ABSTRACT

REPORT FOR AN INTERNSHIP WITH THE FERNALD CLOSURE PROJECT SUPERFUND SITE

By Amanda Nicole Porfidio

This report describes my ten-month internship at the Fernald Closure Project (Ross, OH) in the Soils Characterization Department. I was responsible for writing technical documents to the Environmental Protection Agency (EPA) and the Ohio EPA, which explained and justified the remedial actions taken in specific areas of the site. As part of this certification process, I examined soil data and planned soil sampling to determine the extent and type of contamination for specific areas. I coordinated with and tracked the surveyors, samplers, and the analytical lab to assure that samples were taken in a timely manner and according to the guidelines of the area specific document. This internship provided me applicable experience in soil remediation and utilized my education, background, and skills. It also further developed my critical thinking, problem solving, and communication skills, which will allow me to compete effectively for professional positions in the environmental science field.
REPORT FOR AN INTERNSHIP WITH THE FERNALD CLOSURE PROJECT SUPERFUND SITE

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TABLE OF CONTENTS

ACKNOWLEDGMENTS ............................................................................................................. iii
INTRODUCTION .......................................................................................................................... 1
  General Description of Position .......................................................................................... 1
  Relevant Background ......................................................................................................... 3
  Description of the Certification Process ........................................................................... 5
RESPONSIBILITIES AND ACCOMPLISHMENTS ................................................................. 10
  Initial Training and Starting Work at Fernald ................................................................. 10
  Soils Characterization ...................................................................................................... 10
  Area 8, Phase III-North – Certification ......................................................................... 12
  Area 2, Phase II-Subareas 1, 2, and 4 – Certification ..................................................... 13
  Global PSP ....................................................................................................................... 14
  Area 2, Phase II-Subarea 3 – Predesign ........................................................................ 14
  Computer Program Audit ................................................................................................. 15
TRANSFERABLE SKILLS ATTAINED .................................................................................... 17
CONCLUSIONS........................................................................................................................... 19
ABBREVIATIONS GUIDE AND GLOSSARY OF TERMS..................................................... 20
REFERENCES ............................................................................................................................. 22
APPENDIX................................................................................................................................... 23

LIST OF FIGURES

Figure 1 - Environmental Services Organizational Chart (DOE, 2003)................................. 7
Figure 2 - FCP Controlled Certification Map (DOE, 2004).................................................. 8
Figure 3 - Certification Process Flowchart (DOE, 2003).................................................... 9

LIST OF TABLES

Table 1A – Radiological and Chemical Waste Acceptance Criteria for On-Site Disposal Facility (DOE, 2003) ................................................................................................................ 23
Table 2A – Physical WAC and Prohibited Items for the OSDF (DOE, 2003)....................... 24
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INTRODUCTION

The Fernald Closure Project (FCP) is a former U.S. Department of Energy (DOE) uranium processing facility located southwest of Ross, Ohio. The uranium produced was used by the government for making nuclear weapons during the Cold War. In 1989, production of uranium officially ceased when the site was placed on the National Priorities List as a Superfund Site. Fluor Fernald is an outside contractor who manages the remediation process of the 1,050 acre site, which is planned for completion in May 2006. In the Summer 2003, I began an internship position with the Soils Characterization Department at the FCP, where I was responsible for assisting and supporting their current staff’s projects. My contract was extended twice for a total of 10 months, which gave me the opportunity to complete individual projects and responsibilities in the department. It also allowed me to work during the school year approximately 18 hours per week while taking classes and performing my duties as a departmental computer lab assistant. Trying to balance school responsibilities and working was difficult, but I welcomed and accepted the challenge. This internship not only provided me practice as an environmental professional, but also further refined my organizational and time management skills. This internship report will serve to demonstrate how this experience was a valuable part of my education and how it will support my future career as an environmental scientist.

The introduction of this report will provide a general description of my position in the Soils Characterization Department, give relevant information about the Fernald Site, and give an overview of the certification process at Fernald. Following the introduction will be a detailed description of my internship responsibilities and accomplishments. The third section of this paper will describe the important transferable skills I attained and how my courses from the Institute of Environmental Sciences (IES) contributed to my experience at Fernald. My conclusions in the fourth section will be followed by an Abbreviation Guide and Glossary of Terms.

General Description of Position
My main responsibility in the Soils Characterization Department was to compose technical certification documents for the DOE to submit to the US and Ohio Environmental Protection
Agencies (EPA and OEPA). These documents were written to demonstrate to the agencies that an area was remediated according to agreed upon guidelines and that it could be considered “certified.” The certification process of an area has several deliverables in the form of technical reports, plans, letters and variances. I will explain in detail each of these steps and their associated documents later in this report under “Description of the Certification Process” on page 5. Writing these documents required research on the specific area using previous documents, existing soil data, or process knowledge. It was also necessary to ask people on site if they remembered events or findings that had happened during cleanup of the site. As a scientist, I’m used to going to an article database and searching for primary journal articles. It was hard for me to consider calling someone on site, who might remember what happened in a particular spot, as reliable information. I was surprised how often people remember things that have happened during excavation or that have happened with the EPA.

Document preparation frequently depended on interpreting physical and real-time soil data. This involved working with the Data Management Group and our Computer Aided Design (CAD) operator to produce maps with detailed labels that we created with an Excel Macro. The maps would be made for a specific area of the site and would indicate whether a sample point was clean, contaminated (above-final remediation levels, -FRL) or very contaminated (above-waste acceptance criteria, AWAC). See Table 1A of the Appendix for common constituents and their WAC. Each label would also give the greatest depth of contamination for a given point. A more detailed description of the map label process will be given under the “Responsibilities and Accomplishments” section of this paper on page 10. Using these maps, we could plan and justify future sampling and remediation efforts for a specific area.

The Soils Characterization Department is responsible for guiding remediation for most of the site. (It is not responsible for the Silos Area.) To do this effectively, a project management strategy was implemented in which several supporting departments like Surveying, Sampling, Lab Services, Data Management, Construction, and Engineering assist the Soils Characterization Department. This strategy requires constant communication between each of these support groups. To facilitate this task, a weekly communication meeting was held with the managers in Surveying, Sampling, and Lab Services, and the members of Characterization. See Figure 1,
The FCP emphasizes safety. Every month we had a safety meeting, which also served to communicate progress on-site. Every day in the morning and at noon, there was a construction safety-communication meeting that Characterization was required to attend. These meetings emphasized every employee’s right to refuse or stop work if they saw potentially unsafe work conditions. This included stopping someone else from working because of a potential safety hazard. While I was glad to see a company take steps to ensure safety, it was rather excessive at times, considering the biggest safety hazard to me was probably the mold in our trailer/offices.

In summary, my position responsibilities included writing technical documents, planning soil sampling, interpreting data, communicating with support departments, and advocating safety. I often was responsible for miscellaneous tasks that were non-routine and that no one else in the department had time to do. Specific assignments and tasks are described in more detail in the section of this paper entitled “Responsibilities and Accomplishments,” on page 10.

Relevant Background
Fernald is a Department of Energy (DOE) property that produced uranium for nuclear arms from 1951 until 1989 and is located near Ross, Ohio. As a result of the processes that occurred, there is radiological and chemical contamination of the soil and buildings located on-site. The local Paddy’s Run watershed is also monitored closely for contamination. In 1990, remediation efforts began to clean-up the site and prepare it for closure. This process is expected to be completed in Spring of 2006, while monitoring of the water will continue until 2020.

The site clean-up is primarily regulated by the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA, aka “Superfund”) and the Resource Conservation and Recovery Act (RCRA). It also includes regulations for the Underground Storage Tank
Program under RCRA and the Occupational Safety and Health Act (OSHA). The Department of Energy works closely with the EPA and OEPA to ensure that remediation efforts are made according to the Sitewide Excavation Plan (SEP), which details the remediation process to follow.

As part of the remediation process, a Remedial Investigation/Feasibility Study (RI/FS) was performed to provide a general characterization of the site. RI/FS consists of two phases. The Remedial Investigation “is designed to assess the nature and extent of releases of hazardous substances and determine those areas of a site where releases have created damage or the threat of damage to public health or the environment (Sullivan, p 470, 2003).” The Feasibility Study provides a range of remedial action alternatives based on the RI. The site was also divided into operable units (OUs), which allow a phased approach to remediation of the site.

In addition to OUs, the site was divided into ten general remediation areas, numbered 1 to 9 and the tenth was the Paddy’s Run Creek running through the site. Some of these areas were further divided into phases and parts, based on the similarities and remediation requirements of a given area. As of March 2004, approximately 671 acres of the 1050 acre site had been certified. See Figure 2, page 7 at the end of this section for the FCP Controlled Certification Map, which shows the amount of progress as of January 23, 2004. When I left in March, Area 2, Phase II-Subareas 1, 2, and 4 had just completed certification and were pending approval of the certification report.

Contaminated soil that is excavated and contaminated buildings that are demolished are buried in a specially designed on-site landfill called the On-Site Disposal Facility (OSDF). There are six (6) planned cells for the OSDF. Material that is below the waste acceptance criteria (WAC), but tests above the final remediation level (FRL) is placed in the OSDF. Only material that is below-WAC can be placed in the OSDF. If material is above-WAC (AWAC) then it must be specially contained in a rail car and transported by rail to Utah for storage. Table 2A in the Appendix is a Table listing the Physical WAC and Prohibited Items for the On-site Disposal Facility. Other contaminated materials, such as sludges and liquids, are handled by the Waste Acceptance Organization (WAO), which determines how the materials will be treated and handled.
Description of the Certification Process
A general certification process is followed to certify that an area of the site has been remediated according to site requirements. Refer to Figure 3, page 9 at the end of this section, for the General Area-Specific Soil Remediation Process Flowchart. This process is guided by the sequential submittal of several documents for predesign, excavation control, precertification and certification activities. The site was divided into remediation areas, which were then further subdivided into Phases. For example Area 2 was divided into three phases (I, II, and III). Each phase was an individual project that was taken from Predesign through Certification. The main types of documents that may be written during the certification process include: a Predesign Project Specific Plan (PSP); an Integrated Remedial Design Package (IRDP); a Precertification PSP; a Certification Design Letter and PSP; and a Certification Report. In addition, any revisions made to a PSP after the document’s approval by the EPA and OEPA must be documented in a variance/field change notice (V/FCN), which is also submitted to the agencies for approval and appended to the original document. Managers of Waste Acceptance Organization (WAO), Field Sampling, Onsite Laboratory, Surveying, and Quality Assurance/Quality Control (QA/QC) must all review a document before it is submitted to the agencies. When these documents are submitted by our department, they are first sent to the onsite Department of Energy representative, who then formally submits it for the site to the EPA and OEPA.

Predesign is the first step of the certification process, which attempts to determine the extent of contamination of a specific area of the site. A Predesign Project Specific Plan (PSP) is written to describe in detail the reasoning behind the sampling locations, the constituents to be analyzed, the depth to which the samples will be taken, and any other specifics for this initial investigation. Once the results are received, an Integrated Remedial Design Package (IRDP) is composed by the Engineering Department with assistance from the Soils Characterization Department and Real-time Sampling. It includes detailed excavation designs for the contaminated parts of an area and outlines how remedial action will be carried out. During excavation, real-time sampling is performed at the end of excavation to determine if all radiological contamination has been removed. If not, excavation continues and is checked again with real-time sampling. Real-time
sampling scans the surface and detects radiation, which indicates levels of the primary radiological constituents (Total Uranium, Radium-226, Radium-228, Thorium-228, and Thorium-230). It cannot be used to detect contamination from non-radiochemicals. Once the contaminated portions have been removed and disposed of appropriately, the Precertification PSP can be written, which explains how and why the area is ready for Certification sampling. Often during Precertification a real-time scan of the area to be certified is made, which should indicate that all surfaces are below-FRL for the primary radiological constituents. This is sufficient to show that certification sampling may proceed by writing the Certification Design Letter (CDL) and PSP. Once certification sampling is completed and the area is proven to be “clean,” the final document written is the Certification Report. The Certification Report documents the agreement of the agencies and Fernald that an area can be considered “certified.”
Figure 1 - Environmental Services Organizational Chart (DOE, 2003)
Figure 2 - FCP Controlled Certification Map (DOE, 2004)
Figure 3 - Certification Process Flowchart (DOE, 2003)
RESPONSIBILITIES AND ACCOMPLISHMENTS

Initial Training and Starting Work at Fernald

Before I could start working in the Soils Characterization Department, I was required to take a week of training, which was a 40 hour OSHA equivalent training session. There were three different sets of training: the General Site Worker Training and the Radiological Worker I and II training. Because my job would require me to be in areas that had not been certified, this training was necessary to educate me on safety issues related to working in those areas. Since I was never required to enter asbestos or confined spaces I was not required to receive additional training for working in these specific areas. Great measures are taken to limit the extent of worker exposure to hazardous and radiological conditions known as ALARA, As Low As Reasonably Achievable. So, if a condition can be made less hazardous before people enter an area, steps are taken to reduce or eliminate the risks. To support the ALARA concept, workers wear dosimeters to monitor their exposure to radiation and are not allowed to exceed their maximum dose.

As part of the Radiological Worker I and II training I learned the procedures for entering and exiting a radiologically contaminated area to prevent spreading contamination out of the area. Such measures included dressing in and out of the anti-contamination (yellow) suits and frisking for contamination when exiting the area. This process had a sequence of very important steps to prevent cross-contamination between the “clean” and “contaminated” areas of the site. While working at Fernald, I never needed to enter an area of the site that required “dressing-out” in anti-contamination suits. The only personal protective equipment I was often required to wear when entering my assigned areas were safety goggles, a hard hat, an orange safety vest, and steel-toed boots.

Soils Characterization

I spent most of my first week of working in the Soils Characterization Department observing. I observed that my supervisor and all of my immediate co-workers were intensely busy and had little time to devote to training a new intern. It was rather frustrating being in a new place, at a new job with no idea of where to begin. By reading available documents, I tried to make sense
of what the site was about, what the documents were about, their purpose and any other information. The first thing I noticed as an outsider was that the government abbreviates every possible phrase into an acronym … PSP, CDL, RA, A1PI, etc. Sometimes the acronym was defined in the list at the front of the document, but often it had been defined earlier in the document, buried obscurely in some paragraph. So, my first goal when I started working at Fernald was to become more familiar with the certification document process and the profuse acronyms.

One of the initial reasons I had been hired was to provide support to the other people in the department by looking at data for their projects. My supervisor had written a macro in Microsoft Excel to create detailed labels for data points that helped to characterize the extent of contamination for a specific area of the site. One of my first tasks was to learn how to use this macro and filter the data so that detailed maps could be plotted by our CAD operator. The entire process of creating labels was very tedious. The macro had been designed to compare the soil sample result for a point to both the final remediation level (FRL) and the waste acceptance criteria (WAC) level. If the result was below both those levels it was assigned a “B,” which would be given the color green on the plot for a clean point. If the result was above-FRL but below-WAC, it was assigned the letter “F” and would be colored blue on the plot. If the result was above-FRL and above-WAC, the point was assigned the letter “W” and would be colored red on the plot. While the Macro did most of the work, it was necessary to double-check the macro. If the units did not match between the sample results and the given FRL/WAC, then no letter was assigned and the result would have to be compared manually. This entire process was my least favorite thing to do at my internship, because, while seemingly straightforward, manually comparing the results often required strange conversions, rules, and caveats. However, prior to my working there, my supervisor had been the primary person to run the macro; by the end of my internship, my co-workers could also consult me on the process.

After I had been working at Fernald for about a month and a half, I was given the task of revising the Area 2, Phase II (A2PII) Integrated Remedial Design Plan (IRDP) based on the comments received from the EPA and OEPA. Each comment was considered and given a response explaining why the document was or was not revised accordingly. The A2PII IRDP had
received several comments requiring the department to justify its strategies, so, revising this document required careful consideration on our part. It was necessary to provide further explanation to the agencies without offering the opportunity for further scrutiny. Also, during the predesign and excavation of A2PII, some unpredicted arsenic contamination was discovered by chance, which contributed to the agencies’ critical review of the IRDP, and the department’s effectiveness at determining contamination.

The rest of my responsibilities were devoted to projects for specific areas of the site. First, I was responsible for finishing up the certification of Area 8, Phase III-North. The remainder of my time was spent working on Area 2, Phase II, which included predesign and certification processes. In the sub-sections that follow, I provide detailed accounts of what tasks I performed for each specific area.

**Area 8, Phase III-North – Certification**

My first document-related responsibility was responding to agency (EPA/OEPA) comments for Area 8, Phase III – North (A8PIII-N) Certification Design Letter and Project Specific Plan. This particular area of the site did not require a lot of remedial action; only a small radium hot spot was located and removed. It was located on the northwestern border of the site and was not part of the former production area, so certification of A8PIII-N was relatively straightforward and easy. Once I responded to agency comments and the document was approved, I wrote the Certification Report, which described why the Department of Energy was confident that the area had been remediated to site requirements. The Certification Report presented the statistical results of the sample data. Each constituent was statistically examined to determine if that constituent was below-FRL for the certification unit (CU). In Area 8, Phase III-North there were ten CUs and they were sampled for primary radiological constituents (total uranium, radium-226, radium-228, thorium-228, and thorium-230). All passed the statistical analysis and the Certification Report was approved by the agencies, so Area 8, Phase III-North could be considered “certified.”
Another Certification project I was responsible for was Area 2, Phase II (A2PII)-Subareas 1, 2, and 4. I acted as project lead, which means all the supporting departments would contact me with any questions, concerns, or clarifications regarding the Certification Project Specific Plan (PSP). Typically, I was in contact with Surveying, Sampling, and the Analytical Lab support groups. The Certification Design Letter (CDL) and PSP were written and submitted together. They outlined the certification sampling process for the specific area and the reasoning behind the sampling. A2PII-Subareas 1, 2, and 4 was located in the southwest portion of the site and was not considered part of the former production area, but was considered to be moderately impacted. The Subareas 1, 2, and 4 were specific remediation areas of A2PII: Subarea 1 was the Arsenic Area, Subarea 2 was the Radium Hot Spot, and Subarea 4 was the remaining area of A2PII. Subarea 3 was addressed in other certification documents because it was the infrastructure area and was still in use by the rest of the site (ie. Electrical lines, laydown areas, etc.).

The entire A2PII Certification area was divided into 45 certification units (CUs), which were subdivided into 16 sub-CUs. Each sub-CU contained a randomly placed soil boring/sample point. Only 12 of the 16 samples were analyzed; four were reserved as archives in case the CU does not pass the statistical analysis for certification. In theory, every sample should come back clean. However, in A2PII there were a couple sub-CUs that had above-FRL results. As long as the entire CU was statistically determined to be below-FRL, the CU is considered “certified.” Once the CDL and PSP were approved, surveying and physical soil sampling began. I was responsible for tracking these procedures and the soil sample results. When we received chemical analysis results from the lab, I needed to check the results to verify they were below-FRL. Any CUs that had above-FRL results were sent for statistical analysis. If the CU were to fail, the archives would be analyzed to provide supplemental data. If the CU still failed with additional data, remedial action would have to take place to remove any existing contamination. By the time I left in mid-March, certification sampling had been completed and results were received for all the borings.
Global PSP

Every PSP is required to have certain sections, which are often copied and pasted verbatim from previous PSPs. To eliminate the need to copy these sections every time a PSP is submitted, a Global PSP was composed to provide the general sections for all future PSPs. I was part of this process and was responsible for writing sections describing Area 6 and Area 7. The agencies were initially in favor of this idea, hoping it would reduce the wasteful reproduction of general knowledge and procedures. However, the first draft of the document received criticism from the EPA and OEPA for being too concise with too many references to other documents, which required us to re-think our initial document. Originally, any deviations from the Global PSP were going to be written as variances. The EPA and OEPA changed the requirement, so we had to submit an individual PSP for each remaining area but could reference the Global PSP for the verbatim sections. However, this created problems for the samplers who use a PSP as a working document in the field. So, they were having to take two documents into the field: the area specific supplemental PSP and the Global PSP it referenced.

Area 2, Phase II-Subarea 3 – Predesign

The Area 2, Phase II – Subarea 3 Predesign PSP was written as a supplement to the Global PSP. No other Predesign PSP supplements had been written for the Global PSP, so I had to compose the document from the little experience I had gained, and with help from co-workers. One of my major accomplishments was that my document received no comments from the agencies upon submittal, so it is now used as a template for all subsequent Predesign PSP supplements. Much of this has to do with the extensive editing and re-editing of the document between my supervisor, Frank Miller, and myself prior to submission to the agencies. It also may be attributed to my thoroughness to detail and logical organization of the document.

A primary part of my job was planning soil sampling to determine the type and extent of contamination present. As mentioned a Predesign PSP outlines how, where, and what samples will be taken to help characterize the contamination of an area. To help determine where samples are taken and what constituents to collect, existing RI/FS data for above-FRL/AWAC results were plotted on a map plot using the Excel macro. I looked at what previous constituents (chemicals) had been sampled and what logical constituents should be sampled for. For
example, I planned sampling for the Electrical Subcontractor Area: I decided it would be reasonable to sample for PCBs (polychlorinated bi-phenyls, Aroclor-1254 and Aroclor-1260), since PCBs are often associated with electrical equipment like capacitors. Another example is for the wheelwash facility that was used to prevent cross-contamination between areas by washing potentially contaminated equipment before it passed into a non-contaminated area. It is likely that any constituents found in A2PII could be found in the wheelwash facility, because they may have been rinsed off machinery and equipment before crossing from the contaminated A2PII side to the clean side. For this reason the wheelwash facility area was sampled for all the constituents found in Area 2, Phase II. A2PII-Subarea 3 is surrounded by the A2PII-Subareas 1, 2, and 4 Certification areas, which was previously discussed on page 13. So using knowledge of the surrounding area we were also able to limit the number of constituents to sample for in A2PII-Subarea 3.

Once I decided on where to sample, I went into the field and located the specific points to sample based on my observations. Some points were moved or specifically placed based on field observations. For example there were some suspect piles of soil and a previously identified radium contaminated spot, which we wanted to be certain were included in the sampling. Also, comparing the map where I had planned samples to the actual field conditions resulted in moving points. For example one point was moved a couple feet from a blacktop area to an open soil area, because it was easier to sample open soil than to go through the blacktop to the soil beneath it. Since this initial sampling was to develop a general idea of the extent of contamination, there was no strong argument or rationale to sample it over the blacktop instead of the nearby open soil. It is important to realize that the soil beneath the blacktop will eventually be sampled at some point, likely when the excavation of that parking lot occurs. When I left my internship, the sampling had just begun for the predesign, but no results had been received from the analytical lab.

**Computer Program Audit**

In February the department was required to assess the dependability of the department written computer programs, for example the label making macro that I’ve mentioned to make contamination maps. I was responsible for finding the procedure on the FCP Intranet, reading
the procedure, and relaying it to my co-workers so that we could follow the procedure. I was most familiar with the Excel Macro for label making, so I had to show how it was reliable and gave consistent, accurate results. This involved demonstrating how the cells appropriately assign a label of B, F, or W based on the comparison of a soil sampling result for a tested constituent, with a given FRL or WAC. I also performed QA/QC on some other spreadsheets that my supervisor used. The documentation associated with this process was considered a government record, which means it is stored separately from non-record documents.
TRANSFERABLE SKILLS ATTAINED

Working at Fernald provided me the opportunity to work in a professional environment and apply my academic knowledge to a real-world situation. It primarily utilized my problem solving and document writing skills, while strengthening and developing other important transferable skills. An important part of this job, and every job, was good written and verbal communication. As a project lead, it was important for me to develop clear communication via email and in person. Weekly meetings also allowed me to practice verbal communication with different supporting groups. As a project lead I also utilized project management tools for tracking tasks and results. Developing sampling strategies for these projects allowed me to hone my critical thinking and research skills. My computer skills have also been improved by this internship. I gained some experience with the Microsoft Access database and became more proficient in Microsoft Excel and Word programs as well.

One of my supervisor’s common phrases was “we’re going to switch gears now,” which meant I should drop what I was working on and pick-up on something completely different. This internship often required me to multi-task and to prioritize my tasks accordingly. Not only did I manage my time at work, but also in the rest of my life. I had to coordinate and balance my class time, study time, and free time with my internship. My organizational skills also had to improve to compensate for my strict schedule.

The most valuable skills I’ve attained are working for the government and with federal regulations. I was constantly exposed to Occupational Safety and Health Act (OSHA) safety guidelines. In addition, the remediation/certification process was dictated by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). Sorting through government documents and procedures will likely be necessary in my future career, whether working for the government or a private consulting firm, since everyone is subject to these regulations.

My internship significantly enhanced my graduate education. It was an opportunity to apply my academic knowledge I have gained from the Institute of Environmental Sciences and Miami
University. For example, my course in project management (EGM311/IES680) gave me organizational skills and exposure to tools, like Microsoft Project. As a project lead for specific areas of the site, I was responsible for coordinating the surveyors, samplers, and the analytical lab to maintain a given deadline. This course in project management further refined my organizational and coordination skills, which helped me to effectively meet deadlines at Fernald.

Another important course was environmental law, which outlined the important elements of the Resource Conservation and Recovery Act (RCRA); the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA); and the Occupational Safety and Health Act (OSHA). All of these regulations were an everyday part of my work environment at Fernald. RCRA and CERCLA were the major environmental laws that govern how the site is remediated. With the potential for hazardous work conditions and injuries, OSHA was the primary law regulating how work was done on-site, which likely contributed to the positive safety culture that existed at Fernald.

Other courses that contributed to my internship experience were my statistics courses (STA 671 and IES 612), environmental methodology (IES 611), and hydrogeology (GLG 504). As part of the certification process, data were given to a statistician to analyze the results. Having a general knowledge of statistical analyses allowed me to understand the results more completely than someone who had none. The soil samples that were used to characterize the site were taken with a Geoprobe instrument, which was briefly discussed in my hydrogeology course. While I did not take samples, having additional information about how a Geoprobe collects soil samples compared to another technique gave me a more complete understanding of the sampling procedure. As with any job, I was required to solve problems on several levels. Having had Dr. Willeke’s environmental methodology course, I was prepared to address problems and obstacles in a rational and effective manner.
CONCLUSIONS

I chose to do an internship instead of a thesis because I thought it would offer me applicable skills and experience for my future career as an environmental scientist. The opportunity to work for the Fernald Closure Project fulfilled this objective. I’ve gained real-world experience in the soil remediation/characterization field, utilizing my academic knowledge, background, and tools. My knowledge of chemistry was used and enhanced by working with radiological, metals, and organics data. I have also acquired greater familiarity with federal regulations and documents. Interning at Fernald provided me skills that cannot be absorbed from a book, but only through practice, such as critical thinking, problem solving, and communication skills. Most importantly, this internship will allow me to compete effectively for professional positions in the environmental science field because of the valuable skills and experience I have attained.
ABBREVIATIONS GUIDE AND GLOSSARY OF TERMS

**A2PII** – Area 2, Phase II

**A8PIII-N** – Area 8, Phase III - North

**ASCOC** – Area-Specific Constituent of Concern

**AWAC** - Above-WAC, the result was above the waste acceptance criteria and cannot go into the OSDF; indicated as red on characterization maps

**CDL** – Certification Design Letter, this document is written along with a Certification PSP to explain the design of the certification process for a specific area of the site; it outlines why the site thinks the specific area is ready for certification sampling

**CERCLA** – Comprehensive Environmental Response, Compensation, and Liability Act

Certification – a.k.a “Superfund,” regulates the clean-up of hazardous waste sites and the distribution of clean-up costs among the parties who generated and handled hazardous substances at these sites

**COC** – Constituent of Concern

**CU** – certification unit, the area to be certified is divided into approximately equal areas, or units that are further sub-divided into 16 subunits, which each contain a certification sample point

**DOE** – United States Department of Energy

**EPA** – United States Environmental Protection Agency

**FCP** – Fernald Closure Project, formerly FEMP, Fernald Environmental Management Project

**FRL** – final remediation level, a constituent specific limit below which a result must be, for it to be considered uncontaminated by the given constituent; results above-FRL are indicated as blue and soil in these areas must be removed to the OSDF

**IRDP** – Integrated Remedial Design Package

**OEPA** – Ohio Environmental Protection Agency

**OSDF** – On-Site Disposal Facility, the on-site landfill structure where all waste (soil, buildings, etc.) is placed that is above-FRL, but below-WAC

**Predesign** – this is the first step to characterizing an area of the site; sampling is planned to determine the type and extent of contamination
**Precertification** – this is the step prior to certification to ensure that all of the contamination has been removed during excavation control

**Primary Radiological Constituents** – these are five constituents that are the primary types of contamination on-site, which include total uranium, radium-226, radium-228, thorium-228, and thorium-230.

**PSP** – Project Specific Plan, this document is written to describe the sampling locations, procedures, and rationale for a specific area of the site

**RCRA** – Resource Conservation and Recovery Act

**RI/FS** – Remedial Investigation/Feasibility Study

**SEP** – Sitewide Excavation Plan

**WAC** – Waste Acceptance Criteria, the limit above which waste material is considered unacceptable for the OSDF and must be transported to an off-site hazardous waste storage facility
REFERENCES


Several of the figures were adapted from documents available at the FCP and have been referenced as (DOE, YEAR).
## APPENDIX

<table>
<thead>
<tr>
<th>Constituent</th>
<th>Concentration/Activity</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Neptunium-237</td>
<td>3.12 x 10^5</td>
<td>pCi/g</td>
</tr>
<tr>
<td>2. Strontium-90</td>
<td>5.67 x 10^10</td>
<td>pCi/g</td>
</tr>
<tr>
<td>3. Technetium-99</td>
<td>2.91 x 10^1</td>
<td>pCi/g</td>
</tr>
<tr>
<td>4. Uranium-238 or</td>
<td>3.46 x 10^2</td>
<td>pCi/g</td>
</tr>
<tr>
<td>Total Uranium</td>
<td>1.030 x 10^3</td>
<td>mg/kg</td>
</tr>
<tr>
<td>5. Carbazole</td>
<td>7.27 x 10^4</td>
<td>mg/kg</td>
</tr>
<tr>
<td>6. Bis(2-chlorisopropy1)ether (2)(3)</td>
<td>2.44 x 10^-2</td>
<td>mg/kg</td>
</tr>
<tr>
<td>7. Alpha-chlordane</td>
<td>2.89 x 10^9</td>
<td>mg/kg</td>
</tr>
<tr>
<td>8. Bromodichloromethane (3)</td>
<td>9.03 x 10^-1</td>
<td>mg/kg</td>
</tr>
<tr>
<td>9. 4-Nitroaniline (2)(3)</td>
<td>4.42 x 10^-2</td>
<td>mg/kg</td>
</tr>
<tr>
<td>10. Chloroethane</td>
<td>3.92 x 10^5</td>
<td>mg/kg</td>
</tr>
<tr>
<td>11. Vinyl chloride</td>
<td>1.51 x 10^0</td>
<td>mg/kg</td>
</tr>
<tr>
<td>12. Tetrachloroethene</td>
<td>1.28 x 10^2</td>
<td>mg/kg</td>
</tr>
<tr>
<td>13. Trichloroethene</td>
<td>1.28 x 10^2</td>
<td>mg/kg</td>
</tr>
<tr>
<td>14. 1,1-Dichloroethene</td>
<td>1.14 x 10^1</td>
<td>mg/kg</td>
</tr>
<tr>
<td>15. 1,2-Dichloroethene</td>
<td>1.14 x 10^1</td>
<td>mg/kg</td>
</tr>
<tr>
<td>16. Toxaphene</td>
<td>1.06 x 10^4</td>
<td>mg/kg</td>
</tr>
<tr>
<td>17. Boron (3)</td>
<td>1.04 x 10^3</td>
<td>mg/kg</td>
</tr>
<tr>
<td>18. Mercury</td>
<td>5.66 x 10^4</td>
<td>mg/kg</td>
</tr>
</tbody>
</table>

1) This table is based on information contained in the Operable Unit 2 and Operable Unit 5 Records of Decision.

2) The WAC for these constituents are below their practical quantitation limit (PQL). Analytical limitations will be addressed in Project Specific Plans developed for each remediation area.

3) The WAC for these constituents are below their corresponding final remediation level.

Table 1A – Radiological and Chemical Waste Acceptance Criteria for On-Site Disposal Facility (DOE, 2003)
<table>
<thead>
<tr>
<th>PHYSICAL WASTE ACCEPTANCE CRITERIA</th>
</tr>
</thead>
<tbody>
<tr>
<td>The maximum length of irregularly shaped metals or other components of a building superstructure or finish components shall be 10 feet.</td>
</tr>
<tr>
<td>The maximum thickness of irregularly shaped metals or other components of a building superstructure or finish components shall be 18 inches.</td>
</tr>
<tr>
<td>The maximum thickness of an individual concrete member or other component of a building slab or substructure shall be 4 feet, when the item is handled individually and is a regular shape having no concrete protrusions greater than 18 inches.</td>
</tr>
<tr>
<td>Concrete reinforcement bars shall be cut within a nominal 12 inches of the concrete mass. The additional length added by these bars is not considered in determining the total length of the concrete mass.</td>
</tr>
<tr>
<td>The maximum thickness of uniform pallets of building cladding (e.g., transite panels), properly banded into rectangular shapes, shall be 4 feet.</td>
</tr>
<tr>
<td>Regulated asbestos-containing material (ACM) shall be double-bagged.</td>
</tr>
<tr>
<td>ACM brick and commingled debris shall be double contained.</td>
</tr>
<tr>
<td>Piping having ACM insulation shall be segregated.</td>
</tr>
<tr>
<td>Equipment shall be drained of all oils and liquids.</td>
</tr>
<tr>
<td>Piping with a nominal diameter of 12 inches or greater shall be split in half.</td>
</tr>
<tr>
<td>OSDF Category 3 items having voids greater than 1 cubic foot shall be filled with a quick-set grout, or flowable cohesionless material approved by the OSDF Construction Manager. If a grout is used in this manner, it shall be allowed to set for a minimum of four hours prior to the commencement of placement of that item.</td>
</tr>
</tbody>
</table>

Table 2A – Physical WAC and Prohibited Items for the OSDF (DOE, 2003)