 12, 1993.

¹² U.S. Nuclear Regulatory Commission, *Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses for Byproduct, Source, or Special Nuclear Material*, July, 1982.

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VI. *Physical Security Plan and Nuclear Material Control*

A. Physical Security

The quantities and concentrations of special nuclear material (SNM) involved in this remediation effort are not great enough as to require special security under NRC safeguards requirements. UNC expects that normal industrial site security will be maintained during the remediation effort.

B. Nuclear Material Control

The quantities and concentrations of SNM involved in this remediation effort are not great enough as to require special nuclear material accountability or control. It will be necessary, however, to establish the uranium content of materials shipped for disposal, to meet disposal site requirements. The contractor will track the quantity of soil and the associated inventory of U-235 in the LLRW packages. Specifically, UNC will confirm that the quantity of U-235 does not exceed 350 grams total in the excavated soil. Shipments of LLRW will be made to a licensed disposal facility according to current NRC and DOT guidelines/requirements for LLRW shipments.

For example, if the specific activity of U-235 (93% enrichment) is 7×10^{-5} Ci/gram and the quantity of U-235 is limited to 350 grams, then the maximum activity allowed in the excavated soil is less than 0.0245 curies of U-235. If the average activity of U-235 in the soil is 10 pCi/gram, the maximum volume of soil that can be excavated and stored on the surface at any one time is 2.5 million kilograms or less than 1,600 m³ or less than 56,000 ft³.¹³

¹³ Assume the density of soil to be 1.6 grams/cubic centimeter.

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VII. Schedule for Decommissioning

The schedule for decommissioning is provided in Table 2. It is anticipated that the field work can be completed in approximately four (4) months.

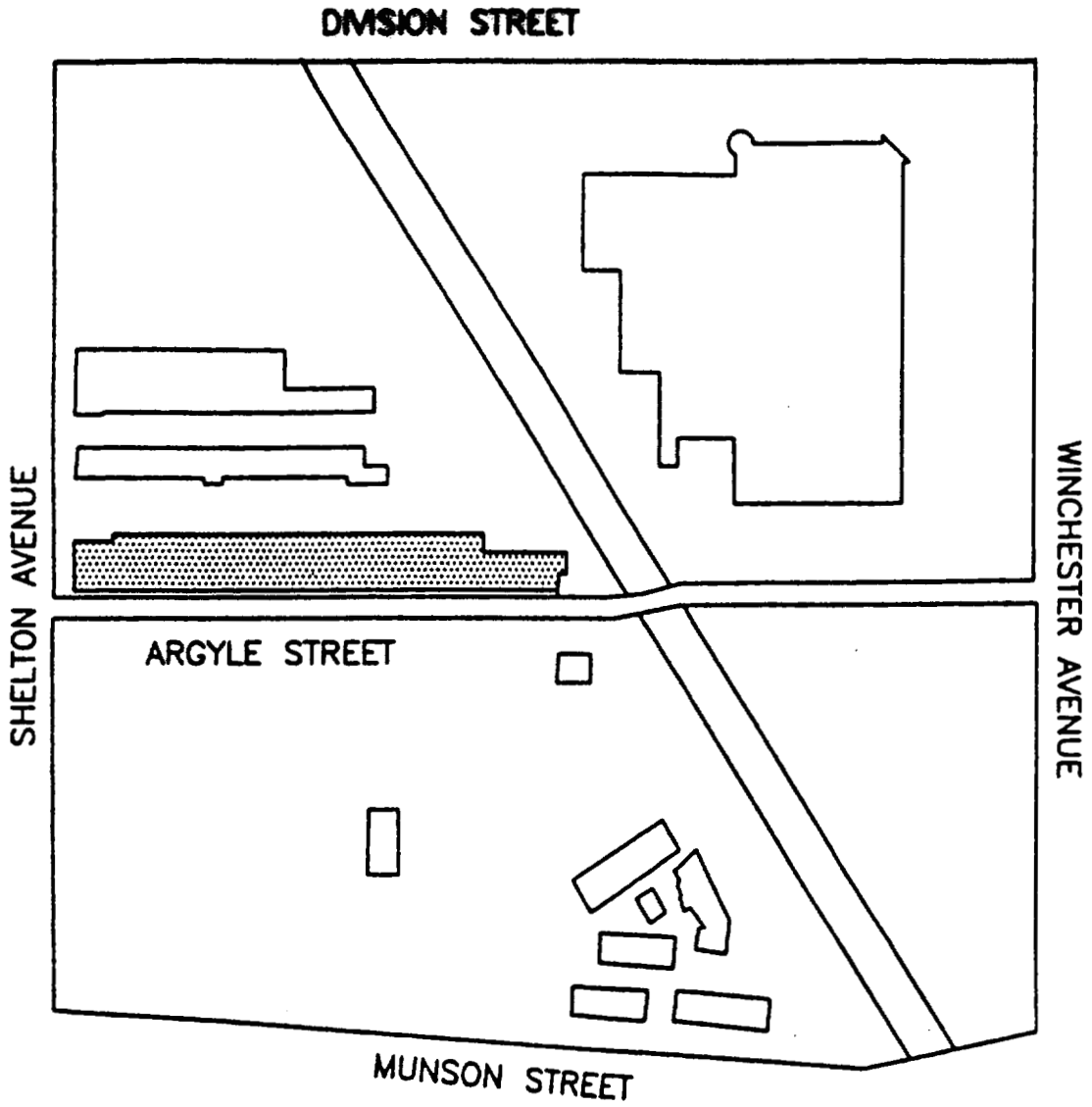
**Table 2
Project Schedule**

Description	Duration (weeks)	Month 1	Month 2	Month 3	Month 4	Month 5	Month 6
Notice to Proceed							
Mobilization	4	—————					
Remediate trench debris and interior soil	6		—————				
Remediate sewer	6			—————			
Package and ship waste for disposal	12		—————				
Final Status Survey	2					—————	
Site Restoration	4						—————
Prepare Final Status Survey Report	4						—————

VIII. FIGURES

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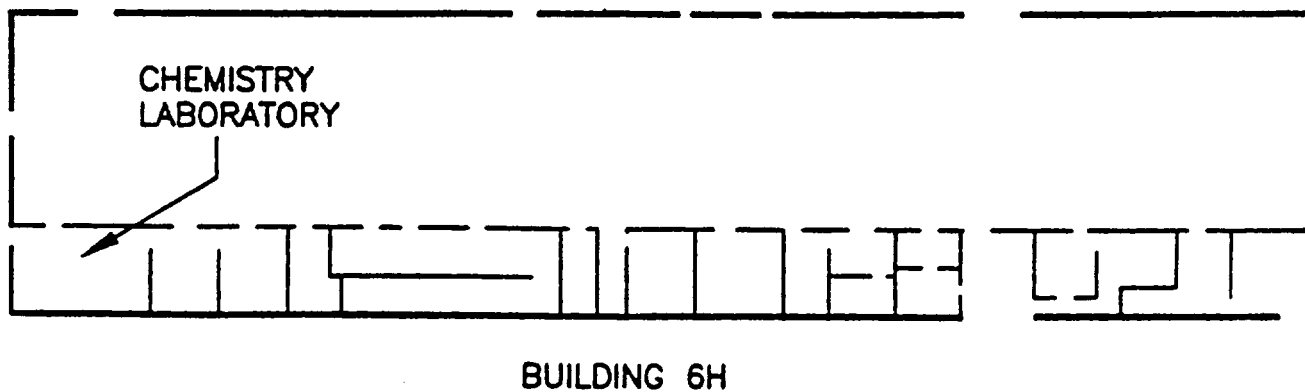
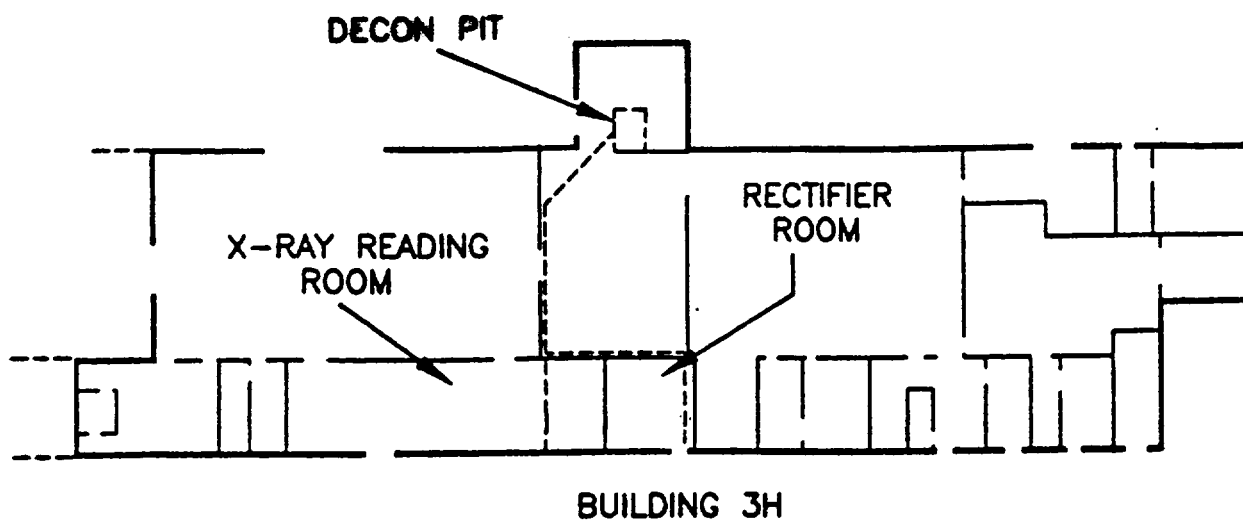
Figure 1
71 Shelton Avenue, New Haven Connecticut



N
↑
Not to Scale
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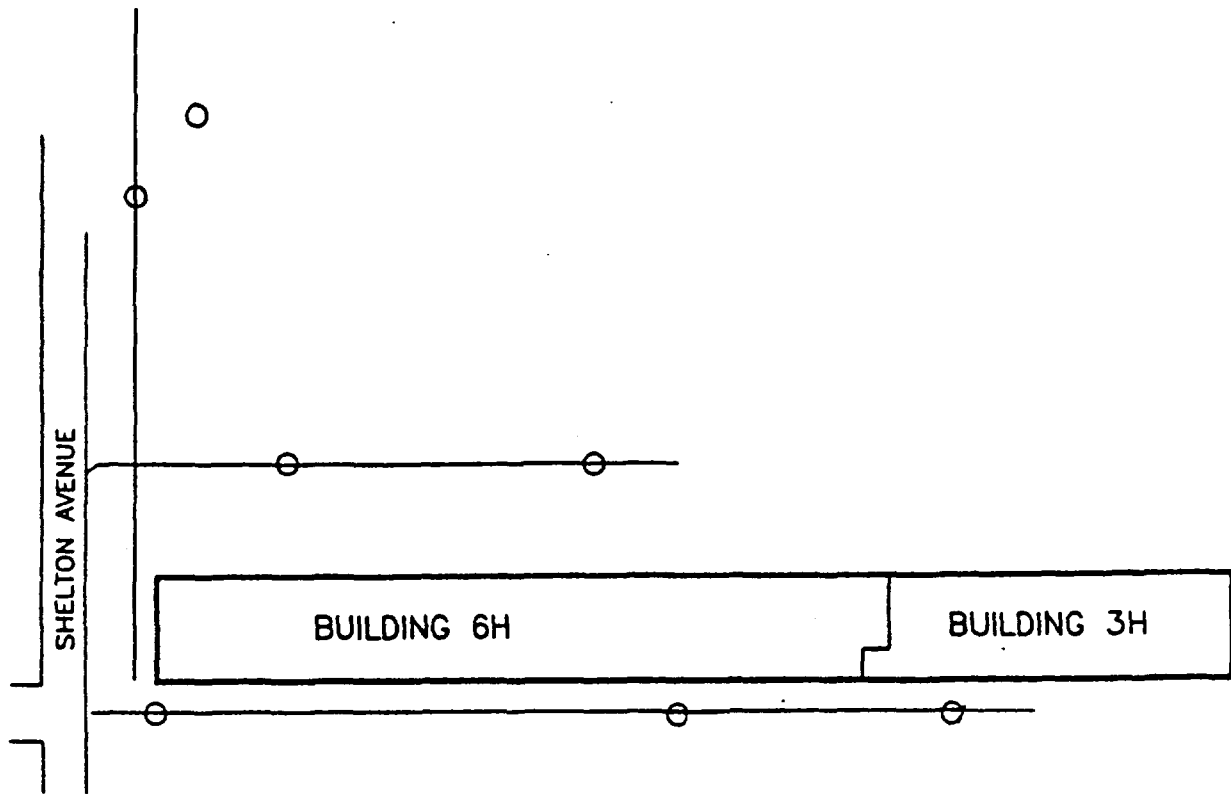
Figure 2
Buildings 3H and 6H



Not to Scale

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Figure 3
Storm Water Sewer System Argyle Street



○ Manhole

N



Not to Scale

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Attachment

GUIDELINES FOR DECONTAMINATION OF FACILITIES AND EQUIPMENT
PRIOR TO RELEASE FOR UNRESTRICTED USE
OR TERMINATION OF LICENSES FOR BYPRODUCT, SOURCE,
OR SPECIAL NUCLEAR MATERIAL

U.S. Nuclear Regulatory Commission
Division of Fuel Cycle & Material Safety
Washington, D.C. 20555

July 1982

[UNC Note - The original document was derived from NRC Regulatory Guide 1.86. It was published in November 1976, included as Appendix I in NRC NUREG/CR-2082 - Monitoring for Compliance With Termination Survey Criteria, and the contents were incorporated into UNC's NRC license as Condition 11.]

The instructions in this guide, in conjunction with Table 1, specify the radionuclides and radiation exposure rate limits which should be used in decontamination and survey of surfaces or premises and equipment prior to abandonment or release for unrestricted use. The limits in Table 1 do not apply to premises, equipment, or scrap containing induced radioactivity for which the radiological considerations pertinent to their use may be different. The release of such facilities or items from regulatory control is considered on a case-by-case basis.

1. The licensee shall make a reasonable effort to eliminate residual contamination.
2. Radioactivity on equipment or surfaces shall not be covered by paint, plating, or other covering material unless contamination levels, as determined by a survey and documented, are below the limits specified in Table 1 prior to the application of the covering. A reasonable effort must be made to minimize the contamination prior to use of any covering.
3. The radioactivity on the interior surfaces of pipes, drain lines, or ductwork shall be determined by making measurements at all traps, and other appropriate access points, provided that contamination at these locations is likely to be representative of contamination on the interior of the pipes, drain lines, or ductwork. Surfaces or premises, equipment, or scrap which are likely to be contaminated but are of such size, construction, or location as to make the surface inaccessible for purposes of measurement shall be presumed to be contaminated in excess of the limits.
4. Upon request, the Commission may authorize a licensee to relinquish possession or control of premises, equipment, or scrap having surfaces contaminated with materials in excess of the limits specified. This may include, but would not be limited to, special circumstances such as razing of buildings, transfer of premises to another organization continuing work with radioactive materials, or conversion of facilities to a long-term storage or standby status. Such requests must:
 - a. Provide detailed, specific information describing the premises, equipment or scrap, radioactive contaminants, and the nature, extent, and degree of residual surface contamination.
 - b. Provide a detailed health and safety analysis which reflects that the residual amounts of materials on surface areas, together with other considerations such as prospective use of the premises, equipment or scrap, are unlikely to result in an unreasonable risk to the health and safety of the public.
5. Prior to release of premises for unrestricted use, the licensee shall make a comprehensive radiation survey which establishes that contamination is within the limits specified in Table 1. A copy of

the survey report shall be filed with the Division of Fuel Cycle and Material Safety, USNRC, Washington, D.C. 20555, and also the Administrator of the NRC Regional Office having jurisdiction. The report should be filed at least 30 days prior to the planned date of abandonment. The survey report shall:

- a. Identify the premises.
- b. Show that reasonable effort has been made to eliminate residual contamination.
- c. Describe the scope of the survey and general procedures followed.
- d. State the findings of the survey in units specified in the instruction.

Following review of the report, the NRC will consider visiting the facilities to confirm the survey.

TABLE 1
ACCEPTABLE SURFACE CONTAMINATION LEVELS

Nuclides ^a	Average ^{b,c,f}	Maximum ^{b,d,f}	Removable ^{b,e,f}
U-nat, U-235, U-238 and associated decay products	5,000 dpm α /100 cm ²	15,000 dpm α /100 cm ²	1,000 dpm α /100 cm ²
Transuranics, Ra-226, Ra-228, Th-230, Th-228, Pa-231, Ac-227, I-125, I-129	100 dpm/100 cm ²	300 dpm/100 cm ²	20 dpm/100 cm ²
Th-nat, Th-232, Sr-90, Ra-223, Ra-224, U-232, I-126, I-131, I-133	1000 dpm/100 cm ²	3000 dpm/100 cm ²	200 dpm/100 cm ²
Beta-gamma emitters (nuclides with decay modes other than alpha emission or spontaneous fission) except Sr-90 and others noted above.	5000 dpm $\beta\gamma$ /100 cm ²	15,000 dpm $\beta\gamma$ /100 cm ²	1000 dpm $\beta\gamma$ /100 cm ²

- a. Where surface contamination by both alpha- and beta-gamma-emitting nuclides exists, the limits established for alpha- and beta-gamma-emitting nuclides should apply independently.
- b. As used in this table, dpm (disintegrations per minute) means the rate of emission by radioactive material as determined by correcting the counts per minute observed by an appropriate detector for background, efficiency, and geometric factors associated with the instrumentation.
- c. Measurements of average contaminant should not be averaged over more than 1 square meter. For objects of less surface area, the average should be derived for each such object.
- d. the maximum contamination level applies to an area of not more than 100 cm².
- e. The amount of removable radioactive material per 100 cm² of surface area should be determined by wiping that area with dry filter or soft absorbent paper, applying moderate pressure, and assessing the amount of radioactive material on the wipe with an appropriate instrument of known efficiency. When removable contamination on objects of less surface area is determined, the pertinent levels should be reduced proportionally and the entire surface should be wiped.
- f. The average and maximum radiation levels associated with surface contamination resulting from beta-gamma emitters should not exceed 0.2 mrad/h at 1 cm and 1.0 mrad/h at 1 cm, respectively, measured through not more than 7 milligrams per square centimeter of total absorber.