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SITE CLOSEOUT REPORT FOR THE COMBUSTION ENGINEERING SITE

WINDSOR, CT

AUTHORIZED PROJECT UNDER THE
FORMERLY UTILIZED SITES REMEDIAL ACTION PROGRAM (FUSRAP)

DECEMBER 2016

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ACRONYMS, ABBREVIATIONS, AND UNITS OF MEASURE

ABB	Asea, Brown, Boveri
AEC	Atomic Energy Commission
ALARA	As Low As Reasonably Achievable
AOCs	Areas of Concern
ARAR	Applicable or Relevant and Appropriate Requirement
bgs	below ground surface
cc	cubic centimeter
CE	Combustion Engineering
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
cm	centimeters
COCs	Constituents of Concern
CTDEP	Connecticut Department of Environmental Protection
CTDEEP	Connecticut Department of Energy and Environmental Protection
DCGL	Derived Concentration Guideline Level
$DCGL_W$	Derived Concentration Guideline Level - wide area average
$DCGL_{emc}$	Derived Concentration Guideline Level - elevated measurement comparison
DOE	United States Department of Energy
DP	Decommissioning Plan
EPA	United States Environmental Protection Agency
FS	Feasibility Study
FSS	Final Status Survey
FSSP	Final Status Survey Plan
FSSR	Final Status Survey Report
ft	foot (feet)
ft^3	cubic feet
FUSRAP	Formerly Utilized Sites Remedial Action Program
g	grams
HEU	highly enriched uranium
in	inch (inches)
IWL	industrial waste lines
LEU	low enriched uranium
MARSSIM	Multi-Agency Radiation Survey and Site Investigation Manual
MED	Manhattan Engineer District
m	meters
mi	miles
MOU	Memorandum of Understanding
mrem	milliroentgen equivalent man
mrem/yr	milliroentgen equivalent man per year

ACRONYMS, ABBREVIATIONS, AND UNITS OF MEASURE (continued)

NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NRC	United States Nuclear Regulatory Commission
O&M	operations and maintenance
ORISE	Oak Ridge Institute for Science and Education
PAH	polynuclear aromatic hydrocarbons
PCB	polychlorinated biphenyls
PCE	tetracholoethylene
pCi/g	picoCuries per gram
QA	Quality Assurance
QC	Quality Control
Ra-226	Radium-226
RAO	Remedial Action Objective
RCRA	Resource Conservation and Recovery Act
RI	Remedial Investigation
ROD	Record of Decision
RSR	Remediation Standard Regulations
SAIC	Science Applications International Corporation
SAP	Sampling and Analysis Plan
SARA	Superfund Amendments and Reauthorization Act
SCOR	Site Closeout Report
SOR	Sum of Ratios
SRP	Selected Remedy Plan
TCLP	Toxicity Characteristic Leaching Procedure
TEDE	Total Effective Dose Equivalent
Th-232	Thorium-232
Total U	Total Uranium
U-234	Uranium-234
U-235	Uranium-235
U-238	Uranium-238
USACE	United States Army Corps of Engineers
UU/UE	Unlimited use and unrestricted exposure
WWTP	Waste Water Treatment Plant
yd^3	cubic yards

EXECUTIVE SUMMARY

The Combustion Engineering (CE) site is located in Windsor, CT. Starting in the mid-1950s, activities with radioactive materials at the CE site included research, development, engineering, production, nuclear fuel fabrication, and other related radiological services. These activities were conducted under contracts with the U.S. Government and commercial customers. Due to spills and leaks associated with these operations and waste disposal practices, various buildings, waste water lines, and some land areas were radiologically contaminated.

The CE site was investigated and remediated under the Formerly Utilized Sites Remedial Action Program (FUSRAP) and also under U.S. Nuclear Regulatory Commission (NRC) regulations. FUSRAP was initiated in 1974 to investigate, and if necessary, clean up or control sites throughout the United States contaminated as a result of MED or Atomic Energy Commission (AEC) activities conducted in support of the nation's early atomic energy and weapons program. Both the MED and the AEC were predecessors of the United States Department of Energy (DOE).

In the early 1990's, DOE reviewed site records and completed investigative site surveys. Subsequently, in 1994, DOE determined that certain areas of the CE site were eligible for remedial actions under FUSRAP.

Congress transferred administration and execution of FUSRAP cleanups from the DOE to the United States Army Corps of Engineers (USACE) in October 1997. Response actions conducted by USACE under FUSRAP were subject to, and conducted in accordance with, the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980 (42 U.S.C 9601 et seq.), as amended, and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) (40 CFR Part 300).

Between 1998 and 2006, USACE performed additional site characterization fieldwork, Remedial Investigation fieldwork, published a risk assessment report, and published a feasibility study report. In 2007, because there was extensive commingling of FUSRAP-related materials with NRC-regulated materials, CE, NRC, USACE, and DOE agreed that CE would conduct the decommissioning of the site pursuant to NRC regulations.

Radiologically contaminated soils and impacted wastewater lines were excavated and transported to a properly licensed and/or permitted off-site facility for disposal by CE's contractor(s). Radiologically impacted buildings were decontaminated and demolished. Impacted building debris was disposed at a properly licensed and/or permitted off-site disposal facility. CE submitted seven Final Status Survey Reports to the NRC for the decommissioning and license termination of the CE site. The implemented remedy achieved the degree of cleanup and protection specified in the Selected Remedy Plan for the CE site for all pathways of exposure.

The privately-owned CE site is currently in the Site Closeout phase. This Site Closeout Report (SCOR) provides a consolidated record of all removal and remedial activities

conducted at the CE site and documents compliance with all statutory requirements. The implemented remedies achieved the degree of cleanup and protection specified in the Selected Remedy Plan for the CE site for all pathways of exposure. No further response is needed to protect human health and the environment from the FUSRAP-eligible constituents of concern. Since FUSRAP-eligible residual radiological concentrations remaining at the CE site allow for unlimited use and unrestricted exposure (UU/UE), no five-year reviews, land use controls, or operations and maintenance are required to maintain the protectiveness of the implemented remedies.

The CE site will be officially transferred from USACE to the DOE Office of Legacy Management within two years from the signature date of this SCOR. Once transfer of the CE site from USACE is complete, the DOE will retain sole responsibility for its long-term stewardship, which is limited to records management for this site.

1.0 INTRODUCTION

The Combustion Engineering (CE) site is located at 2000 Day Hill Road, Windsor, CT, approximately eight miles north of Hartford, CT. The U.S. Department of Energy (DOE) identified the CE site as an eligible site to be investigated and remediated under the Formerly Utilized Sites Remedial Action Program (FUSRAP) by the U.S. Army Corps of Engineers (USACE). Generally under FUSRAP, after the DOE has determined a site is eligible, USACE is authorized to investigate, and clean up or control sites contaminated as the result of actions by the Atomic Energy Commission (AEC) and its predecessor, the Manhattan Engineer District (MED), in support of the nation's early atomic energy and weapons program.

This report provides a final overall summary of response actions taken at the site by USACE and CE. The scope of the USACE response action at the CE site was to address the following FUSRAP-related constituents of concern (COCs) in site soils and on building surfaces: uranium-234 (U-234), uranium-235 (U-235), uranium-238 (U-238), and cobalt-60 (Co-60). USACE addresses FUSRAP sites in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) as amended by the Superfund Amendments and Reauthorization Act (SARA) and the National Oil and Hazardous Substance Pollution Contingency Plan (NCP). USACE began addressing the Site in accordance with CERCLA, however, CE proceeded with decommissioning of the site under U.S. Nuclear Regulatory Commission (NRC) regulations to allow termination of the NRC license as opposed to USACE completing the investigation, evaluation, and remedial action at the CE site in accordance with CERCLA. USACE reviewed the remedial approach taken by CE and found it equivalent to the required CERCLA approach. Community involvement was adequate to meet CERCLA requirements.

As a means of comparison, and to explain the approach taken at CE, the major milestones of the CERCLA process are compared to the approach taken at CE in the below table.

CERCLA Milestone	CE Approach or Document	Conducted by
Preliminary Assessment	Historical Site Assessment	DOE
Site Inspection	Gamma Scans and Building Investigations	USACE
Remedial Investigation	Remedial Investigation	USACE
Feasibility Study	Feasibility Study	USACE
Proposed Plan	Proposed Remedy Plan	CE
Record of Decision	Site Remedy Plan	CE
Remedial Action Work Plan	Decommissioning Plan	CE

The objective of the licensee, CE, was to decommission the site such that it would meet the criteria for an unrestricted use as specified in the License Termination Rule (LTR) found in 10 CFR 20, Subpart E. The LTR critical group, defined as "the group of individuals reasonably expected to receive the greatest exposure to residual radioactivity for any applicable set of circumstances" is the construction worker for the Combustion Engineering Site. This site release scenario is acceptable to USACE.

Radiologically contaminated soils and impacted wastewater lines were excavated and transported to a properly licensed and or permitted off-site facility for disposal by CE's contractor(s). Radiologically impacted buildings were decontaminated and demolished. Impacted building debris was disposed of at a properly licensed or permitted off-site disposal facility. CE submitted seven Final Status Survey Reports to the NRC for the decommissioning and license termination of the Combustion Engineering Site. The implemented remedy achieved the degree of cleanup and protection specified in the Selected Remedy Plan for the Combustion Engineering Site for all pathways of exposure.

USACE concurs that no further response is needed to protect human health and the environment from the FUSRAP-related COCs at the CE site.

2.0 SITE LOCATION AND DESCRIPTION

The CE Site is located in the Town of Windsor, eight miles north of Hartford, CT and within 3 miles of the Bradley International Airport (Figure 1). The CE site is bordered by Day Hill Road to the south which is comprised of agricultural and commercial property; to the west is commercial property and a sand and gravel quarry; to the north of the site is the Windsor/Bloomfield Sanitary Landfill and Recycling Center (Landfill); and to the east of the site is forested land as well as residential and commercial properties. The northwest corner of the CE property is bordered by the Rainbow Reservoir portion of the Farmington River. The nearest residence is located approximately 500 feet north of the site in Birchwood, north of the Farmington River. The CE property consists of approximately 612 acres.

The site is currently zoned industrial I-2 by the Town of Windsor, and is located in a Mixed Land Use area of Hartford County. The I-2 Industrial Zone designates general, higher-intensity industrial uses. Nearby land uses are primarily commercial, agricultural, industrial, and residential. Much of the northern and western portions of the property are wooded.

The NRC issued a license amendment to license number 06-00217-06 in 2009 that authorized a partial site release for unrestricted use of 365 contiguous acres of the 612 acre facility after it was confirmed that the residual radioactivity met the radiological criteria for release for unrestricted use. The 365-acre parcel, which did not include any FUSRAP areas, had been previously remediated by CE in accordance with an NRC-approved Decommissioning Plan (DP) and under NRC oversight.

3.0 SITE HISTORY

Combustion Engineering acquired ownership of the property in the 1950's and maintains the property title. In 1989, CE merged with Asea Brown Boveri Inc, (now ABB Inc.) and became ABB Combustion Engineering Nuclear Power. Despite the merger, CE maintains its corporate identity and is still referred to as Combustion Engineering. Although CE is associated with ABB, and has leased portions of its operations to other companies, CE retained property ownership of the site (ENSR 2004). In this Site Closeout Report, ABB Combustion Engineering Nuclear Power is referred to as "Combustion Engineering" or "CE".

From the mid-1950s, activities with radioactive materials at the CE site have included research, development, engineering, production, nuclear fuel systems servicing, nuclear fuel fabrication, and other related radiological services. These activities were conducted under contracts with the U.S. Government (U.S. Navy) and commercial customers. Although the site was primarily used for nuclear fuel production activities with low-enriched uranium (commercial customers) and high-enriched uranium (U.S. Navy), other services and activities involving byproduct material, thorium, and radium were also conducted at the site. Due to spills and leaks associated with these operations and waste disposal practices (i.e., incineration), various buildings, waste water lines, and some land areas were radiologically contaminated.

From the mid-1950s to the early 1960s, certain buildings and areas of the site were used in support of the U.S. Government's Naval nuclear programs under contracts with the AEC. The site areas impacted by these programs have residual uranium contamination.

In the early 1960s, the AEC issued License No. 06-00217-06 to CE, primarily authorizing research and development related activities. In 1968, the AEC issued License No. SNM-1067 to CE authorizing commercial fuel manufacturing activities to be conducted at the site. These licenses have been amended and renewed several times since they were issued to address administrative and technical changes at the

facility and to address various corporate name changes. Commercial fuel research, development, and assembly ceased in April 2000, when CE sold its worldwide nuclear power business to Westinghouse. Westinghouse continued to service contaminated reactor components at the site until August 2001, when CE initiated preparations and plans for site decommissioning. Decommissioning activities were consolidated under License No. 06-00217-06, and License No. SNM-1067 was amended to authorize possession and storage only.

In 2004, CE initiated remediation for portions of the site under an NRC-approved Decommissioning Plan (DP). From 2005 through 2007, CE conducted Final Status Surveys (FSSs) and submitted Final Status Survey Reports (FSSRs) for the remediated portions of the site and in December 2007 requested unrestricted release of the 365-acre parcel of the site where decommissioning activities had been completed. Following a review of the FSSRs and after conducting confirmatory surveys, NRC approved the partial site release in January 2009.

As described above, radiological contamination at the site consisted of both NRC-regulated materials and materials from the U.S. Government's non-commercial related activities for the AEC. The U.S. Department of Energy has responsibility for decommissioning activities at sites designated as FUSRAP sites, and designated the CE site as a FUSRAP site. USACE executes decommissioning and remediation activities under the FUSRAP in accordance with a Memorandum of Understanding Between DOE and USACE (USACE 1999). As a result of the past work activities at the site, there was extensive commingling of FUSRAP-related materials with NRC-regulated materials in portions of the CE site with residual radiological contamination. This commingling brought the materials under both the NRC regulatory authority and USACE FUSRAP authority. Following discussions among CE, NRC, USACE, and DOE, the NRC and USACE in August 2007 agreed that in order to facilitate the efficient and effective decommissioning of the site, CE would conduct the decommissioning of the site pursuant to NRC regulations. CE amended their DP for the second phase of site decommissioning to encompass the FUSRAP-related materials along with the remaining NRC-regulated materials. In December 2007, CE (through its contractor, MACTEC) finalized the Selected Remedy Plan (SRP). The SRP is the Decision Document. It presents the selected remedial actions for the FUSRAP areas at the CE site.

In 2011, NRC approved a revised DP (Rev. 2) that considered the cleanup of both the residual NRC-regulated material and FUSRAP-related material for the remaining impacted areas of the CE site. The revised DP included site-specific cleanup criteria (Derived Concentration Guideline Levels (DCGLs)) that were approved by the NRC. CE and its contractor implemented the DP under NRC oversight during calendar years 2011-2012. Onsite remediation activities were completed in December 2011 and CE submitted the series of seven FSSRs from July 2011 through May 2012. USACE reviewed the FSSRs and had no objection to license termination (see Attachment C). Upon removal of stored licensed material and completion of the onsite remediation activities by CE, the NRC approved an action in February 2012 to terminate the SNM-

1067 license. NRC License No. 06-00217-06 remained in effect until final site decommissioning actions were completed. This license was terminated by the NRC in September 2013. Amendment No. 18 to SNM-1067, which terminates the license, is included in Attachment C. Likewise, Amendment No. 67 to License No. 06-00217-06, which terminates the license, is also included in Attachment C.

4.0 PREVIOUS INVESTIGATIONS

The Combustion Engineering Site has undergone a number of investigations relating to the occurrence of FUSRAP-related COCs. This is a brief timeline of the events which are discussed in more detail in the following sections:

- 1993 DOE (Oak Ridge Institute for Science and Education(ORISE)) Site Survey
- 1996 ORISE Additional Site Survey/Evaluation
- 1997 USACE is assigned responsibility for FUSRAP
- 1998 USACE (SAIC) Characterization fieldwork
- 2000 Remedial Investigation (RI) fieldwork
- 2004 RI/Risk Assessment Report (ENSR) published
- 2006 Feasibility Study Report Version 4.2 (ENSR) published
- 2007 USACE/CE Agreement
- 2009 CE starts site remediation activities
- 2011-12 CE submits 7 FSSRs for approval

4.1 DOE INVESTIGATIONS

CE discovered and investigated radiological contamination at the site in the early 1990s, and suspected that some residuals were the direct result of MED/AEC processes. In 1991, CE provided information on residual radioactivity at the site to DOE. DOE reviewed site records and completed a survey of the property to determine whether the radioactivity was connected to the AEC activities, which were conducted at the site in the late 1950's and early 1960's. In 1993, at the request of the DOE, the Oak Ridge Institute for Science and Education (ORISE) performed radioactive surveys of portions of the site. The surveys confirmed that radiological residuals were present in areas within Building 3 and the grounds north of Building 3, the Waste Storage Pad, the Drum Burial Pit, Site Brook and its associated bank, and the Industrial Drain Lines. The results of this survey are documented in *Designation Survey for the Combustion Engineering Site*, *Windsor, Connecticut* (ORISE, 1994). DOE issued the *Authority Determination for the Combustion Engineering Site*, Windsor, Connecticut on June 20, 1994 (DOE,1994). This Determination Letter stipulates that the DOE has authority to conduct a Remedial Investigation, and any subsequent remedial actions (as necessary) at the CE site under FUSRAP for the following areas:

- Building 3
- Other facilities or areas associated exclusively with Building 3 (i.e. sewer lines)

- Areas where radioactive contamination is exclusively HEU (i.e., U-235 enrichment in excess of 20%)

The Authority Determination letter also states that remedial action at the site must be restricted to highly-enriched uranium (HEU) or other nuclear materials whose possession has not been licensed.

In the summer of 1996, DOE requested that ORISE re-evaluate the radioactive conditions of the CE site. The objective of this follow-up study was to provide more up-to-date information on site conditions, and incorporate sediment sampling data collected from Site Brook for the S1C Facility (nuclear submarine training facility) closure. This study confirmed the results of the 1993 survey. During this re-evaluation, uranium contamination in Site Brook was further characterized using a data set of over 121 sediment samples collected from Site Brook in 1991 by S1C facility personnel (ORISE, 1996).

The S1C Facility consisted of a nuclear powered submarine prototype, which CE operated for the U.S. Navy as part of a government-owned, contractor-operated (GOCO) arrangement. After approximately 10 years of operation by CE, in 1970, the federal government transferred operation of the facility from CE to the General Electric Company (GE). GE's operation in Windsor was one of several operations conducted as part of the Knolls Atomic Power Laboratory (KAPL). KAPL, Inc., based in upstate New York, is a research and development facility, solely dedicated to support of the U.S. Naval Nuclear Propulsion Program. KAPL operations were subsequently transferred from GE to Martin Marietta Energy Systems. Martin Marietta then merged with Lockheed Corporation to form Lockheed-Martin, Inc. The KAPL facility in Windsor was closed permanently in 1993, and decommissioned by Lockheed-Martin personnel. Prior to its closure, however, discharges of cobalt-60 from KAPL to the CE site occurred.

4.2 USACE INVESTIGATIONS

In 1997, the responsibility to administer and execute FUSRAP to clean up contaminated sites from the Nation's early atomic energy program was transferred from DOE to USACE by Congress with the passage of the Energy and Water Development Appropriations Act for fiscal year 1998 (P.L. 105-62, signed into law October 13, 1997). One of the initial steps taken at the CE site by USACE was to develop a Sampling and Analysis Plan (SAP) for the characterization of the FUSRAP areas at the site. The plan included field screening and field sampling activities necessary to identify on-site radionuclides, and to assess the potential hazards that each area poses to human health and the environment (ENSR, 2000).

Using the DOE Authority Determination Letter and subsequent site reconnaissance, the following nine study areas on the CE site were identified as being subject to FUSRAP investigation:

Environmental Study Areas

- Areas Surrounding Buildings 3 and 6
- Drum Burial Pit
- Waste Storage Pad (Woods Area)
- Site Brook
- Debris Pile
- Industrial Drain Lines
- Clamshell Area

Building Study Areas

- Building 313A
- Building 6

In April and May 1998, USACE directed Science Applications International Corporation (SAIC) to perform a gamma walkover survey of the areas around Buildings 3/3A and 6, the Waste Storage Pad, the Drum Burial Pit, and areas along Site Brook. This investigation showed that radioactivity was present in the surface of each of these areas (SAIC, 1998).

In 1998, SAIC completed a second investigation to characterize the Building 3/3A complex. The building characterization report (SAIC, 1999) provides details relative to the methods and procedures implemented, and presents the radiological survey and analytical results. This investigation showed that radionuclides were present mostly at the north end of Building 3, and primarily on exposed surfaces. This investigation also showed radionuclides in the drain lines leading from the buildings, but no evidence of radionuclides at Building 3A.

In 2000/2001, ENSR completed a characterization study to better understand the presence of radiological materials within the FUSRAP areas. ENSR completed this work under contract to USACE. The data generated through field activities were summarized and presented in a report titled *Data Report, Combustion Engineering Site, Windsor, Connecticut* (ENSR, 2001).

Based upon the results of the RI (ENSR, 2004) and risk assessments, the following areas were eliminated from evaluation in the FS prepared by the USACE contractor, as summarized below (ENSR 2006):

- There are no risks in excess of regulatory thresholds posed by HEU in soil in the Areas Surrounding Buildings 3 and 6, or by soil near the Industrial Drain Lines.

- There is no radioactive material in excess of building-specific Derived Concentration Guideline Levels (DCGLs) inside Buildings 313A and 6.

- Groundwater and surface water, in the vicinity of the nine study areas, do not contain HEU.

4.3 CE INVESTIGATIONS

In April 2002, CE initiated additional characterization activities at the areas that had been accepted by FUSRAP in order to address data gaps and to better delineate the vertical and/or horizontal extent of residual radioactivity. This work is described in the *Limited Radiological Characterization Investigation Report* (Harding ESE, 2002).

Also in 2002, CE (through its contractor MACTEC), conducted additional characterization activities at five areas of the site that, at that time, were not designated as FUSRAP areas. This work is described in *Radiological Characterization Report for Five Potential FUSRAP Areas*, (MACTEC, March 2003).

For the Remedial Investigation (RI), USACE requested the cooperation of CE to compile the most complete data set possible. The data set included both CE and USACE information obtained for the FUSRAP study areas. CE provided sampling data from their Limited Radiological Characterization programs, relative to the FUSRAP study areas.

5.0 SELECTED REMEDY

The remedy selected for the CE Site is referred to as Alternative SS3 - Excavation and Off-Site Disposal, in the Selected Remedy Plan issued December 2007. Implementation of the Selected Remedy involved excavation of contaminated soils, building demolition, offsite transportation of waste, and disposal of waste at an appropriately permitted/licensed disposal facility.

USACE determined, in its Feasibility Study report (ENSR, 2006) that the NRC standards for decommissioning of licensed facilities found in Title 10, Part 20, Section 1402, of the Code of Federal Regulations (10 CFR 20.1402) were relevant and appropriate for cleanup of FUSRAP-contamination in soils at the Combustion Engineering Site.

Under 10 CFR 20.1402, a facility is considered to be acceptable for unrestricted use if residual radioactivity above background does not exceed a total effective dose equivalent (TEDE) of 25 millirem per year (mrem/yr) to the average member of the critical group, including groundwater sources of drinking water. The facility must further reduce residual radioactivity to as low as reasonably achievable (ALARA) levels. The critical group, defined as "the group of individuals reasonably expected to receive the greatest exposure to residual radioactivity for any applicable set of circumstances" is the occupational worker for the Combustion Engineering site for total uranium (U-234, U-235, and U-238) and Co-60.

The State of Connecticut has determined that a potential future dose of 19 mrem/yr is protective of human health and satisfies the requirements of its Remediation Standard Regulations.

In compliance with these standards, CE:

1. Excavated FUSRAP contaminated soils that exceeded, excluding background, a Sum of Ratios (SOR) of 1, based on the average Derived Concentration Guideline Levels ($DCGL_w$). Site-specific DCGLs were derived for soil and accepted by the NRC as part of the DP. The approved site-specific $DCGL_w$ for total uranium is 557 pCi/g and the $DCGL_w$ for Co-60 is 5 pCi/g. Although the occupational worker is judged the most likely future exposure scenario, the resident farmer was limiting. Therefore, DCGLs were derived to limit the future potential dose to the resident farmer to 19 mrem/yr. Additional information can be found in the report *Derivation of the Site-Specific Soil DCGL*s (MACTEC, 2003). In addition, the elevated measurement comparison ($DCGL_{emc}$) was used to ensure no localized areas of elevated radioactivity remained that could potentially produce an unacceptable risk. Verification of compliance with soil cleanup goals was demonstrated using surveys developed in accordance with the Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM). This confirmation methodology was developed and documented in the Final Status Survey Plans (FSSPs) during the remedial design.

2. Decontamination and/or dismantlement of buildings. Building DCGLs for the Site were calculated using RESRAD-BUILD Version 3.4 modeling code. For total uranium, building renovation or demolition is more conservative than building occupancy, and inhalation is the primary exposure pathway. On the other hand, building occupancy was more restrictive for reactor byproduct and external dose is the primary exposure pathway. For each scenario, a DCGL is proposed for total uranium and reactor byproduct (Co-60) for building surfaces yielding 19 mrem per year and high enrichment (90%). The building surface DCGLs are 20,148 dpm/100 cm^2 for total uranium and 6,980 dpm/100 cm^2 for reactor byproduct (Co-60). Additional information can be found in the report *Development of Building DCGLs* (MACTEC, 2008)

3. During decommissioning activities, thorium-232 (Th-232) and radium-226 (Ra-226) were identified within some portions of the Woods Area and the Drum Burial Pit due to the disposal of incineration wastes in those areas. Consequently, site-specific soil DCGLs for these two radionuclides were calculated and accepted by the NRC. The approved site-specific $DCGL_w$ for Th-232 is 4.0pCi/g and the $DCGL_w$ for Ra-226 is 5.5 pCi/g which correspond to 19 mrem/yr to the resident farmer. Additional information can be found in *Derivation of the Site-Specific Soil DCGLs, Addendum, Soil DCGLs for Thorium and Radium* (ABB, 2010).

4. Removed and disposed off site all impacted soils to achieve cleanup goals, as discussed in item 1 above, for FUSRAP COCs.

Remedial Action Objectives (RAOs), as stated in the Selected Remedy Plan, for the FUSRAP areas are listed below.

- Decontaminate and dismantle radiologically contaminated buildings and systems at Building 3 and Building 6 to prevent exposure to unacceptable levels of radiological contamination.
- Dismantle Buildings 3 and 6 to allow complete evaluation of contamination conditions in soil and drain lines beneath and next to the buildings
- Prevent contaminants in vadose zone soil at concentrations exceeding the CTDEP Pollutant Mobility Criteria from contributing to groundwater contamination above concentrations of concern.
- Prevent human receptor exposure to radiologically contaminated soil and sediment at the identified FUSRAP areas at levels exceeding DCGLs.
- Prevent human receptor exposure to chemically contaminated soil and sediment at the identified FUSRAP areas at concentrations exceeding cleanup levels based on CTDEP Remediation Standard Regulations (RSRs).
- Prevent human receptor exposure to groundwater with contaminants exceeding the cleanup levels.

The Selected Remedy addressed the principal threat from FUSRAP COCs at the site by removing radiological contamination from the site that may pose a future threat to the health of persons at the site. Implementation of this remedy was intended to meet the unrestricted release criteria as defined in the LTR. The Selected Remedy only addressed FUSRAP-related COCs, and did not address any other hazardous substances that may have been present at the site. The determination of the need for and performance of response actions related to other releases of hazardous substances at this site was not within the authority of USACE under FUSRAP. It was the responsibility of other agencies and parties to undertake any other necessary response actions at the site.

6.0 REMEDIAL ACTION SUMMARY

The following subsections provide a brief description of FUSRAP designated areas and present the nature and extent of radiological contamination. Figure 2 shows the location of the FUSRAP designated areas. Each of these areas contained high enriched uranium (HEU) contamination in soils, sediment, and/or building surfaces. FUSRAP designated areas are contaminated with Government HEU in excess of 20% enrichment in the isotope U-235 and Government low enriched uranium (LEU). Ground and surface water around the FUSRAP designated areas is not radiologically impacted.

The bulk of characterization activities at most of the FUSRAP designated areas was concluded by 2004. Remediation of the Rapaport Building as a vicinity property was conducted by USACE in 1999. Radiological remediation efforts at the other FUSRAP designated areas began in 2009.

6.1 REMEDIAL ACTION

The original designation surveys and subsequent investigations by USACE and CE identified the following eight FUSRAP areas requiring remediation.

Buildings 3 and 6 (AOC 9)

Operations utilizing HEU and other radiological materials and chemicals were conducted in Buildings 3 and 6. Building 3 housed nuclear fuel fabrication facilities. It was a one-story, 56,000 square foot structure constructed in 1956 and divided into three sections: the North Bay, Main Bay, and the 70-foot tall High Bay. Building 6 was constructed in 1956 and treated radiologically contaminated waste water from Building 3.

Following decontamination and dismantlement of Buildings 3 and 6, the primary objective of the remedial action was to remove subsurface utilities (e.g., storm drain, sanitary, and industrial waste line piping) and associated soil in the vicinity of the Building 3 and 6 area which had uranium activity above the DCGL. The secondary objective was to remove materials with chemical constituents at concentrations above Connecticut Department of Energy and Environmental Protection (CTDEEP) Remediation Standard Regulations Criteria. Materials with polynuclear aromatic hydrocarbons (PAHs) at concentrations above applicable CTDEEP RSR Criteria were co-located with the materials with elevated uranium activity.

Excavation of the Buildings 3 and 6 Area was completed between April 2010 and June 2011. Removal of subsurface utilities and excavation of contaminated soil was performed in a series of excavation events. The initial excavation removed the bulk of the contaminated materials that had been identified during characterization activities. However, as confirmation sampling and FSS activities were performed, additional contaminated materials were discovered and subsequently removed during additional excavation events.

Radiological surveys were conducted on the subsurface utilities removed during the remediation, as well as the completed excavation areas.

The following is a summary of waste materials generated during remediation of the Buildings 3 and 6 Area.

[1]Waste Type	Volume (cubic feet)
Radiologically-contaminated debris	27,547
Radiologically-contaminated soil	440
Mixed waste	7.5
Non-radiological hazardous waste	37.5
Non-radiological chemical or TSCA waste	980
TOTAL VOLUME	29,012

[1]Construction Summary Report, Buildings 3 and 6 Area, AMEC for ABB,

Restoration of the Buildings 3 and 6 Area was accomplished by backfilling where necessary and re-grading the areas to meet the performance criteria for slopes specified in the design documents, prevent topographical depressions, and blend with the surrounding topography. Final restoration of the area consisted of placement of topsoil and grass seed to prevent erosion and replacement of asphalt pavement.

A Final Status Survey (FSS) was conducted in accordance with the requirements of the Site's DP to demonstrate that radiological parameters did not exceed the established DCGLs. A FSS Report was prepared and submitted to the NRC and CTDEEP to document closure of the Building 3/6 Area from a radiological perspective.

Drum Burial Pit (AOC 21)

The Drum Burial Pit was used from 1956 through 1960 to dispose of miscellaneous solid waste materials and contaminated solid wastes generated from radiological processes during the period of contract work for the Government. Most of the materials were contained in 55-gallon drums.

DOE and USACE identified the Drum Burial Pit as a FUSRAP designated area containing HEU contamination in soil. The Drum Burial Pit contained HEU in excess of 20% enrichment (ranging from 53 to 82% enrichment), which had been identified as posing potential risks to human health and the environment. The Drum Burial Pit contained HEU activity up to 15,923 picocuries per gram (pCi/g), which far exceeded the DCGL of 557 pCi/g.

The primary objective of the remedial action was to remove soil and debris associated with the Drum Burial Pit with uranium activity at levels above the DCGL. The secondary objective was to remove materials with chemical constituents at concentrations above CTDEEP RSR Criteria. Materials with beryllium and polychlorinated biphenyls (PCBs) at concentrations above applicable CTDEEP RSR Criteria were co-located with the materials with elevated uranium activity.

Excavation of the Drum Burial Pit was completed between November 2009 and May 2011.

Excavation of contaminated soil and debris was performed in a series of excavation events. The initial excavation removed the bulk of the contaminated materials that had been identified during characterization activities. However, as confirmation sampling and FSS activities were performed, additional contaminated materials were discovered and subsequently removed during additional excavation events.

As anticipated, several buried drums were encountered during the excavation activities. The drums encountered varied in condition; from empty, crushed drum pieces to fully intact drums containing various quantities of solid and/or liquid materials. The drums

were removed, and the drum contents and underlying soils were sampled and analyzed for radiological and chemical constituents to characterize the materials for off-site disposal. The drum contents were removed and containerized for disposal and/or the drums were over-packed for off-site disposal.

Radiological surveys were conducted on the subsurface debris removed during the remediation, as well as the completed excavation areas.

The following is a summary of the waste materials generated during remediation of the Drum Burial Pit.

[1]Waste Type	Volume (cubic feet)
Radiologically-contaminated debris	22,652
Radiologically-contaminated soil	4,751
TOTAL VOLUME	27,403

[1]Construction Summary Report, Drum Burial Pit, AMEC for ABB, October, 2011

Restoration of the Drum Burial Pit was accomplished by backfilling and re-grading the area to meet the performance criteria for slopes specified in the design documents, prevent topographical depressions, and blend with the surrounding topography. Grass seed was applied to the remediation areas to establish vegetative growth and to prevent erosion.

A FSS was conducted in accordance with the requirements of the Site's DP to demonstrate that radiological parameters did not exceed the established DCGLs. A FSS Report was prepared and submitted to NRC and CTDEEP to document closure of the Drum Burial Pit from a radiological perspective.

Equipment Storage Yard (AOC 10)

The Equipment Storage Yard occupies approximately four acres along the southwestern shoreline of Small Pond. The area originally was used in the mid-1950s to store miscellaneous fill and construction debris.

The Equipment Storage Yard contained Government HEU in excess of 20% enrichment, which has been identified as posing potential risks to human health and the environment. The Equipment Storage Yard contained HEU activity exceeding the DCGL of 557 pCi/g and therefore was designated FUSRAP uranium.

The objective of the remedial action was to remove soil and debris associated with the Equipment Storage Yard with uranium activity at levels above the DCGL and to remove materials with chemical constituents at concentrations above CTDEEP RSR Criteria. Based on historical information, the primary chemical constituents of concern associated with the Equipment Storage Yard were PAHs, PCBs, antimony, and one

pesticide (i.e., 4,4-DDE. Some areas of soil with chemical constituents at concentrations above applicable CTDEEP RSR Criteria were co-located with the materials with elevated uranium activity.

Excavation of the Equipment Storage Yard was initially conducted between December 2009 and October 2010. Excavation of contaminated soil and historic fill material was performed in a series of excavation events. The initial excavation removed the bulk of the contaminated materials that had been identified during characterization activities. However, as confirmation sampling and FSS activities were performed, additional contaminated materials were discovered and subsequently removed during additional excavation events.

Buried debris (e.g., asphalt, concrete, and metal) was encountered during excavation activities. The debris was segregated and characterized for off-site disposal.

A partially buried drum was removed from the excavation area and containerized for off-site disposal. The drum contents and underlying soils were sampled and analyzed for radiological and chemical constituents to characterize the materials for off-site disposal.

The next phase of remediation consisted of excavation of the historic fill material to the approximate groundwater table to remove oversized debris and radiologically-contaminated materials. The excavation and screening activities were conducted between June and September 2011. Materials identified as chemically-contaminated and/or radiologically-contaminated were transported offsite for disposal. Material identified as non-contaminated (i.e., chemical concentrations below RSR Criteria and radiological activity below the DCGL) was returned to the excavation area during backfilling and restoration activities.

In October 2011, a series of soil samples were collected within the area of soil with PCE concentrations above RSR Criteria to further evaluate radiological activity. The area of PCE contaminated soil was then excavated and segregated into piles of approximately 50 cubic yards, followed by additional chemical characterization to determine final disposition of these soils.

The following is a summary of waste materials generated during remediation of the Equipment Storage Yard.

[1]Waste Type	Volume (cubic feet)
Radiologically-contaminated soil	834
Chemically-contaminated soil	100,063
Non-radiological hazardous waste	19,015
Non-radiological chemical waste	89,166
TOTAL VOLUME	209,078

[1]Construction Summary Report, Equipment Storage Yard, AMEC for ABB, March, 2012

Restoration of the Equipment Storage Yard was accomplished by backfilling and re-grading the areas to meet the performance criteria for slopes specified in the design documents, prevent topographical depressions, and blend with the surrounding topography. Final restoration of the area consisted of placement of topsoil and grass seed to prevent erosion.

A FSS was conducted in accordance with the requirements of the Site's DP to demonstrate that radiological parameters did not exceed the established DCGLs. A FSS Report was prepared and submitted to the NRC and CTDEEP to document closure of the Equipment Storage Yard from a radiological perspective.

Woods Area (AOCs1 and 4)

The Woods Area was used to store and stage radiologically-contaminated materials generated from industrial processes conducted in Buildings 1, 2, 3, 5, 6, 6A, and S1C during the period of contract work for the Government. Most of these materials were contained in 55-gallon drums that were stored in the Woods Area prior to shipment to off-site disposal facilities. Burial of radiologically-contaminated materials also occurred in this area.

DOE and USACE identified the Woods Area as a FUSRAP designated area containing HEU contamination in soil. The Woods Area contained Government HEU in excess of 20% enrichment (ranging from 24 to 87% enrichment), which had been identified as posing potential risks to human health and the environment. The Woods Area contained HEU activity up to 30,674 pCi/g, which far exceeded the DCGL of 557 pCi/g.

The primary objective of the remedial action was to remove soil and debris associated with the Woods Area with uranium activity at levels above the DCGL. The secondary objective was to remove materials with chemical constituents at concentrations above CTDEEP RSR Criteria. Materials with PCE, PAHs, PCBs, benzidine, antimony, lead, and zirconium at concentrations above applicable CTDEEP RSR Criteria were co-located with the materials with elevated uranium activity.

Excavation of the Woods Area was completed between November 2009 and May 2011. Excavation of contaminated soil and debris was performed in a series of excavation events. The initial excavation removed the bulk of the contaminated materials that had been identified during characterization activities. However, as confirmation sampling and FSS activities were performed, additional contaminated materials were discovered and subsequently removed during additional excavation events. Several buried drums and areas of buried debris (e.g., asphalt, concrete, and metal) were encountered during excavation activities. The drums encountered varied in condition; from empty, crushed drum pieces to fully intact drums containing various quantities of solid and/or liquid materials. The drums were removed, and the drum contents and underlying soils were sampled and analyzed for radiological and chemical constituents to characterize the materials for off-site disposal. The drum contents were removed and containerized for disposal and/or the drums were over-packed for off-site disposal.

Areas of buried debris were removed and the debris was containerized along with the excavated soil. Large pieces of debris (e.g., concrete slabs) were reduced in size as necessary to comply with the requirements of the off-site disposal facilities. Radiological surveys were conducted on the subsurface debris removed during the remediation, as well as the completed excavation areas.

The following is a summary of waste materials generated during remediation of the Woods Area.

[1]Waste Type	Volume (cubic feet)
Radiologically-contaminated debris	3,735
Radiologically-contaminated soil	39,487
Mixed waste	12
TOTAL VOLUME	43,234

[1]Construction Summary Report, Woods Area, AMEC for ABB, October, 2011

Restoration of the Woods Area was accomplished by backfilling where necessary and re-grading the areas to meet the performance criteria for slopes specified in the design documents, prevent topographical depressions, and blend with the surrounding topography. Final restoration of the area consisted of placement of topsoil and grass seed and/or placement of leaf litter to prevent erosion.

A FSS was conducted in accordance with the requirements of the Site's DP to demonstrate that radiological parameters did not exceed the established DCGLs. A FSS Report was prepared and submitted to the NRC and CTDEEP to document closure of the Woods Area from a radiological perspective.

Site Brook (AOC 14) and Debris Piles (AOC 13)

Site Brook (also known as Perkins Brook) flows northwest from Goodwin Pond for approximately one-half mile to the Farmington River. Site Brook received industrial and diluted radiological wastewaters and storm water runoff during the Government contract period. Discharges to the Site Brook have included treated sanitary wastewater, industrial wastewater, diluted radioactive wastewater from Building 6, and low-level radioactive wastes from the S1C facility. HEU was used in industrial processes and was present in the Site Brook floodplain soils and sediment.

DOE and USACE identified Site Brook as a FUSRAP designated area containing HEU contamination in floodplain soils and sediment. Site Brook contained Government HEU in excess of 20% enrichment (ranging from 17 to 95% enrichment), which has been identified as posing potential risks to human health and the environment. Site Brook

contained HEU activity up to 21,238 picocuries per gram (pCi/g), which far exceeded the DCGL of 557 pCi/g.

Uranium levels in Site Brook were highest at the industrial waste line (IWL) outfalls, located near the former wastewater treatment plant (WWTP). This area also encompasses the Debris Piles located between Site Brook and the former WWTP.

The primary objective of the remedial action was to remove soil, sediment, and debris associated with the Site Brook, Debris Piles, and IWL outfall areas with uranium activity at levels above the DCGL. The secondary objective was to remove materials with chemical constituents at concentrations above CTDEEP RSR Criteria. The only chemical constituent detected at concentrations above applicable CTDEEP RSR Criteria was zirconium in the Debris Piles, which was co-located with the materials with elevated uranium activity.

Remediation of Site Brook included removal of defined areas or segments of contaminated sediment along the brook. The remediation areas were delineated based on previous environmental site characterization efforts. Remediation of the segments began with the upper most segment (nearest Goodwin Pond) progressing to the next segment continuing west towards the terminus of Site Brook and Farmington River.

Remediation of Site Brook segments was accomplished by first diverting surface water flow at each of the segments. Flow diversion was required to facilitate remediation to be conducted in relatively dry conditions, or at least in non-flowing water. This approach allowed the other reaches of Site Brook to continue to receive flow throughout the remediation process. The diversion methods included installation of dewatering wells, sumps, temporary bladder dams, and diversion piping.

Once the stream flow was diverted, surveys were conducted to confirm the presence and extent of contaminated materials to be removed. Contaminated sediment and soil were then removed using vacuum equipment, hand tools, and small excavation equipment.

Remediation of the Debris Piles consisted of complete removal of the surficial debris, along with a few inches of the original ground surface that was exposed following removal of the debris.

Remediation of the IWL outfall areas was accomplished by first inspecting the IWLs and associated manholes for holes and cracks, and then performing surveys for radiological activity. The subsurface piping, manholes, and associated outfall structures were then removed and reduced in size as necessary to comply with the requirements of the off-site disposal facilities.

Following removal of the contaminated sediments and soil, confirmatory sampling and surveys were conducted to verify that the completed remediation area did not exhibit radiological activity above the DCGLs. All work was done in accordance with required wetlands permits.

The following is a summary of waste materials generated during remediation of the Site Brook, Debris Piles, and IWL outfall areas.

[1]Waste Type	Volume (cubic feet)
Radiologically-contaminated debris	4,291
Radiologically-contaminated soi/sediment	13,306
Non-radiological chemical waste	16
TOTAL VOLUME	17,613

[1]Construction Summary Report, Site Brook, Debris Piles, and IWL Outfall Areas, AMEC for ABB, March 2012.

Restoration of the remediation areas was performed in accordance with the requirements of the design documents. Backfilling of the stream channel was performed using materials similar to those within the existing stream bed. The stream channel was reconstructed to closely match the existing channel, taking into consideration the flow path, entrenchment, and sinuosity of the existing channel. Wetland soil was blended using a mixture of organic material and mineral soil. A wetland seed mix was sown to promote re-vegetation of the disturbed areas and woody debris was used to stabilize the wetland soil. Mulch and leaf litter were used to stabilize disturbed upland areas. Impacts to vegetation were addressed by planting and seeding native tree, shrub, and herbaceous species. Following completion of restoration efforts, the temporary diversion features were removed and surface water flow was restored.

A FSS was conducted in accordance with the requirements of the Site's DP to demonstrate that radiological parameters did not exceed the established DCGLs. A FSS Report was prepared and submitted to the NRC and CTDEEP to document closure of Site Brook, Debris Piles, and IWL outfall areas from a radiological perspective.

Industrial Waste Line (AOC 12)

The IWL system included two industrial waste lines (installed in 1956 and 1974) and one sanitary line (installed in 1956) that ran in parallel from near Buildings 3 and 6 to the WWTP. During the period of contract work for the Government, radioactive wastes from Building 3 were discharged to waste dilution tanks in Building 6, and then subsequently to the IWLs installed in 1956. These discharges were from processing HEU.

The IWLs were identified to contain sediment with uranium levels up to 97,000 pCi/g, which far exceeded DCGL of 557 pCi/g. HEU had been identified in the IWLs at up to 74% enrichment.

DOE and USACE identified the IWLs as a FUSRAP designated area that contained HEU in excess of 20%, which had been identified as posing potential risks to human health and the environment.

The objective of the remedial action was to remove the subsurface piping and manholes associated with the IWLs; the subsurface structures and utilities associated with the former WWTP; and any soil or other materials associated with these subsurface structures and utilities with uranium activity at levels above the DCGL.

The overburden soil (from ground surface to approximately the top of the IWL piping) was excavated and stockpiled for later re-use as backfill material in the completed IWL excavation areas. The IWLs and associated manholes were inspected for holes and cracks and surveyed for radiological activity. The subsurface piping and structures associated with the IWLs and former WWTP were removed and reduced in size as necessary to comply with the requirements of the off-site disposal facilities. The debris (e.g., piping and manhole structures) and associated soil were loaded into containers for off-site disposal. Excavation of the IWLs and former WWTP was completed between May and December 2010.

Radiological surveys were conducted on the subsurface piping and structures, as well as the completed excavation areas.

The following is a summary of waste materials generated during remediation of the IWLs and former WWTP.

[1]Waste Type	Volume (cubic feet)
Radiologically-contaminated debris	19,805
Radiologically-contaminated soil	2,662
Non-radiological hazardous waste	8
TOTAL VOLUME	22,475

[1]Construction Summary Report, Industrial Waste Lines and Waste Water Treatment Plant, AMEC for ABB, October 2011.

Restoration of the IWLs and former WWTP was accomplished by backfilling the excavation areas with the stockpiled overburden soils initially removed during the IWL excavation activities, followed by re-grading the areas to meet the performance criteria for slopes specified in the design documents, prevent topographical depressions, and blend with the surrounding topography. With the exception of the southern portion of the IWL excavation, topsoil and grass seed were placed in the excavation areas to establish vegetative growth and to prevent erosion.

A FSS was conducted in accordance with the requirements of the Site's DP to demonstrate that radiological parameters did not exceed the established DCGLs. A FSS Report was prepared and submitted to the NRC and CTDEEP to document closure of the IWLs and former WWTP from a radiological perspective.

Clamshell Pile (AOC27)

Clam shells were placed in the Site Brook in the late 1950s to buffer the pH of discharged wastewater, including radioactive wastewater. The Clam Shell Pile was a

mound of soil/sediment and clam shells that were removed from the streambed of Site Brook sometime after 1960.

DOE and USACE identified the Clam Shell Pile as a FUSRAP designated area containing HEU contamination in soil. The Clam Shell Pile contained Government HEU in excess of 20% enrichment (ranging from 26% to 33% enrichment), which had been identified as posing potential risks to both human health and the environment. The Clam Shell Pile contained HEU up to 1,297 pCi/g, which exceeded the DCGL of 557 pCi/g.

The primary objective of the remedial action was to remove the Clam Shell Pile and associated materials with uranium activity at levels above the DCGL. The secondary objective was to remove materials with chemical constituents at concentrations above CTDEEP RSR Criteria. Materials with zirconium and PCBs at concentrations above applicable CTDEEP RSR Criteria were co-located with the materials with elevated uranium activity.

Excavation of the Clam Shell Pile was completed in November 2009. The completed excavation area was approximately 24 feet by 44 feet, with an overall depth ranging from 1.5 to 6 feet below ground surface (bgs). Approximately 2,415 cubic feet of material (approximately 90 tons) was excavated, placed in shipping containers, and loaded into gondola rail cars for off-site disposal.

Restoration of the Clam Shell Pile was accomplished by re-grading the area to meet the performance criteria for slopes specified in the design documents, prevent topographical depressions, and blend with the surrounding topography. Topsoil and grass seed were placed in the excavation area to establish vegetative growth and to prevent erosion.

A FSS was conducted in accordance with the requirements of the Site's DP to demonstrate that radiological parameters did not exceed the established DCGLs. A FSS Report was prepared and submitted to the NRC and CTDEP to document closure of the Clam Shell Pile from a radiological perspective.

6.2 COMMUNITY INVOLVEMENT

Notice of the availability of the Proposed Remedy Plan for the FUSRAP areas was published in the Journal Inquirer of Manchester, Connecticut, on September 27, 2007. A public informational meeting and hearing on the Proposed Remedy Plan was held at the Windsor Town Hall on October 18, 2007, and a public comment period was held from September 27 through October 27, 2007. At the public meeting, CE presented the Proposed Remedy Plan and answered questions from the public prior to providing opportunity for formal comments on the plan. Comments received during the public comment period and CE's responses are contained in the Responsiveness Summary that is Part 3 of the Selected Remedy Plan (MACTEC, 2007).

In addition, the community was kept advised of investigative and cleanup activities at the CE Windsor Site through periodic meetings, public notices, and newsletters.

The Proposed Remedy Plan and other remaining commercial and FUSRAP area documents were made available for public review in the Administrative Record file that is maintained at the Windsor Public Library, 323 Broad Street, Windsor, Connecticut.

6.3 FUTURE LAND USE

The CE Site occupies approximately 600 acres and is located south of the Farmington River. Approximately one-third of the CE Site is developed with buildings, infrastructure, and maintained landscape. The remaining two-thirds of the property are wooded. The CE Windsor Site is classified as an I-2 Industrial Zone by the Town of Windsor.

The I-2 Industrial Zone category designates general, higher-intensity industrial uses. Over the history of its operation, the CE Site was used primarily for nuclear and fossil power research and development, nuclear fuel production, and repair of nuclear power plant equipment. Current operations at the CE Site consist of fossil fuel research, development, engineering, and design activities.

Following cleanup of the remaining commercial and FUSRAP radiological areas of the CE Site, CE intends to redevelop the Site, or at least a portion thereof. Definitive reuse plans have not been defined at this time. However, based on zoning and surrounding land use, it is most likely that future use of the Site will continue to be commercial/industrial.

7.0 MONITORING RESULTS

7.1 FINAL STATUS SURVEYS

The FSS is a process designed to determine whether concentrations of residual radioactivity comply with the cleanup criteria as defined in the Selected Remedy Plan. The FSS process for the post-remediation assessment of residual radioactivity at the Combustion Engineering Site was conducted in accordance with MARSSIM (EPA, 2000).

MARSSIM identifies three classifications of areas, according to contamination potential:

- Class 1 areas are areas that had, prior to remediation, a potential for radioactive contamination or known contamination in excess of the DCGL.
  - Class 1 soil areas are <2,000 m^2.
- Class 2 areas are areas that have not been remediated, that have a potential for radioactive contamination or known contamination, but are not expected to exceed the DCGL.

- Class 2 soil areas were < 10,000 m^2.

- Class 3 areas are areas that were not expected to contain residual radioactivity, or are expected to contain levels of residual radioactivity at a small fraction of the DCGL.
  - Class 3 areas are unlimited in size.

Implementation of the FSS process included execution of some, or all, of the following activities for each FSS Unit within the Combustion Engineering Site:

- Areas of the site were classified as Class 1, Class 2, or Class 3 survey units.
- Gamma walkover scans were performed over 100 percent of accessible soil surfaces within Class 1 survey units, between 25 and 50 percent of accessible soil surfaces within Class 2 survey units, and 10 percent of accessible soil surfaces within Class 3 survey units.
- Systematic (and some bias) surface soil samples were collected from within individual survey units in accordance with the Site Final Status Survey Plan.
- Samples were analyzed on-site via gamma spectroscopy.
- Independent Verification samples were collected by CTDEEP.
- Seven Final Status Survey Reports (Submittals 1-7) were prepared, submitted to, and approved by USACE, CTDEEP, and NRC.

Following is a survey unit summary as detailed in FSSR Submittals 1-7.

Submittal 1 (Industrial Waste Lines)
Fifteen survey units were created in support of the FSS: eight Class 1 survey units, three Class 2 survey units, and four Class 3 survey units. 341 volumetric soil samples were collected. Concentrations of residual radioactivity were found to be very minimal with a maximum total uranium result less than 2% of the DCGL (Attachment B, Tables 1 and 2).

Submittal 2 (Building 3 High Bay)
Three survey units were created in support of the FSS. All three survey units were Class 3 survey units. 94 direct static surface measurements (not counting replicate measurements) and an equal number of removable surface measurements from the wall, floor, ceiling, and roof surfaces from the 3 survey units were collected and analyzed. Residual radioactivity was found to be very minimal and essentially at background (Attachment B, Table 3).

Submittal 3 (Clamshell Pile, Drum Burial Pit, and Woods Area)
Fourteen survey units were created in support of the FSS: nine Class 1 survey units and five Class 2 survey units. 373 volumetric soil samples were collected. Survey unit average concentrations of residual radioactivity were found to be low with a maximum total uranium result less than 12% of the DCGL (Attachment B, Tables 4 - 7).

Submittal 4 (Building 3/6 area)
Eleven survey units were created in support of the FSS: ten Class 1 survey units and one Class 2 survey unit. 295 volumetric soil samples from the 11 survey units were collected. Concentrations of residual radioactivity were found to be very minimal with a maximum total uranium result less than 14% of the DCGL (Attachment B, Tables 8 and 9).

Submittal 5 (Site Brook and Debris Piles)
Thirteen survey units were created in support of the FSS: six Class 1 survey units, six Class 2 survey units, and one Class 3 survey unit. 338 volumetric soil samples were collected. Survey unit average concentrations of residual radioactivity were found to be low with a maximum total uranium result less than 57% of the DCGL (Attachment B, Tables 10 and 11).

Submittal 6 (Equipment Storage Yard)
Nine survey units were created in support of the FSS: two Class 1 survey units, five Class 2 survey units, and two Class 3 survey units. 171 volumetric soil samples were collected. Survey unit average concentrations of residual radioactivity were found to be low with a maximum total uranium result less than 2% of the DCGL (Attachment B, Tables 12 and 13).

Submittal 7
No remediation was performed in the areas addressed in this FSS Report. Submittal 7 did not include any FUSRAP areas. The FSS units presented in this Report represent the as-left condition of open land areas located throughout the site.

7.2 COMPARISON TO EPA FINAL GUIDANCE

On June 13, 2014, EPA published new final guidance in OSWER 9285.6-20 entitled "Radiation Risk Assessment at CERCLA Sites: Q&A". The guidance replaced a previous version issued in 1999 and it changed the Superfund recommendation on what is considered a protective dose-based ARAR from 15 mrem/yr to 12 mrem/yr to achieve a 3 E-4 cancer risk.

At CE, soil DCGLs were developed for the most limiting scenario (the resident farmer) based on a factor of 1 mrem potential dose per 29.3 pCi/g total uranium. The maximum total uranium FSS result from all survey units at CE was 317.9 pCi/g. This corresponds to a potential dose of 10.8 mrem/yr to the resident farmer which is below EPA's recommended dose of 12 mrem/yr. The second highest total uranium FSS result from all survey units was 105.4 pCi/g.

8.0 DEMONSTRATION OF CLEANUP QUALITY

During sampling and survey activities by CE's contractor at the Site, controls were implemented to ensure sufficient data of adequate quality and usability was collected for

confirming that the project's release levels were met. These controls also ensured that data was verified authentic, was appropriately documented, and is technically defensible. Quality assurance (QA) was achieved through three primary approaches: data management, sample custody, and quality control (QC) measurements.

8.1 Data Management

Volumetric sample collection and field measurement results were recorded both electronically (GPS logging of sample locations) and through hard copy (radiological survey forms, maps, and chain-of-custody forms). Volumetric sample laboratory analytical result data were recorded electronically. Records of field-generated data were reviewed by contractor supervisory personnel. Electronic copies of original electronic data sets are preserved on a retrievable data storage device. No data reduction, filtering, or manipulation was performed on the original electronic versions of data sets.

8.2 Sample Custody

Sample quality, related to sample collection, was controlled through the use of trained personnel implementing approved, written operating procedures. Methods employed in operating procedures took into account the need to prevent sample contamination through the use of dedicated equipment, decontamination of equipment between sample collection, and isolation of samples in discrete sample containers.

FSS sample custody and control was accomplished by:

- Assigning a unique sample identification number to each sample collected in accordance with the FSSP,
- Recording the date, time, sample type, and location and linking that information with the sample identification number and the required analysis,
- Requiring that sampling personnel, possessing the physical samples, be accountable for the Chain-of-Custody for the sample, and
- Implementing a Chain-of-Custody protocol for sample materials processed on-site as well as those samples sent for analysis at an off-site laboratory.

8.3 QC Measurements

A significant portion of the data comes from volumetric media samples and from in situ field measurements using conventional health physics techniques and practices. Both require additional steps in order to ensure accuracy of the sampling techniques and analysis methodologies.

8.3.1 Volumetric Duplicate Samples

The prescribed QC for volumetric media sampling activities consisted of duplicate (split) sampling. Duplicate sampling provides the means to assess the consistency and precision of the overall sampling and analytical system. Field duplicate samples were prepared in the field at a frequency of no less than 5 percent (1:20) for the sample population expected, and were submitted to the on-site gamma spectroscopy system for analysis as duplicate samples.

The QC metric for monitoring instrument precision consisted of a laboratory instrument replicate count, which is the repeated measurement of a sample that has been prepared for counting (i.e., laboratory sample preparation and radiochemical procedures have been completed). It is used to determine the precision of the analytical system (repeated measurements using the same instrument) and the instrument calibration (repeated measurements using two different instruments, such as two different germanium detectors with multichannel analyzers). Laboratory Instrumentation Replicate counts were performed in the HP count laboratory at a frequency of no less than 5 percent (1:20) for the sample population expected, and were performed on the on-site gamma spectroscopy system for analysis as laboratory recounts.

The prescribed QC for laboratory instruments consists of instrument source response checks, energy calibration checks, efficiency calibration checks, background checks, and replicate volumetric measurements performed on a percentage of the samples collected using an off-site system.

8.3.2 Field Instrument Response Checks

The prescribed QC for radiological surveys (gamma walkover, static, or screening surveys) consisted of survey instrument response checks. Daily or prior to initiating the surveys, the survey instrument was response checked to a known source. A control chart for the instrument was created to evaluate the instruments' responses to the radioactive source over the sampling period time frame. No degradation or unexplained variability of the instruments' response was observed during the performance of the FSS.

8.4 NRC Technical Evaluation

The NRC completed its review of CE's FSSRs, conducted inspections, performed confirmatory measurements and sampling, received confirmation that waste shipments from the site had been received by a licensed disposal facility, and received appropriate decommissioning records. The NRC staff concluded, in accordance with 10 CFR 30.36(k), that: (1) licensed material had been properly disposed; (2) reasonable effort had been made to eliminate residual radioactive contamination; (3) the licensee had submitted site radiological survey and other information that demonstrated that the site was suitable for release for unrestricted use in accordance with the radiological criteria for license termination in 10 CFR Part 20 Subpart E; and (4) records required by 30.51(d) and 30.51(f) had been received.

NRC staff found that CE had completed decommissioning in accordance with its approved DP. Therefore, the staff concluded that the site was acceptable for release for unrestricted use with no further action, and that the license could be terminated.

In accordance with the 2002 Memorandum of Understanding (MOU) between the EPA and the NRC, "Consultation and Finality on Decommissioning and Decontamination of Contaminated Sites", the NRC staff provided a Level 1 consultation letter to the EPA stating that the proposed DCGLs for radionuclides in soil exceeded the trigger values in Table 1 of the MOU. The NRC staff further indicated that in accordance with the MOU, a Level 2 consultation would be provided if the residual soil contamination values following remediation exceeded the trigger values in Table 1 of the MOU. NRC staff reviewed the FSSRs, compared the FSSR data to the values for residential soil concentration in the MOU table, and concluded that the residual soil concentration values did not exceed the trigger values in Table 1 of the MOU to require a Level 2 consultation. This conclusion was documented in an informational letter to the EPA.

The NRC's Technical Evaluation Report is included in Attachment C.

9.0 SUMMARY OF OPERATION AND MAINTENANCE

The applied alternative of complete soil excavation above Selected Remedy Plan criteria and off-site disposal does not require operation and maintenance actions at the Combustion Engineering Site.

10.0 SUMMARY OF REMEDIAL COSTS

Below is a summary of remediation costs for the CE FUSRAP Site. There are no O&M costs.

Summary of Remediation Costs at the CE FUSRAP Site[1]

CE Removal/Remedial Costs	
USACE costs	$8,301,377
CE (ABB) costs	$64,000,000

[1]As a result of a Consent Decree entered on February 6, 2015 in the case of ABB Inc v United States, Civil Action No. 3:13-CV-1265(CSH), U.S. District Court, District of Connecticut, the United States paid to ABB $31,044,520 in settlement of ABB's claims for response costs, and ABB paid $3,148,322 to the United States in settlement of the United States' claim for response costs. Total response costs paid by the United States are $36,197,575, and total response costs paid by ABB are $36,103,802.

11.0 FIVE-YEAR REVIEW

Since the implemented remedy has resulted in FUSRAP-related COCs remaining at the site below levels that allow for unlimited use and unrestricted exposure, five-year reviews are not required pursuant to Section 121(c) of CERCLA and Part 300.430(f)(4)(ii) of the NCP

12.0 SITE TRANSFER FROM USACE TO DOE

12.1 General Site Transfer Process

Per the Memorandum of Understanding (MOU) between USACE and DOE (DOE and USACE, 1999), USACE will employ the following process to transfer a completed FUSRAP site from USACE to DOE.

USACE will provide the DOE with a signed copy of the declaration of response action completion and Site Closeout Report and any O&M and land use control implementation plans that may be required to ensure future protectiveness of the implemented remedy. USACE will also request and provide the DOE with any available letters from regulators regarding remedial action goals and will provide the DOE with an estimate of annual out-year cost requirements, a general description of the remedial goals, and any restrictions remaining on the property.

Ninety days before the end of the two-year short-term operations and maintenance period for which USACE is responsible, USACE will notify the DOE with the effective date of site transfer to DOE for long-term stewardship. Accompanying this notification will be a complete copy of the Administrative Record, the O&M plans and actual costs of the O&M for the first two years, and a description of the long-term actions required by the DOE. In addition, at sites where land use controls are required, USACE will provide the DOE with informational copies of the draft site-specific land use controls and implementation plans and keep DOE informed of changes in completion schedules and other events/issues that might impact DOE's future responsibilities at the site.

12.2 Site Transfer Process for the CE FUSRAP Site

Per the MOU between USACE and DOE, USACE will provide the DOE with a signed copy of the declaration of response action completion and Site Closeout Report (SCOR) for the CE FUSRAP Site, once available. The signature date of this CE SCOR officially starts the two-year short-term O&M period, for which USACE is responsible.

Ninety days before the end of the two-year short-term O&M period, USACE will notify the DOE with the effective date of transfer of the CE FUSRAP Site to DOE for long-term stewardship (i.e., two years from the signature date of this CE SCOR). Accompanying this notification will be a complete copy of the Administrative Record.

As discussed in Section 7.0, since residual total uranium, cobalt-60, radium-226 and thorium-232 are indistinguishable from background (i.e., naturally occurring)

radionuclide concentrations, no FUSRAP-eligible hazardous substances, pollutants, or contaminants remain at the CE FUSRAP Site that would preclude unlimited use and unrestricted exposure. In other words, the CE Site is deemed protective for unrestricted use and no land use controls, O&M, or five-year reviews are required to ensure the protectiveness of the remedy. Therefore, long-term actions required by the DOE for the privately-owned CE Site will be limited to records management.

During the two-year short-term O&M period, USACE will keep DOE informed of changes in completion schedules and other events/issues that might impact the DOE's future responsibilities at the CE FUSRAP Site.

13.0 SITE SUMMARY

The implemented remedy achieved the degree of cleanup and protection specified in the Selected Remedy Plan (SRP) for the Combustion Engineering Site for all pathways of exposure. No further response is needed to protect human health and the environment from the FUSRAP-related COCs. All SRP remedial action goals have been achieved and compliance with the LTR, the State of Connecticut Remediation Standard Regulations, and EPA guidance has been demonstrated at the site. Residual concentrations have been found to be suitable for all projected uses of the site without restrictions.

14.0 REFERENCES

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ATTACHMENT A: FIGURES

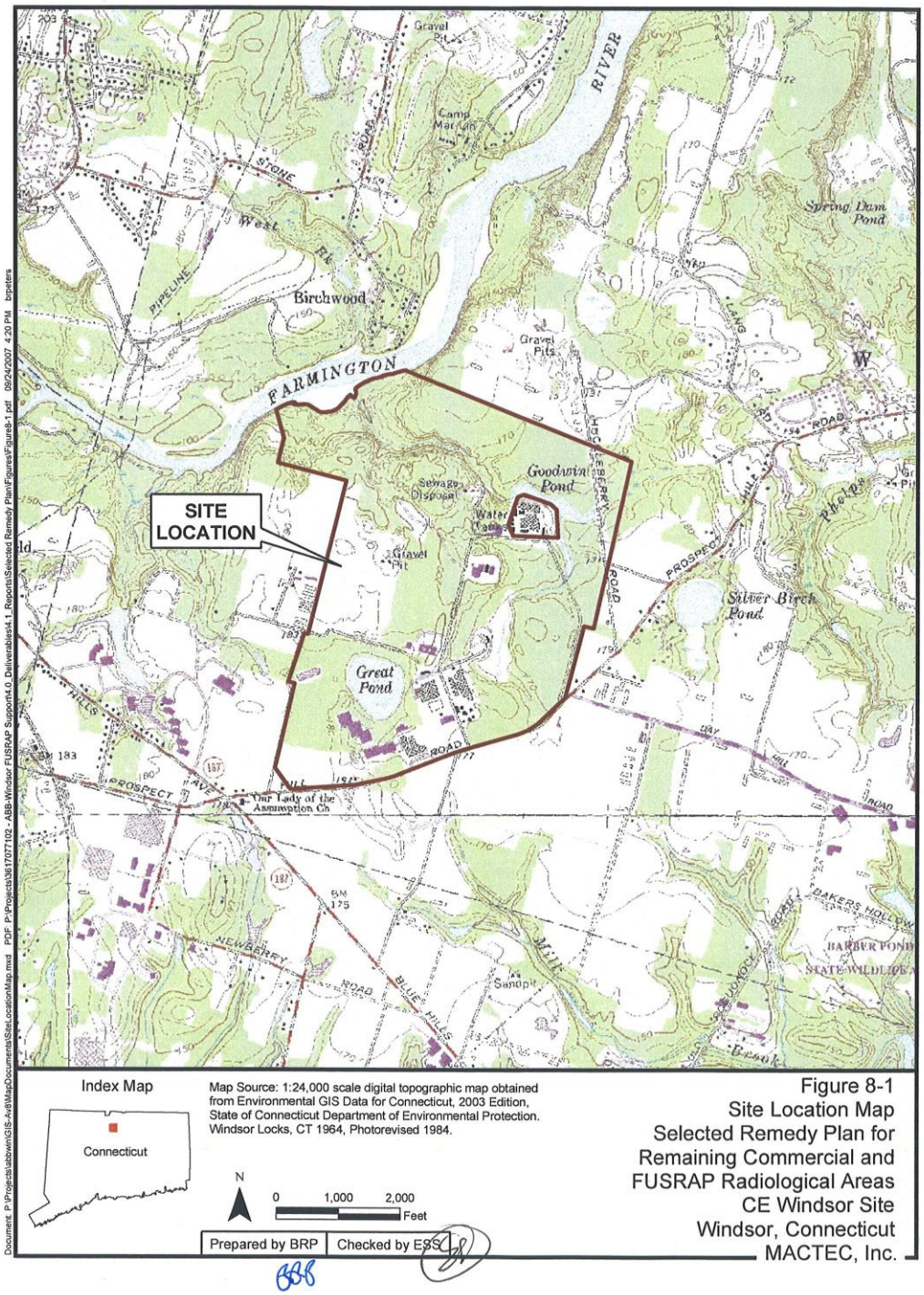

Figure 1. Combustion Engineering Site in Relation to Surrounding Area

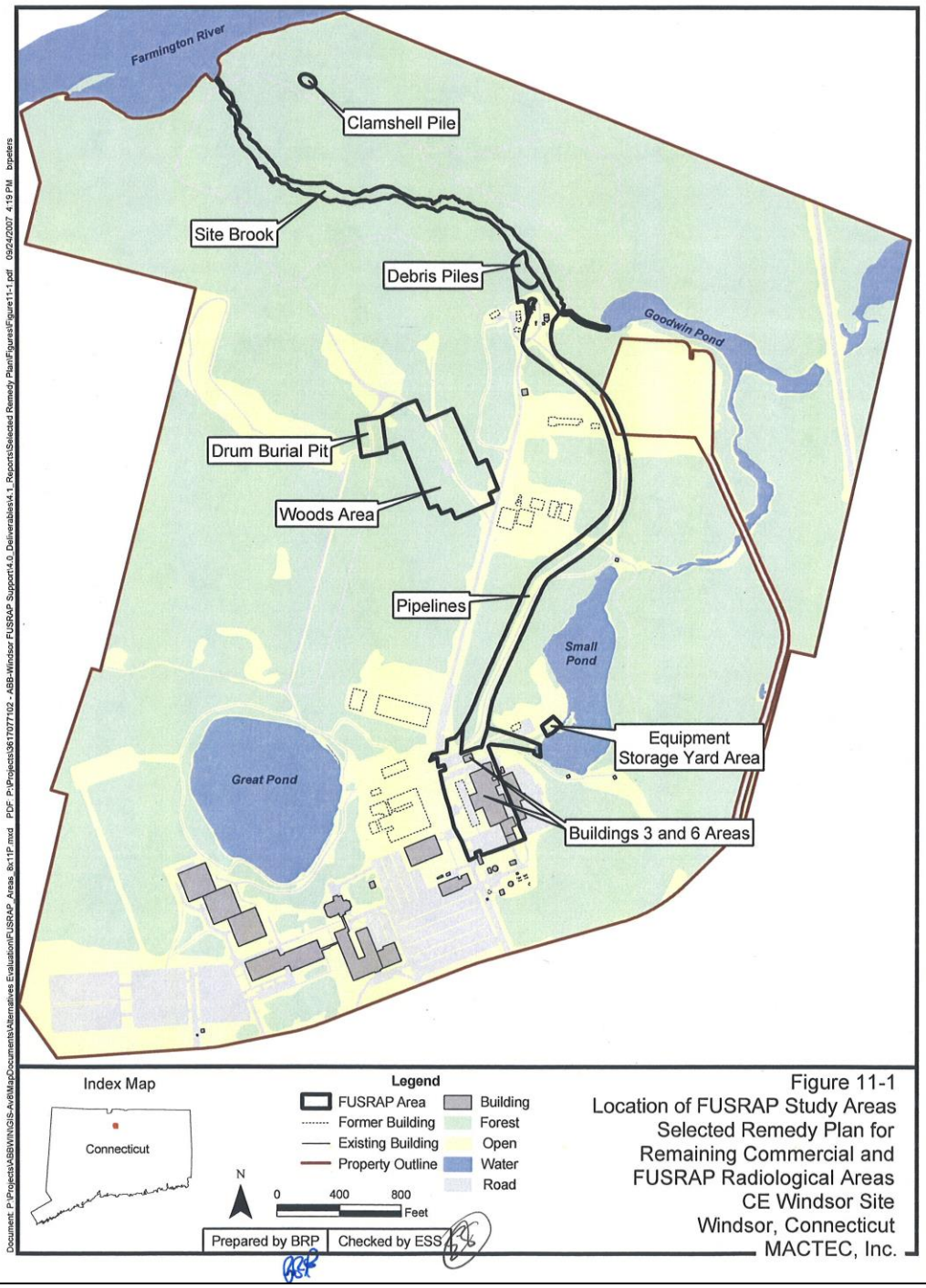

Figure 2. Former FUSRAP Areas of Concern (AOCs) on the Combustion Engineering Site in Relation to Surrounding Area. AOCs are Clamshell Pile (AOC27), Site Brook (AOC14), Debris Pile (AOC13), Drum Burial Pit (AOC21), Woods Area (AOCs1&4), Pipelines (AOC12), Equipment Storage Yard (AOC10), and Buildings 3 and 6 (AOC9).

ATTACHMENT B: FSS DATA TABLES

Table 1

FSSR Submittal 1, Summary Statistics for Total U[1]

Statistic	Survey Unit (CE-FSS)														
	41-01	41-02	41-03	42-01	42-02	42-03	42-04	42-05	42-06	42-07	42-08	43-01	43-02	43-03	43-04
Number of Samples	16	14	14	29	29	29	29	29	29	17	14	29	19	29	17
Arithmetic Mean	2.70	2.56	2.89	3.21	2.68	2.25	2.35	2.25	3.35	2.55	2.05	2.77	2.58	2.84	2.54
Standard Deviation	1.20	1.39	1.57	1.43	1.36	1.51	1.21	1.15	1.30	1.27	1.40	1.41	2.19	1.60	1.01
Standard Error of the Mean	0.30	0.37	0..42	0.26	0.25	0.28	0.22	0.21	0.24	0.31	0.37	0.26	0.50	0.30	0.24
Coefficient of Variation	0.44	0.54	0.54	0.44	0.51	0.67	0.51	0.51	0.39	0.50	0.68	0.51	0.85	0.56	0.40
Geometric Mean	2.70	2.66	2.77	3.14	2.51	2.48	2.22	2.08	3.06	2.27	1.72	2.53	2.69	2.42	2.36
Maximum	4.50	4.8	5.80	7.30	5.70	4.80	4.70	4.60	6.10	5.60	4.00	5.10	8.10	8.04	5.23
Median	2.90	2.60	3.30	3.20	2.70	2.60	2.30	2.00	3.30	2.30	2.45	2.80	2.80	2.53	2.49
Minimum	-0.10	-0.90	-0.10	-0.70	-0.90	-1.00	-1.00	-0.30	0.70	0.90	-0.60	-0.20	-1.00	-0.99	0.98
Range	4.60	5.70	5.90	8.00	6.60	5.80	5.70	4.90	5.40	4.70	4.60	5.30	9.10	9.03	4.25
UCL95 (median)	3.50	3.20	3.40	3.50	3.10	3.30	2.90	2.60	3.90	2.90	3.20	3.40	3.10	3.29	2.97
LCL95 (median)	1.80	1.60	1.50	2.70	2.10	1.50	1.70	1.80	2.60	1.80	0.50	1.90	1.00	0.99	1.81

Note 1: All statistics reported above with the exception of the Number of Samples, the Standard Error of the Mean, and the Coefficient of Variation are in units of pCi/g.

[1]Final Status Survey Report, Submittal Number 1, ABB, July, 2011

Table 2

FSSR Submittal 1, Summary Statistics for Co-60[1]

Statistic	Survey Unit (CE-FSS)														
	41-01	41-02	41-03	42-01	42-02	42-03	42-04	42-05	42-06	42-07	42-08	43-01	43-02	43-03	43-04
Number of Samples	16	14	14	29	29	29	29	29	29	17	14	29	19	29	17
Arithmetic Mean	-0.01	0.00	-0.01	0.00	0.00	0.01	0.00	-0.01	0.01	-0.02	0.00	-0.01	0.00	0.00	0.01
Standard Deviation	0.05	0.03	0.07	0.04	0.05	0.05	0.04	0.04	0.05	0.05	0.05	0.05	0.04	0.04	0.03
Standard Error of the Mean	0.01	0.01	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Coefficient of Variation	-3.44	8.97	-5.35	-22.84	-14.69	3.69	14.86	-6.45	9.86	-2.35	-16.31	-4.28	-9.45	10.02	2.48
Geometric Mean	0.03	0.02	0.03	0.02	0.03	0.04	0.02	0.02	0.03	0.03	0.02	0.02	0.02	0.02	0.01
Maximum	0.07	0.06	0.07	0.11	0.07	0.08	0.06	0.09	0.10	0.07	0.07	0.06	0.06	0.12	0.10
Median	-0.02	0.01	0.00	0.00	0.00	0.03	0.00	0.00	0.01	-0.03	0.01	0.00	0.01	0.00	0.01
Minimum	-0.08	-0.06	-0.21	-0.09	-0.10	-0.09	-0.11	-0.10	-0.12	-0.10	-0.12	-0.15	-0.06	-0.09	-0.02
Range	0.15	0.11	0.28	0.20	0.18	0.17	0.17	0.18	0.21	0.17	0.19	0.21	0.12	0.21	0.12
UCL95 (median)	0.02	0.02	0.02	0.01	0.03	0.04	0.03	0.01	0.04	0.03	0.03	0.01	0.02	0.03	0.03
LCL95 (median)	-0.05	-0.02	-0.08	-0.02	-0.04	-0.01	-0.01	-0.02	-0.03	-0.06	-0.04	-0.03	-0.04	-0.02	-0.01

Note 1: The coefficient of variation statistics reported above are virtually meaningless since the measured activity for all survey units is at or near 0.00.
Note 2: All statistics reported above with the exception of the Number of Samples, the Standard Error of the Mean, and the Coefficient of Variation are in units of pCi/g.

[1]Final Status Survey Report, Submittal Number 1, ABB, July, 2011

Table 3

FSSR Submittal 2, Scan Survey Results[1]

Survey Unit (CE-FSS)	Building Scan Results								
	Survey Unit Class	Percent of Survey Unit Surveyed (accessible floor)	Number of Elevated Locations Identified and Sampled	Recorded Background Reading (cpm)		Highest Scan Reading (gross cpm)		Highest Scan Reading (net cpm)	
				α	β	α	β	α	β
30-01	3	45	0	2	559	2	800	0	241
30-02	3	75	0	3	614	3	800	0	186
30-03	3	0	0	n/a	n/a	n/a	n/a	n/a	n/a

[1]Final Status Survey Report, Submittal Number 2, Building 3 High Bay, ABB, September 2011

Table 4

FSSR Submittal 3, Summary Statistics for Total U[1]

Statistic	Survey Unit (CE-FSS)													
	35-01	35-02	36-01	36-02	38-01	38-02	38-03	38-04	38-05	39-01	39-02	39-03	39-04	40-01
Number of Samples	30	17	29	17	33	33	33	19	29	33	33	33	17	17
Arithmetic Mean	9.68	3.39	4.14	3.99	6.35	5.99	7.92	4.26	5.20	3.49	3.42	3.42	3.36	4.61
Standard Deviation	10.57	1.99	4.00	2.25	4.30	5.48	12.00	2.08	3.50	1.75	2.85	1.38	1.19	1.57
Standard Error of the Mean	1.93	0.48	0.74	0.54	0.75	0.95	2.09	0.48	0.65	0.30	0.50	0.24	0.29	0.38
Coefficient of Variation	1.09	0.59	0.97	0.56	0.68	0.91	1.52	0.49	0.67	0.50	0.83	0.40	0.35	0.34
Geometric Mean	5.45	2.52	3.46	3.37	5.31	4.79	4.88	3.66	3.84	3.18	2.73	3.37	3.10	4.35
Maximum	41.20	7.50	23.70	9.70	20.00	26.40	62.20	10.40	16.60	7.20	11.60	6.20	5.00	6.90
Median	4.65	3.80	3.00	3.30	5.30	4.40	3.90	4.10	4.30	3.10	2.90	3.10	3.50	4.20
Minimum	0.10	0.20	1.80	0.80	1.80	-0.70	1.70	0.30	0.10	-0.30	-1.00	-0.90	1.00	2.40
Range	41.10	7.30	21.90	8.90	18.20	27.10	60.50	10.10	16.50	7.50	12.60	7.10	4.00	4.50
UCL95 (median)	8.80	4.20	4.10	5.50	6.30	5.60	5.00	4.50	6.50	4.40	4.20	4.10	4.20	6.00
LCL95 (median)	2.90	1.80	2.60	2.80	4.50	3.20	3.10	3.10	3.40	2.50	2.50	2.90	2.80	3.20

Note 1: All statistics reported above with the exception of the Number of Samples, the Standard Error of the Mean, and the Coefficient of Variation are in units of pCi/g.

Prepared/Date: GSM 12/01/11

[1]Final Status Survey Report, Submittal Number 3, Burning Grounds, Drum Burial Pit, Woods Area, Building 2 Sanitary Waste Line, and Clam Shell Pile, ABB, December, 2011

Table 5

FSSR Submittal 3, Summary Statistics for Co-60[1]

Statistic	Survey Unit (CE-FSS)													
	35-01	35-02	36-01	36-02	38-01	38-02	38-03	38-04	38-05	39-01	39-02	39-03	39-04	40-01
Number of Samples	30	17	29	17	33	33	33	19	29	33	33	33	17	17
Arithmetic Mean	0.00	0.00	0.02	0.01	0.01	0.00	0.00	-0.01	0.00	-0.02	0.00	0.01	-0.02	0.00
Standard Deviation	0.04	0.05	0.03	0.05	0.06	0.04	0.04	0.04	0.05	0.06	0.04	0.05	0.07	0.04
Standard Error of the Mean	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.01
Coefficient of Variation	-16.56	-13.15	1.56	6.10	6.70	-21.71	-75.69	-6.80	22.99	-3.05	12.32	4.25	-3.12	12.45
Geometric Mean	0.03	0.04	0.02	0.03	0.04	0.02	0.03	0.02	0.02	0.02	0.02	0.04	0.05	0.02
Maximum	0.08	0.06	0.07	0.09	0.11	0.09	0.11	0.07	0.09	0.07	0.09	0.08	0.10	0.07
Median	0.01	-0.01	0.02	0.00	0.01	0.00	-0.01	0.01	0.00	-0.01	0.01	0.02	-0.02	0.01
Minimum	-0.09	-0.11	-0.04	-0.06	-0.11	-0.10	-0.07	-0.10	-0.08	-0.21	-0.10	-0.07	-0.15	-0.08
Range	0.17	0.17	0.11	0.15	0.22	0.19	0.18	0.17	0.17	0.28	0.19	0.14	0.25	0.14
UCL95 (median)	0.02	0.04	0.03	0.04	0.04	0.02	0.02	0.02	0.01	0.01	0.02	0.04	0.00	0.03
LCL95 (median)	-0.04	-0.03	0.01	-0.03	-0.02	-0.02	-0.02	-0.05	-0.03	-0.04	-0.01	-0.01	-0.06	-0.03

Note 1: The coefficient of variation statistics reported above are virtually meaningless since the measured activity for all survey units is at or near 0.00.
Note 2: All statistics reported above with the exception of the Number of Samples, the Standard Error of the Mean, and the Coefficient of Variation are all in units of pCi/g.

[1]Final Status Survey Report, Submittal Number 3, Burning Grounds, Drum Burial Pit, Woods Area, Building 2 Sanitary Waste Line, and Clam Shell Pile, ABB, December, 2011

Table 6

FSSR Submittal 3, Summary Statistics for Ra-226[1]

Statistic	Survey Unit (CE-FSS)										
	36-01	36-02	38-01	38-02	38-03	38-04	38-05	39-01	39-02	39-03	39-04
Number of Samples	29	17	33	33	33	19	29	33	33	33	17
Arithmetic Mean	0.73	0.74	0.75	0.68	0.67	0.73	0.74	0.63	0.56	0.86	0.64
Standard Deviation	0.09	0.13	0.12	0.14	0.10	0.11	0.12	0.09	0.07	0.20	0.11
Standard Error of the Mean	0.02	0.03	0.02	0.02	0.02	0.03	0.02	0.02	0.01	0.03	0.03
Coefficient of Variation	0.12	0.17	0.16	0.20	0.14	0.15	0.16	0.15	0.13	0.23	0.17
Geometric Mean	0.73	0.73	0.74	0.66	0.66	0.72	0.73	0.62	0.56	0.84	0.63
Maximum	0.94	1.01	1.05	0.90	0.85	0.92	0.99	0.86	0.79	1.58	0.87
Median	0.73	0.70	0.74	0.67	0.68	0.73	0.76	0.64	0.56	0.80	0.66
Minimum	0.57	0.53	0.50	0.39	0.46	0.59	0.50	0.47	0.41	0.65	0.48
Range	0.37	0.48	0.55	0.51	0.39	0.33	0.49	0.39	0.38	0.93	0.39
UCL95 (median)	0.77	0.84	0.77	0.76	0.71	0.83	0.80	0.68	0.59	0.87	0.71
LCL95 (median)	0.67	0.67	0.68	0.59	0.64	0.64	0.68	0.57	0.53	0.74	0.54

Note 1: All statistics reported above with the exception of the Number of Samples, the Standard Error of the Mean, and the Coefficient of Variation are in units of pCi/g.

Prepared/Date: GSM 12/01/11

[1]Final Status Survey Report, Submittal Number 3, Burning Grounds, Drum Burial Pit, Woods Area, Building 2 Sanitary Waste Line, and Clam Shell Pile, ABB, December, 2011

Table 7

FSSR Submittal 3, Summary Statistics for Th-232[1]

Statistic	Survey Unit (CE-FSS)										
	36-01	36-02	38-01	38-02	38-03	38-04	38-05	39-01	39-02	39-03	39-04
Number of Samples	29	17	33	33	33	19	29	33	33	33	17
Arithmetic Mean	0.86	0.88	0.92	0.75	0.84	0.87	0.92	0.99	0.80	1.08	0.85
Standard Deviation	0.07	0.16	0.14	0.13	0.13	0.11	0.13	0.27	0.21	0.26	0.14
Standard Error of the Mean	0.01	0.04	0.02	0.02	0.02	0.03	0.03	0.05	0.04	0.04	0.03
Coefficient of Variation	0.08	0.18	0.16	0.18	0.15	0.13	0.15	0.27	0.26	0.24	0.16
Geometric Mean	0.86	0.87	0.91	0.74	0.83	0.86	0.91	0.96	0.78	1.05	0.84
Maximum	1.00	1.17	1.34	1.07	1.03	1.04	1.20	1.81	1.41	2.01	1.15
Median	0.86	0.91	0.90	0.78	0.84	0.87	0.94	0.95	0.82	0.99	0.81
Minimum	0.71	0.58	0.65	0.48	0.55	0.63	0.66	0.53	0.38	0.75	0.61
Range	0.29	0.59	0.69	0.59	0.48	0.41	0.54	1.28	1.03	1.26	0.54
UCL95 (median)	0.90	0.99	0.91	0.81	0.94	0.93	0.97	1.05	0.87	1.12	0.96
LCL95 (median)	0.81	0.78	0.87	0.71	0.76	0.81	0.87	0.87	0.75	0.95	0.79

Note 1: All statistics reported above with the exception of the Number of Samples, the Standard Error of the Mean, and the Coefficient of Variation are in units of pCi/g.

Prepared/Date: GSM 12/01/11

[1]Final Status Survey Report, Submittal Number 3, Burning Grounds, Drum Burial Pit, Woods Area, Building 2 Sanitary Waste Line, and Clam Shell Pile, ABB, December, 2011

Table 8

FSSR Submittal 4, Summary Statistics for Total U[1]

Statistic	Survey Unit (CE-FSS)										
	03-01	03-02	03-03	03-04	03-05	03-06	06-04	06-05	06-06	06-07	06-08
Number of Samples	29	29	29	29	29	17	29	29	29	29	17
Arithmetic Mean	2.60	2.80	2.88	2.33	4.61	1.46	4.34	3.62	3.28	2.84	6.92
Standard Deviation	1.07	1.11	1.14	0.87	4.35	1.38	4.82	3.10	1.58	1.57	17.58
Standard Error of the Mean	0.20	0.19	0.21	0.16	0.81	0.33	0.90	0.58	0.29	0.29	4.26
Coefficient of Variation	0.41	0.36	0.40	0.38	0.94	0.94	1.11	0.86	0.48	0.55	2.54
Geometric Mean	2.34	2.80	2.60	2.15	3.60	1.36	3.48	2.97	2.63	2.91	2.78
Maximum	4.80	4.60	5.70	4.20	22.30	4.10	24.00	15.80	5.90	5.90	75.00
Median	2.60	2.60	2.80	2.20	3.70	1.30	3.20	2.80	3.70	2.60	3.00
Minimum	0.40	-0.40	0.60	0.40	0.40	-1.50	-0.60	1.10	0.20	-0.20	0.20
Range	4.40	5.00	5.10	3.80	21.90	5.60	24.60	15.80	5.70	6.10	74.80
UCL95 (median)	3.00	3.36	3.60	2.50	4.30	2.60	3.80	3.20	3.80	3.50	3.70
LCL95 (median)	2.10	2.20	2.20	1.80	2.90	0.50	2.50	2.20	2.60	2.30	2.40

Note 1: All statistics reported above with the exception of the Number of Samples, the Standard Error of the Mean, and the Coefficient of Variation are in units of pCi/g.

Note 2: The higher standard deviation and coefficient of deviation presented for Survey Unit 06-08 (as compared with the other Survey Units) can be explained by the single outlier result of 75 pCi/g, significantly below the $DCGL_W$ of 557 pCi/g.

[1]Final Status Survey Report, Submittal Number 4, Building Complexes 3 & 6, ABB, December 2011

Table 9

FSSR Submittal 4, Summary Statistics for Co-60[1]

Statistic	Survey Unit (CE-FSS)										
	03-01	03-02	03-03	03-04	03-05	03-06	06-04	06-05	06-06	06-07	06-08
Number of Samples	29	29	29	29	29	17	29	29	29	29	17
Arithmetic Mean	0.01	0.02	0.01	0.00	0.00	0.02	0.00	0.01	0.01	0.00	0.00
Standard Deviation	0.06	0.03	0.04	0.03	0.04	0.03	0.04	0.03	0.06	0.05	0.05
Standard Error of the Mean	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.01	0.01	0.01
Coefficient of Variation	4.49	2.96	4.66	13.95	55.95	2.23	9.26	5.03	9.93	-26.7	154.2
Geometric Mean	0.04	0.03	0.03	0.03	0.02	0.03	0.03	0.01	0.03	0.03	0.03
Maximum	0.11	0.07	0.08	0.07	0.11	0.07	0.09	0.06	0.14	0.07	0.10
Median	0.03	0.01	0.02	-0.01	0.00	0.02	0.01	0.01	0.01	0.01	-0.01
Minimum	-0.15	-0.04	-0.10	-0.05	-0.06	-0.04	-0.07	-0.05	-0.16	-0.09	-0.07
Range	0.26	0.11	0.17	0.12	0.17	0.12	0.16	0.11	0.29	0.17	0.17
UCL95 (median)	0.04	0.03	0.03	0.02	0.01	0.04	0.02	0.02	0.04	0.03	0.02
LCL95 (median)	-0.02	-0.01	-0.01	-0.02	-0.03	-0.01	-0.02	-0.01	-0.02	-0.03	-0.02

Note 1: The coefficient of variation statistics reported above are virtually meaningless since the measured activity for all survey units is at or near 0.00.

Note 2: All statistics reported above with the exception of the Number of Samples, the Standard Error of the Mean, and the Coefficient of Variation are in units of pCi/g.

[1]Final Status Survey Report, Submittal Number 4, Building Complexes 3 & 6, ABB, December 2011

Table 10

FSSR Submittal 5, Summary Statistics for Total U[1]

Statistic	Survey Unit (CE-FSS)												
	26-09	33-01	33-02	33-03	33-04	33-05	33-06	33-07	33-08	33-09	34-01	42-09	42-10
Number of Measurements	14	17	29	17	29	17	18	17	30	30	30	29	18
Arithmetic Mean	3.35	2.08	28.99	15.45	22.33	9.48	6.33	5.19	13.34	25.89	13.15	2.33	4.12
Standard Deviation	1.72	2.93	31.06	17.86	24.59	9.79	14.28	4.73	17.85	59.94	16.44	1.25	4.57
Standard Error of the Mean	0.46	0.71	5.77	4.33	4.57	2.37	3.37	1.15	3.26	10.94	3.00	0.23	1.08
Coefficient of Variation	0.51	1.40	1.07	1.16	1.10	1.03	2.25	0.91	1.34	2.31	1.25	0.53	1.11
Geometric Mean	2.89	2.61	15.18	7.38	13.39	5.50	3.29	3.93	7.69	10.02	8.52	1.80	3.94
Maximum	5.70	9.90	102.60	53.90	105.40	30.70	62.90	19.70	93.10	317.90	77.50	4.40	16.70
Median	3.20	2.10	12.20	5.80	16.60	5.70	2.65	3.80	8.15	9.05	9.25	2.40	3.10
Minimum	1.00	-4.20	1.90	0.40	2.50	-2.90	-0.30	1.40	-0.10	-4.40	2.00	0.10	-2.40
Range	4.70	14.10	100.70	53.50	102.90	33.60	63.20	18.30	93.20	322.30	75.50	4.30	19.10
UCL_{95} (median)	5.10	2.60	34.70	20.70	21.50	17.30	3.90	4.90	14.20	15.10	10.90	3.10	5.90
LCL_{95} (median)	1.60	0.70	6.20	2.80	6.60	2.30	1.80	2.50	4.10	3.60	4.20	1.30	1.10

Note 1: All statistics reported above with the exception of the Number of Samples, the Standard Error of the Mean, and the Coefficient of Variation are in units of pCi/g.

Prepared/Date: GSM 03/12/12

[1]Final Status Survey Report, Submittal Number 5, Site Brook, Goodwin Pond, Debris Pile, and Industrial Waste Line Outfalls, ABB, March, 2012

Table 11

FSSR Submittal 5, Summary Statistics for Co-60[1]

Statistic	Survey Unit (CE-FSS)												
	26-09	33-01	33-02	33-03	33-04	33-05	33-06	33-07	33-08	33-09	34-01	42-09	42-10
Number of Measurements	14	17	29	17	29	17	18	17	30	30	30	29	18
Arithmetic Mean	0.01	0.06	0.03	0.06	0.02	0.01	0.01	0.01	0.01	0.02	0.02	-0.01	0.00
Standard Deviation	0.04	0.12	0.04	0.06	0.06	0.05	0.05	0.04	0.04	0.05	0.06	0.05	0.05
Standard Error of the Mean	0.01	0.03	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Coefficient of Variation	6.99	1.90	1.48	0.90	2.90	4.24	3.37	4.57	4.40	2.74	2.44	-7.15	13.38
Geometric Mean	0.02	0.04	0.04	0.06	0.04	0.04	0.04	0.03	0.02	0.03	0.04	0.03	0.03
Maximum	0.05	0.51	0.14	0.15	0.16	0.10	0.08	0.08	0.07	0.13	0.12	0.08	0.09
Median	0.01	0.03	0.04	0.07	0.03	0.00	0.03	0.01	0.02	0.02	0.02	-0.02	0.00
Minimum	-0.08	-0.03	-0.07	-0.07	-0.14	-0.07	-0.07	-0.06	-0.06	-0.12	-0.13	-0.13	-0.09
Range	0.13	0.54	0.21	0.22	0.30	0.17	0.16	0.14	0.13	0.25	0.25	0.21	0.18
UCL_{95} (median)	0.04	0.08	0.05	0.09	0.04	0.04	0.05	0.05	0.03	0.03	0.06	0.03	0.06
LCL_{95} (median)	-0.04	0.00	0.00	0.02	-0.01	-0.01	-0.03	-0.03	-0.02	0.00	-0.01	-0.03	-0.05

Note 1: The coefficient of variation statistics reported above are virtually meaningless since the measured activity for all survey units is at or near 0.00.
Note 2: All statistics reported above with the exception of the Number of Samples, the Standard Error of the Mean, and the Coefficient of Variation are in units of pCi/g.

[1]Final Status Survey Report, Submittal Number 5, Site Brook, Goodwin Pond, Debris Pile, and Industrial Waste Line Outfalls, ABB, March, 2012

Table 12

FSSR Submittal 6, Summary Statistics for Total U[1]

Statistic	Survey Unit (CE-FSS)								
	23-02	23-03	23-04	23-05	23-06	23-07	23-08	25-02	25-03
Number of Measurements	17	29	17	17	29	17	14	17	14
Arithmetic Mean	2.98	2.78	3.49	2.49	4.11	3.03	2.10	1.67	1.96
Standard Deviation	1.22	1.05	0.67	0.72	1.91	1.20	1.25	1.83	1.01
Standard Error of the Mean	0.30	0.19	0.16	0.17	0.36	0.29	0.33	0.44	0.27
Coefficient of Variation	0.41	0.38	0.19	0.29	0.47	0.40	0.60	1.10	0.52
Geometric Mean	2.77	2.55	3.43	2.38	3.72	2.75	1.74	2.20	1.62
Maximum	6.50	4.70	4.60	3.70	8.40	6.30	4.30	3.50	4.00
Median	2.90	2.60	3.50	2.40	3.70	2.90	2.25	2.40	2.25
Minimum	1.20	0.50	2.50	1.10	1.80	0.50	-0.20	-2.20	0.30
Range	5.30	4.20	2.10	2.60	6.60	5.80	4.50	5.70	3.70
UCL_{95} (median)	3.50	3.20	3.90	3.00	4.80	3.60	2.70	3.20	2.50
LCL_{95} (median)	2.30	2.20	2.80	2.00	2.60	2.40	0.40	0.40	0.80

Note 1: All statistics reported above with the exception of the Number of Samples, the Standard Error of the Mean, and the Coefficient of Variation are in units of pCi/g.

Prepared/Date: GSM 04/05/12

[1]Final Status Survey Report, Submittal Number 6, Equipment Storage Yard and Small Pond, ABB, April, 2012

Table 13

FSSR Submittal 6, Summary Statistics for Co-60[1]

Statistic	Survey Unit (CE-FSS)								
	23-02	23-03	23-04	23-05	23-06	23-07	23-08	25-02	25-03
Number of Measurements	17	29	17	17	29	17	14	17	14
Arithmetic Mean	0.00	0.00	0.02	0.00	-0.01	0.00	0.02	0.00	0.00
Standard Deviation	0.05	0.04	0.04	0.03	0.04	0.03	0.04	0.05	0.03
Standard Error of the Mean	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Coefficient of Variation	-11.09	-8.97	2.32	-8.43	-5.33	55.02	2.41	16.72	71.65
Geometric Mean	0.02	0.02	0.04	0.02	0.03	0.02	0.03	0.03	0.01
Maximum	0.08	0.07	0.08	0.06	0.07	0.05	0.07	0.11	0.06
Median	0.00	0.00	0.02	0.00	-0.01	0.00	0.02	0.01	0.00
Minimum	-0.13	-0.07	-0.05	-0.05	-0.09	-0.05	-0.04	-0.10	-0.05
Range	0.21	0.14	0.13	0.10	0.16	0.10	0.12	0.21	0.11
UCL_{95} (median)	0.02	0.14	0.04	0.02	0.02	0.03	0.05	0.03	0.01
LCL_{95} (median)	-0.03	-0.03	-0.01	-0.03	-0.03	-0.02	-0.03	-0.01	-0.01

Note 1: The coefficient of variation statistics reported above are virtually meaningless since the measured activity for all survey units is at or near 0.00.
Note 2: All statistics reported above with the exception of the Number of Samples, the Standard Error of the Mean, and the Coefficient of Variation are all in units of pCi/g.

[1]Final Status Survey Report, Submittal Number 6, Equipment Storage Yard and Small Pond, ABB, April, 2012

ATTACHMENT C

The Technical Evaluation Report included in Attachment C represents the NRC's staff review of ABB, Inc.'s request to terminate License No. 06-00217-05 and release the CE site for unrestricted use following completion of decommissioning activities at the site.

U.S. Army Corps of Engineers' Letter to CE regarding license termination

U.S. NRC License 06-00217-06, Amendment No. 67

U.S. NRC License SNM-1067, Amendment No. 18

TECHNICAL EVALUATION REPORT
COMPLETION OF DECOMMISSIONING ACTIVITIES
ABB, INC. CE WINDSOR SITE, WINDSOR, CONNECTICUT
DOCKET NO: 03003754, LICENSE NO: 06-00217-06

1.0 Executive Summary

This Technical Evaluation Report has been prepared as part of the U.S. Nuclear Regulatory Commission (NRC) staff's review of ABB Inc.'s (ABB) request to terminate License No. 06-00217-06 and release the Windsor, Connecticut (CT), site for unrestricted use following completion of decommissioning activities at the site. Decommissioning activities at the ABB site consisted of: decontamination and demolition of buildings and structures to ground surface, removal of concrete floor slabs, removal of underground utilities, removal of impacted soils above the cleanup criteria, packaging and shipment of wastes for offsite disposal, and conducting final status surveys (FSSs). The NRC staff conducted periodic inspections to confirm that decommissioning activities were conducted in accordance with the approved Decommissioning Plan (DP) and conducted survey measurements and sample analyses at the site to confirm ABB's FSS data.

The NRC's technical evaluation included the staff's review of ABB's FSS reports (FSSRs), review of NRC confirmatory survey and sample results, and confirmation that waste shipments have been received by a licensed disposal facility and that appropriate records have been received. The NRC determined that ABB has adequately demonstrated that the site meets the NRC's radiological requirements for release for unrestricted use in accordance with 10 CFR 20.1402, and the NRC license for the facility can therefore be terminated. The NRC staff coordinated this licensing action with staffs from the Connecticut Department of Energy and Environmental Protection (CTDEEP) and the U.S. Army Corps of Engineers (USACE). Both agencies indicated no objection to the NRC proceeding with termination of ABB's NRC license.

2.0 Facility Operating History

Asea Brown Boveri Inc. (now ABB Inc.) acquired the former Combustion Engineering, Inc. (CE) site in Windsor, CT in 1990, and the site is often referred to as the CE Windsor site. From the mid-1950s, activities with radioactive materials at the CE Windsor site have included research, development, engineering, production, nuclear fuel systems servicing, nuclear fuel fabrication, and other related radiological services. These activities were conducted under contracts with the U.S. Government (Navy) and commercial customers. Although the site was primarily used for nuclear fuel production activities with low-enriched (commercial customers) and high-enriched uranium (U.S. Navy), other services and activities involving byproduct material, thorium, and radium were also conducted at the site. Due to spills and leaks associated with these operations and waste disposal practices (i.e., incineration), various buildings, waste water lines, and some land areas were radiologically contaminated.

From the mid-1950s to the early 1960s, certain buildings and areas of the site were used in support of the U.S. Government's Naval nuclear programs under contracts with the U.S. Atomic Energy Commission (AEC). The site areas impacted by these programs have residual uranium contamination.

In the early 1960s, the AEC issued License No. 06-00217-06, primarily authorizing research

and development related activities. In 1968, the AEC issued license number SNM-1067 authorizing commercial fuel manufacturing activities to be conducted at the site. These licenses have been amended and renewed several times since they were issued to address administrative and technical changes at the facility and to address various corporate name changes. Commercial fuel research, development, and assembly ceased in April 2000, when ABB sold their worldwide nuclear power business to Westinghouse. Westinghouse continued to service contaminated reactor components at the site until August 2001, when ABB initiated preparations and plans for site decommissioning. Decommissioning activities were consolidated under License No. 06-00217-06, and License No. SNM-1067 was amended to authorize possession and storage only.

In 2004, ABB initiated remediation for portions of the site under an NRC-approved DP. From 2005 through 2007, ABB conducted FSSs and submitted FSSRs regarding the remediated portions of the site and in December 2007 requested unrestricted release of a 365-acre parcel of the site where decommissioning activities had been completed. Following a review of the FSSRs and conducting confirmatory surveys, NRC approved the partial site release in January 2009.

As described above, radiological contamination at the site consisted of both NRC-regulated materials and materials from the U.S. Government's non-commercial related activities for the AEC. The U.S. Department of Energy (DOE) has responsibility for decommissioning activities at sites designated as Formerly Utilized Sites Remedial Action Program (FUSRAP) sites, and designated the ABB Windsor, CT site as a FUSRAP site. The USACE staff executes decommissioning activities under the FUSRAP for the DOE. As a result of the past work activities at the site, there was extensive commingling of FUSRAP-related materials with NRC regulated materials in portions of the site with residual radiological contamination. This commingling brought the materials under both the NRC regulatory authority and USACE FUSRAP authority. Following discussions among ABB, NRC, USACE, and DOE, the NRC and USACE in August 2007 agreed that in order to facilitate the efficient and effective decommissioning of the site, ABB could conduct the decommissioning of the site pursuant to NRC regulations. ABB amended their DP under development for the second phase of site decommissioning to encompass the FUSRAP-related materials along with the remaining NRC-regulated materials.

In 2011, NRC approved a revised DP (Rev. 2) that considered the cleanup of both the residual NRC-regulated material and FUSRAP-related material for the remaining impacted areas of the ABB site. The revised DP included site-specific cleanup criteria (Derived Concentration Guideline Levels (DCGLs)) that were approved by the NRC. ABB and their contractors implemented the DP under NRC oversight during calendar years 2011-2012. Onsite remediation activities were completed in December 2011 and ABB submitted a series of seven FSSRs from July 2011 through May 2012. Upon removal of stored licensed material and completion of the onsite remediation activities by ABB, the NRC approved an action in February 2012 to terminate the SNM-1067 license. NRC License No. 06-00217-06 has remained in effect until final site decommissioning actions are completed.

3. Facility Description

The ABB site is located in the Town of Windsor, eight miles north of Hartford, CT. The ABB site is bordered by Day Hill Road and agricultural and commercial land to the south; commercial development and a sand and gravel quarry to the west; the Windsor/Bloomfield

Sanitary Landfill and Recycling Center (Landfill) to the north; and forested land as well as residential and commercial developments to the east. The northwest corner of the property is bordered by the Rainbow Reservoir portion of the Farmington River. The nearest residence is located approximately 500 feet north of the site in Birchwood, north of the Farmington River. The property consisted of approximately 612 acres, located at 2000 Day Hill Road, Windsor CT.

In 2009, the NRC issued a license amendment to NRC license number 06-00217-06 that authorized a partial site release for unrestricted use of 365 contiguous acres of the 612-acre facility after it was confirmed that the residual radioactivity met the radiological criteria for release for unrestricted use. The 365-acre parcel had been previously remediated by ABB in accordance with an NRC-approved DP and under NRC oversight. The site is currently zoned industrial by the Town of Windsor, and is located in a Mixed Land Use area of Hartford County. Nearby land uses are primarily commercial, agricultural, industrial, and residential. Much of the northern and western portions of the property are wooded.

4. Radiological Status of Facility

ABB conducted a radiological site assessment that included site characterization surveys and radiological surveys performed during routine operations. The assessment indicated that there was residual contamination on facility structures, in underground systems and components, in soil adjacent to contaminated structures and systems, and in soil in areas where radioactive materials were extensively handled, treated, or stored. Other impacted areas included a debris pile, which contained concrete rubble, partially buried drums, and miscellaneous material. In addition, the Site Brook was also impacted by site operations as a result of receiving diluted radioactive wastewaters and storm water runoff.

The 365-acre parcel out of the total 612-acre site that was released in 2009 did not include any FUSRAP areas, leaving approximately 247 acres for the final phase of decommissioning. Radionuclide contaminants were primarily cobalt-60 (Co-60), radium-226 (Ra-226), thorium-232 (Th-232), uranium-234 (U-234), uranium-235 (U-235), and uranium-238 (U-238).

ABB conducted remediation activities at the site as described in their DP (Rev. 2). These remediation activities included building decontamination and demolition, removal and disposal of impacted wastewater lines, and removal and disposal of contaminated soil and sediment to levels below the Derived Concentration Guideline Levels (DCGLs). The DCGLs are calculated radionuclide-specific cleanup values, derived from an exposure scenario that corresponds to the radiological release criteria. These calculated values were used to convert building surface and soil concentration data to the dose equivalent values that can be compared to the regulatory limits.

ABB has requested release of the remaining impacted areas of the site for unrestricted use pursuant to 10 CFR 20.1402. Therefore, residual radioactivity levels that are distinguishable from background remaining at the site at the time of license termination cannot result in a total effective dose equivalent to an average member of the critical group that exceeds 0.25 milliSieverts per year (mSv/y) (25 millirem per year (mrem/y)). ABB calculated the site DCGLs based on meeting a dose limit of 0.19 mSv/y, (19 mrem/y), which meets the NRC release criteria. Residual radioactivity must also be at levels that are as low as is reasonably achievable (ALARA).

5.0 Technical Evaluations

After completion of decommissioning activities, including soil removal, ABB conducted their FSS in accordance with the guidance in the Multi-Agency Radiological Survey and Site Investigation Manual ((MARSSIM), NUREG 1575, Rev. 1) and their FSS Plan. ABB partitioned the impacted area of the site (approximately one million square meters) into 68 individual survey units, ranging in size from 149 to 146,000 square meters. Based on the MARSSIM guidance, ABB classified each survey unit by its potential for residual contamination. Survey units with the greatest potential for contamination (Class 1) received the highest degree of survey effort. ABB collected and analyzed a total of 1,562 systematic and biased soil samples in the 68 survey units. In accordance with the FSS Plan, ABB also performed radiological scanning measurements of the soil surfaces within each of the survey units using handheld equipment. Based on the results of these scanning measurements, ABB identified 19 relatively small areas (ranging in size from 0.5 to 11 square meters) within eight of the survey units where additional soil sampling was needed to evaluate elevated scanning measurements. ABB performed elevated measurement comparisons by taking an additional 103 samples over approximately 21 square meters within these eight survey units. Because multiple radionuclides were the potential contaminants, the concentration values were compared to their individual DCGLs and then aggregated using a sum of the fractions approach to determine compliance with the DCGLs.

ABB used the results for the 1,562 systematic samples and the 103 elevated measurement comparison samples to calculate the average sum of the fractions values for the 68 survey units. The NRC staff reviewed the FSS reports and sample data and determined that the sample data met the approved site-specific DCGLs for the 68 survey units.

Between December 2009 and May 2012, the NRC conducted ten inspections of ABB's decommissioning activities, which included: site mobilization and preparation, managing an onsite counting laboratory, training, safety, excavation/remediation, waste handling, and FSS activities. The NRC's inspections were performed to ensure work was performed consistent with the NRC-approved DP, FSS Plan, and NRC regulations. In addition to the direct observation of decommissioning activities, NRC inspectors collected 328 split soil samples from excavated survey units that had not been backfilled or restored. Samples were analyzed by the NRC's contractor, the Oak Ridge Associated Universities (ORAU), for the radionuclides of concern. Analytical results for four of the samples exceeded the established remediation criteria, and an additional remediation was performed by ABB in these areas in order to meet the release criteria. NRC also contracted ORAU to perform a series of in-place confirmatory radiological surveys at selected areas on the ABB site. These surveys included walkover scanning measurements, direct measurements, and sample collection and analysis. All of these results met ABB's established remediation criteria. The NRC staff also requested and received confirmation that all radioactive waste shipments had been received and properly disposed at the licensed disposal facility.

Based on these actions, the NRC has concluded that: (1) decommissioning activities by ABB were performed in accordance with the approved DP; (2) ABB's FSS data was collected and evaluated consistent with the MARSSIM guidance and the FSS Plan; and, (3) ABB's FSS results and NRC independent measurements demonstrated that the site meets the NRC radiological criteria for release for unrestricted use. The decommissioning activities also involved shipping a large volume of contaminated soil and debris (in excess of 300,000 cubic feet) for offsite disposal. Staff determined that the residual activity at the site has been reduced to levels that are ALARA.

NRC license termination regulations also have requirements for forwarding specific records to the NRC prior to license termination. For ABB, this would include documents specified in 10 CFR 30.36(k): specifically, records of events involving the spread of contamination in and around the site, as-built drawings, and financial assurance records. By documentation provided in the DP and FSSRs, the NRC has concluded that the licensee has met these requirements.

6.0 Environmental Considerations

Pursuant to 10 CFR 51.21, 51.32, and 51.35, an environmental assessment (EA) was prepared with a finding of no significant impact (FONSI) as part of the licensing action for approval of the revised DP (Rev. 2). A notice was published in the Federal Register on May 31, 2011 (76 FR 31379). Through inspections, review of documents, and the results of independent confirmatory measurements and sample analysis, NRC staff has determined that the decommissioning project was conducted in accordance with the approved DP. Because the EA published in May 31, 2011 bounds the environmental considerations related to this licensing action, no additional EA or FONSI will be required to terminate License No. 06-00217-06.

7.0 U.S. Environmental Protection Agency (USEPA) Consultation

In accordance with the 2002 Memorandum of Understanding (MOU) between the USEPA and the U.S. NRC, “Consultation and Finality on Decommissioning and Decontamination of Contaminated Sites,” the NRC staff provided a Level 1 consultation letter to the USEPA in June 2008 stating that the proposed DCGLs for four radionuclides (Cobalt-60, Uranium-234, Uranium- 235, and Uranium-238) in soil exceeded the consultation trigger values for residential soil concentration in Table 1 of the MOU. The NRC staff further indicated that in accordance with the MOU, a Level 2 consultation would be provided if the residual soil contamination values following remediation exceeded the trigger values in Table 1 of the MOU. NRC staff reviewed the FSSRs, compared the FSSR data to the values for residential soil concentration in the MOU table, and concluded that the residual concentration values did not exceed the trigger values in Table 1 of the MOU to require a Level 2 consultation. The staff documented this conclusion in an informational letter to the USEPA in May 2013.

8.0 State Consultation

The NRC staff has involved representatives of the Connecticut Department of Energy and Environmental Protection (CTDEEP) throughout the decommissioning process at the ABB site. Representatives from CTDEEP have accompanied NRC staff during NRC inspections at the site, participated in the collection of post-remediation soil samples for independent radiological analysis by the state and the NRC, and been on distribution for correspondence between NRC and ABB, including the series of seven FSSRs. In a letter dated May 1, 2013, CTDEEP indicated that with the exception of one sample location, they had no issues with the FSSR submittals. This area was subsequently re-sampled on June 12, 2013 by CTDEEP, and a split sample was provided to the NRC. Based on review of the sample results from both the NRC and CTDEEP, it was confirmed that residual radioactivity meets the cleanup criteria developed for the site.

In a letter to the NRC dated July 26, 2013, CTDEEP stated that the analytical results of the single sample taken from the site brook on June 12, 2013 indicate radioactivity at background levels in the sample. Additionally, CTDEEP stated that they have completed their assessment of plans, documents, and procedures related to the radiological remediation of the ABB site and

have concluded their onsite confirmatory measurements. Within the scope of their review, CTDEEP has determined that the site meets their established release criteria.

9.0 USACE Consultation

As indicated in Section 2, “Facility Operating History,” radiological contamination at the site consisted of both NRC-regulated materials and FUSRAP-related materials. The decommissioning of FUSRAP-related material is under the purview of the USACE for the DOE. The NRC staff has involved USACE representatives in the decommissioning process at the ABB site through periodic communications and distribution of correspondence between NRC and ABB. In particular, the series of seven FSSRs were transmitted to USACE as each was received. Based on these communications and USACE review of documents, USACE indicated in a letter dated June 27, 2013 that they have no comments or questions regarding the FSS reports and do not object to the NRC proceeding with termination of ABB’s license.

10.0 Summary and Conclusion of Technical Evaluations

The NRC has completed its review of ABB’s FSSRs, conducted inspections, performed confirmatory measurements and sampling, received confirmation that waste shipments from the site have been received by a licensed disposal facility, and has received appropriate decommissioning records. Therefore, the NRC staff concludes, in accordance with 10 CFR 30.36(k), that: (1) licensed material has been properly disposed; (2) reasonable effort has been made to eliminate residual radioactive contamination; (3) the licensee has submitted site radiological survey and other information that demonstrates that the site is suitable for release for unrestricted use in accordance with the radiological criteria for license termination in 10 CFR Part 20 Subpart E; and (4) records required by 30.51(d) and 30.51(f) have been received. NRC staff finds that ABB has completed decommissioning in accordance with its approved DP. The site meets the requirements of the License Termination Rule (10 CFR 20.1402). Therefore, the staff concludes that the site is acceptable for release for unrestricted use with no further action, and the license can be terminated.

11.0 Principal Contributors

John Nicholson, Project Manager, Health Physicist
Orysia Masnyk-Bailey, Health Physicist
Mark Roberts, Senior Health Physicist

12.0 References

- ABB, Inc. Decommissioning Plan, Revision 2; CE Windsor Site (Previously Identified FUSRAP Areas Including Debris Piles & Site Brook). August 2010. (ADAMS Accession No. ML102310473)

- ABB, Inc. Decommissioning Plan, Revision 2; CE Windsor Site - Figures. August 2010. (ADAMS Accession No. ML102310512)

- ABB, Inc. Decommissioning Plan, Revision 2; CE Windsor Site - Tables. August 2010. (ADAMS Accession No. ML102310479)

- ABB, Inc. Decommissioning Plan, Revision 2; CE Windsor Site – Appendix A:

RESRAD Reports – Resident Farmer Thorium and Radium. August 2010. (ADAMS Accession No. ML102310548)

- ABB, Inc. Decommissioning Plan Revision 2 CE Windsor Site – Appendix B: Probabilistic Evaluation Graphical Summary. August 2010. (ADAMS Accession No. ML102310553)

- ABB, Inc. Derivation of the Site Specific Soil DCGLs, Addendum, Soil DCGLs for thorium and radium. August 2010. (ADAMS Accession No. ML102310539)

- ABB, Inc., Final Status Survey Plan, Revision 1, July 2011. (ADAMS Accession No. ML12095A015)

- Notice of Availability of Environmental Assessment and Finding of No Significant Impact for License Amendment for ABB, Inc., Windsor, CT, 76 FR 31379, May 31, 2011. (ADAMS Accession No. ML111520200)

- NRC letter (ADAMS Accession No. ML111530426) and License Amendment No. 65 approving ABB's Decommissioning Plan for the Windsor, CT site, June 2, 2011. (ADAMS Accession No. ML111530431)

- U.S. Army Corps of Engineers (USACE) letter to NRC Proposing Process to Decommission ABB, Inc. Windsor Site, August 2, 2007. (ADAMS Accession No. ML072490480)

- NRC Response to USACE Proposed Process, August 15, 2007. (ADAMS Accession No. ML072210979)

- Memorandum of Understanding Between the U. S. Environmental Protection Agency and the U.S. Nuclear Regulatory Commission; Consultation and Finality on Decommissioning and Decontamination of Contaminated Sites, 67 FR 65375, October 24, 2002. (ADAMS Accession No. ML022830208)

- NRC letter to EPA - Notification of ABB, Inc. Site Decommissioning, June 16, 2008. (ADAMS Accession No. ML081260725)

- EPA Response with recommendations to NRC Notification, September 16, 2008. (ADAMS Accession No. ML082671189)

- NRC Response to EPA Recommendations, October 8, 2008. (ADAMS Accession No. ML082750032)

- Letter to the USEPA regarding Completion of Scheduled Decommissioning Activities at the ABB, Inc. Site, Windsor, Connecticut (NRC License No. 06-00217-06), May 10, 2013. (ADAMS Accession No. ML13119A082)

- ABB, Inc. Final Status Survey Report (FSSR) Packages; FSSR No. 1 (ADAMS Accession No. ML112300112); FSSR No. 2 (ADAMS Accession No. ML112700136); FSSR No. 3 (ADAMS Accession No. ML113460140); FSSR No. 4 (ADAMS Accession No. ML113560401);

FSSR No. 5 (ADAMS Accession No. ML12081A033); FSSR No. 6 (ADAMS Accession No. ML12102A206); FSSR No. 7 (ADAMS Accession No. ML12138A304)

- NRC Region I Inspection Reports: December 2-3, 2009 (ADAMS Accession No. ML093570138); April 14, 2010 (ADAMS Accession No. ML101330463); June 15, September 3, 2010 (ADAMS Accession No. ML102730670); May 4, 2011 (ADAMS Accession No. ML111520055); August 17, 24-25; September 19-20, 2011 (ADAMS Accession No. ML113630402); October 24-27, 2011; April 30-May 3, 2012 (ADAMS Accession No. ML13058A138)

- Oak Ridge Associated Universities, Revised Final Report - Confirmatory Survey Results, March 25, 2013. (ADAMS Accession No. ML13094A142)

- ABB, Inc., Application Request for Termination of License No. SNM-1067, December 21, 2011. (ADAMS Accession No. ML120180024)

- NRC License Termination Amendment for SNM-1067, February 28, 2012. (ADAMS Accession No. ML120550518)

- ABB Inc., Letter - Request for License Termination, April 25, 2013. (ADAMS Accession No. ML13127A415)

- EnergySolutions, Letter regarding verification of licensed waste disposal for ABB, Inc. CE Windsor Site, May 9, 2013. (ADAMS Accession No. ML13143A152)

- Connecticut Department of Energy and Environmental Protection, Letter regarding review of Final Status Survey Reports from ABB, Inc., May 1, 2013. (ADAMS Accession No. ML13136A202)

- Connecticut Department of Energy and Environmental Protection, Letter regarding CTCTDEEP Analytical Results of Single Soil Sample from Site Brook and Completion of Review of Final Status Survey Reports from ABB, Inc., July 26, 2013. (ADAMS Accession No. ML13219A150)

- Title 10 Code of Federal Regulations, Part 20, Subpart E, Radiological Criteria for License Termination

- NUREG-1757, Volume 1, Rev 2, “Consolidated Decommissioning Guidance, Decommissioning Process for Materials Licensees”, Final Report, September 2006. (ADAMS Accession No. ML063000243)

- NUREG-1757, Volume 2, Rev 1, Consolidated Decommissioning Guidance, “Characterization, Survey, and Determination of Radiological Criteria”, September 2006. (ADAMS Accession No. ML063000252)

- NUREG-1575, Rev. 1, “Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM)”, August 2000. (ADAMS Accession No. ML003761445)

- Oak Ridge Associated Universities, Letter Report for Analytical Results for One Soil Sample from ABB, Inc., Windsor, CT, July 2, 2013. (ADAMS Accession No. ML13205A077)

- USACE letter to NRC, Closeout of the FUSRAP cleanup of the ABB Windsor Site, June 27, 2013. (ADAMS Accession No. ML13190A351)

DEPARTMENT OF THE ARMY
NEW ENGLAND DISTRICT, CORPS OF ENGINEERS
696 VIRGINIA ROAD
CONCORD, MASSACHUSETTS 01742-2751

June 27, 2013

REPLY TO
ATTENTION OF
Engineering & Planning Division

REC RG1 07 02'13 AM07:44

Mr. Marc Ferdas
Chief, Decommissioning Branch
U.S. Nuclear Regulatory Commission
2100 Renaissance Boulevard
Suite 100
King of Prussia, PA 19406-2713

06-00217-06
03003754

RE: Closeout of the FUSRAP cleanup of the ABB Windsor Site

Mr. Ferdas,

In accordance with the attached Proposed Process to Decommission and Clean Up the ABB Windsor Site, dated August 2, 2007, I am writing to notify you that we have no further comments regarding Final Status Survey Report Submittals Numbers 1 through 7 and responses to comments submitted by ABB. The Corps of Engineers has no objection to the NRC proceeding with termination of the license for ABB, Inc. site at 2000 Day Hill Road, Windsor, Connecticut.

Please give me a call at (978) 318-8162 if there are any questions or concerns.

Sincerely,

Scott E. Acone, P.E. PMP
Chief, Engineering & Planning Division

Atch

License No. 06-00217-06
Docket No. 030-03754

579789

REC'D IN LAT 7-02-13

NMSS/RGN1 MATERIALS-002

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U.S. NUCLEAR REGULATORY COMMISSION

Amendment No. 67

MATERIALS LICENSE

Licensee	
1. ABB Inc.	3. License number 06-00217-06
2. 5 Waterside Crossing Windsor, Connecticut 06095	4. Expiration date: Not Applicable
	5. Docket No. 030-03754 Reference No.

In accordance with the letter dated April 25, 2013 (ADAMS Accession No. ML13127A415), this license is hereby terminated.

For the U.S. Nuclear Regulatory Commission

Date September 9, 2013

By ***Original signed by John Nicholson***

John Nicholson
Decommissioning Branch
Division of Nuclear Materials Safety
Region I
King of Prussia, Pennsylvania 19406

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U.S. NUCLEAR REGULATORY COMMISSION Amendment No. 18

MATERIALS LICENSE

Licensee	
1. ABB Inc.	3. License number SNM-1067
2. 5 Waterside Crossing Windsor, CT 06095	4. Expiration date Not Applicable
	5. Docket No. 070-01100 Reference No.

In accordance with the letter dated December 21, 2011, this license is hereby terminated.

For the U.S. Nuclear Regulatory Commission

Date February 28, 2012

By ***Original signed by John Nicholson***

John Nicholson
Decommissioning Branch
Division of Nuclear Materials Safety
Region I
King of Prussia, Pennsylvania 19406