Engineering Laboratory

Project Plan Documentation (Binder)

CENE486C – BLM Mindy Mill

College of Engineering, Informatics, and Applied Sciences

1. Title Page
    a. Project Name and Description
        i. Bureau of Land Management Mindy Mill Site Investigation
        ii. A collection of soil samples from the abandoned Mindy Mill site has occurred. These samples will be processed for heavy metal readings and analysis by drying the soil and sieving to separate different particles. The soil will be analyzed through the usage of x-ray fluorescence and inductively coupled plasma for heavy metal recordings and verification.
    b. Project Dates: start date and end date
        i. Lab Use Start Date: 02/5/2026
        ii. Lab Use End Date: 02/20/2026
    c. Project Contact Name and e-mail
        i. Dr. Jeffery Heiderscheidt Jeffery.Heiderscheidt@nau.edu
2. Contact Information Page
    a. Project Contacts
        i. Name and e-mail of all project team member

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Gloria Millanez	em2673@nau.edu	(480)205-4476
Annika Dillemuth	aed369@nau.edu	(520)904-2805

        ii. Name of Faculty Sponsor or Technical Advisor

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Dr. Wilbert Odem	Wilbert.Odem@nau.edu

        iii. Name of Course Instructor and Capstone Grading Instructor

Dr. Jefferey Heiderscheidt	Jeffrey.Heiderscheidt@nau.edu

    b. Emergency Contacts
        i. EH&S contacts; names, e-mail and phone number

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ii. NAU Police phone number
(928)523-3611

iii. Poison Control phone number
(800)222-1222

3. Project Summary Page
   a. A brief description of the planned laboratory work.

This senior capstone project is for the preliminary assessment and site investigation (PA/SI) of the Mindy Mill site located south of Kingman, Arizona.

On site laboratory work will include steps to analyze and prepare the soil samples for further off-site verification utilizing Inductively Coupled Plasma Mass Spectroscopy (ICPMS) machinery. This work will be sieving, moisture content procedures, XRF in lab, and then selecting samples based on the XRF results.

FIRST DIVIDER – Initial Project Plan

1. Provide a planning document (e.g., a project plan, study plan, work plan, sampling and analysis plan, experimental plan, etc.) that provides more detail about the proposed lab activity planned. At a minimum, the planning document should provide the following information.
    a. Project title.

Preliminary Assessment and Site Investigation of Mindy Mill

    b. Names and contact information for all individuals performing project work and whether they will be entering the laboratory space.

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    c. Lab based project objectives.
    d. Lab based project approach for each objective.
    e. Planned laboratory activities, the duration (starting and ending dates) of each activity, and the person(s) responsible for performing each activity. Your end date should include time for clean-up activities after the project has been completed.
        i. Summarize the method you will follow for each activity

Task 1: Lab Space Preparation

Task 2: Moisture Content

Task 3: Sieve Samples

Task 4: Test Using XRF

Task 1: Lab Space Preparation

Start Date: February 5, 2026

End Date: February 6, 2026

This task involves cleaning and setting up the lab space. The soils lab will require that the countertops to be used will be wiped down and cleared of any remaining soil from previous lab spaces. From here, the materials used for the moisture content and sieving are to be acquired and cleaned prior to use utilizing the compressed air line to clear the particles.

Task 2: Moisture Content

Start Date: February 6, 2026

End Date: February 8, 2026

Moisture content of samples will be determined according to ASTM D2216-98. The samples will be weighed prior to drying. They will then be placed in an oven at 105 to 110 degrees Celsius for a minimum of 24 hours and until a constant mass is achieved. The dried samples are then reweighed, and the moisture content will be calculated from the mass difference between the wet and dry samples. The presence of water dilutes elemental concentrations and alters the matrix of the sample, which affects X-Ray attenuation and results in inaccurate XRF measurements. The removal of moisture content is necessary to ensure that samples are consistent and allow for elemental concentrations to be measured by the X-Ray Fluorescence (XRF) instrument to be reported on the dry weight. The moisture content quantified from the ex-situ XRF samples allows for correction of the in-situ XRF samples to be reported on dry weight as well.

Commented [GM1]: Not sure what this one means, Adam didn't talk about it that I remember

Commented [JO2R1]: i think we already do this throughout the task, its just saying okay so how are you actually going to do it when you are in the lab so that you can accomplish the objective

Commented [GM3]: Will go back and edit all dates once we have an anticipated date of completion for the binder

Task 3: Sample Sieving

Start Date: February 9, 2026

End Date: February 15, 2026

This task involves the separation of particles to remove debris and ground that are larger than 75 micrometers to obtain particle sizes that are less than 75 micrometers for optimized homogeneity. All sieves used will be #4 (425 millimeters), #10 (2.0 millimeters), #60 (250 micrometers), #200 (75 micrometers), and a pan. Sieves will be used in the stated order to go from top to bottom. For the improvement of XRF analysis accuracy, the smallest sieve to be used will be #200, which is less than 75 micrometers with a pan at the bottom to collect the fines that will be used in making the sample cups. Multiple sieves asides from the needed #200 are used to prevent clogging and the need to manually grind and remove debris through the sieving process. The method utilized will be used solely for the separation of particles; a particle size distribution will not be analyzed for the purpose of this lab.

Commented [GM4]: We just need to pick out what sieves we want to use other than #60 (see comments in materials below)

Task 4: XRF Procedures

Start Date: February 16, 2026

End Date: February 23, 2026

The procedures for use for XRF analysis involve the EPA Method 6200 as well as the XL3 Analyzer User Guide. XRF Analysis will consist of dividing each sample into nine polyethylene sample cups to then sustain a 90 second XRF scan. The EPA Method 6200 will be the base of our operations, and we will follow the instructions of minimizing moisture content and homogenizing the soil before prepping in powdered sample cups for the XRF scan. The data points from these scans will be collected and documented into an excel.

Commented [GM5]: Check with GI on if we are using this method or if we are using cups

2. Identify all laboratory equipment, laboratory supplies, tools, and chemicals that will be used.

Task 1: Lab Space Preparation

Equipment

- Dust Masks (N95 at minimum)

- Compressed Air

- Chemical Fume Hood: This will be used for all manual soil handling and subsampling. (Located in the Environmental Engineering lab on floor 2 of the Engineering Building)

- Nitrile Gloves

Task 2: Moisture Content

Equipment

- Balances

- Drying Oven

- Container Handling Apparatus (i.e. gloves or tongs)

- Soil Containers for Drying Oven

- Nitrile Gloves

- Soil Containers: bags for the dry soil which will then be replace in airtight 14-gallon totes

Task 3: Sample Sieving

Equipment

- Sieves

  - #10, #40, #60, #200, Bottom Sieve Pan

- Mechanical Sieve Shaker

- Balances

- Sieving Containers

- Soil Containers: bags for the fine particles

- Cumulative Mass Container: 15–30-gallon drums for larger particles than 75 micrometers; these will need to be requested through Environmental Health and Safety.

- Sieve Brushes

- Air Compressor

- Nitrile Gloves

- Chemical Fume Hood

Task 4: XRF Procedures

Equipment

- Polyethylene Sample Cups

- X-Ray Window Film

- Containers

- Trowels

- Plastic Bags

- Chemical Fume Hood

- Nitrile Gloves

3. Identify all hazards/risks associated with each of your planned laboratory activities.
   - Burns
   - Soil Inhalation
   - Eye Exposure
   - Dermal Contact to Contaminants
   - Soil Ingestion
   - Radiation Exposure
4. Identify all safety protocols that are associated with conducting work in the lab.
   a. This might include the following:
      i. EH&S online lab trainings
         Chemical Hygiene and Safety Training

Commented [GM6]: Can someone verify if this makes sense? I figured we will want some bigger ones to help slowly trickle it down to the 60 and finer but I am not sure of this. Once this is cleared we can fix the sieve stuff

Commented [JO7R6]: I kept the 40 and 60, added a 10 and 200 instead, this will help achieve the same outcome but these will help achieve that faster hopefully because more sieves means more time in the shaker

X-Ray Training
Laser Training

ii. Engineering Control Devices
iii. Personal Protection Equipment (required)
KN95 Dust Masks
Gloves
Protective Eyewear
iv. Never working alone in the lab (required)
All work is set to be completed in at least pairs.

5. Identify all non-hazardous and hazardous wastes that your activities will generate and their waste disposal requirements.
    a. Identify your hazardous waste cleanup plan for any workspace, tools, equipment, or any other items that may have become contaminated by hazardous materials.

Disposal of **hazardous soils** containing Lead, Arsenic, or Uranium, is to be placed in a 30-gallon drum provided by EH&S, and they are to be notified when lab procedures are completed so that they will come in and dispose of the soil properly.

Disposal of hazardous soils that are present on equipment being used will involve an air compressor being utilized to clean the equipment outside of the lab.

Any containers or equipment that held the contaminated or hazardous materials is to be labelled as such and will be requested for pickup through the EH&S ticketing system for proper disposal.

Disposal of **non-hazardous waste** in the lab will consist of cleaning all equipment with the air compressor, and disposing of all soil will depend on its volume. If the soil is non-hazardous and all samples compiled are less than 5-10 gallons then they may be disposed of normally in a regular trash bin. If the soil volume exceeds this, then EH&S must be contacted for further guidance. EH&S will direct either of the following options, compost, donate, or use an approved disposal site that they can provide.

    b. Any plan for hazardous waste/material; whether it be storage, disposal, or clean up requires collaboration with EH&S.
        1) Include the CECMEE lab manager (cc'd) on all email communications with EH&S.

EH&S is currently notified of our project and is aware that we will be sending in a pickup request for hazardous waste and for proper drums to contain debris and unused soil.

6. Identify all training that has been completed and training that will be completed to perform the work correctly and safely.
    a. Training or Experience to indicate that you are prepared to complete any of the methods or use any of the tools or equipment required for your work.

Training required prior to conducting any laboratory analysis per the Civil and Environmental Engineering Lab Protocols is NAU Chemical Hygiene and Lab Safety Training as well as the X-Ray training due to the usage of the XRF.

SECOND DIVIDER – Emergency Response Plan

Include tables that detail steps to be taken for each type of possible incident for each biological, chemical or physical hazard identified in your plan. The tables included must be in an alphanumeric sequence associated with each hazard. See the table below for an example of how to set up this table. You can have multiple tables for multiple hazard types: physical, chemical, or other.

Table 1: Hazards, Preventative Measures, and Emergency Response

Hazard	Preventative Measures	Emergency Response Plan
Burn	Proper handling of heated items such as utilizing tongs or heat-resistant gloves at all times	First Degree: rinse with cold water, moisturize the area, leave uncovered or loosely cover with a sterile dressing Second Degree: rinse with cold water for 10-20 minutes, cover with antibiotic ointment and sterile dressing Third Degree: remove clothing around the burn, run cold water over the burn, to be cared for in an emergency room
Dermal	Wearing long sleeves, full length pants, and gloves will limit exposure to contaminants within the soil.	Temporary exposure poses no emergency response risk, wash all clothing after lab work, and if skin is exposed, clean as normal.
Particles Entering the Eye	Wear protective eyewear at all times when handling the soil.	If soil gets into the eyes, do not rub them, and utilize the eyewash stations within the lab.
Inhalation	Utilizing a dust mask at all times when working with the soil or handle soil in the chemical fume hood when possible.	Inhalation does not risk immediate emergency response. Over exposure leads to health risks over time.
Ingestion	Utilizing a dust mask at all times when working with the soil or handle soil in chemical fume hood when possible.	Ingestion does not risk immediate emergency response. Over exposure leads to health risks over time.
Radiation	Utilizing the mobile test stand to prevent any exposure to x-rays.	If a high rate of x-ray exposure occurs, monitor burns or radiation sickness. If these occur, seek medical attention.

THIRD DIVIDER – Contaminant of Concern Handling and Safety

Include chemical and SDS information for each chemical used in an alphanumeric sequence. You will need to work out your safe storage, handling, and disposal plan with EH&S. Please cc in the lab manager for all email communications with EH&S. If you are completing an analysis of water or soil that might be contaminated by a hazardous substance locate and provide appropriate information on the suspected substances.

1. Chemical Identification Page
    a. Name of chemical: Arsenic
    b. Chemical storage: Samples to be stored within the teams 14 gallon totes, and individual bags for each sample.
    c. Safe handling of chemical: Always handle with full PPE (gloves, dust mask, full sleeves, fully length pants, protective eyewear), keep in the designated containers for the sample until it is ready to be accumulated.
    d. Waste accumulation procedure: Place into a 30 gallon drum provided by EH&S and marked for disposal.
    e. Waste Disposal Plan: Submit a disposal request from EH&S to dispose of the soil.

2. Chemical SDS
https://www.flinnsci.com/sds_80.1-arsenic/sds_80.1/?srsltid=AfmBOoqUxTYGhxUSPgdoeIHdqDKxrEq2y8zRb3UAgnc7tlZt8bLjjgHD

3. Chemical Identification Page
    a. Name of chemical: Lead
    b. Chemical storage: Samples to be stored within the teams 14 gallon totes, and individual bags for each sample.
    c. Safe handling of chemical: Always handle with full PPE (gloves, dust mask, full sleeves, fully length pants, protective eyewear), keep in the designated containers for the sample until it is ready to be accumulated.
    d. Waste accumulation procedure: Place into a 30 gallon drum provided by EH&S and marked for disposal.
    e. Waste Disposal Plan: Submit a disposal request from EH&S to dispose of the soil.

4. Chemical SDS
https://www.flinnsci.com/sds_432-lead/sds_432/?srsltid=AfmBOoqZ9edQ-MbjIrdMArDNnE0Pq5FwL1ZG7kf-biqUFNPhVg9fkVe1

5. Chemical Identification Page
    a. Name of chemical: Uranium
    b. Chemical storage: Samples to be stored within the teams 14 gallon totes, and individual bags for each sample.
    c. Safe handling of chemical: Always handle with full PPE (gloves, dust mask, full sleeves, fully length pants, protective eyewear), keep in the designated containers for the sample until it is ready to be accumulated.
    d. Waste accumulation procedure: Place into a 30 gallon drum provided by EH&S and marked for disposal.

e. Waste Disposal Plan: Submit a disposal request from EH&S to dispose of the soil.

6. Chemical SDS
   https://www.energy.gov/nnsa/articles/sds-uranium-metal

FOURTH DIVIDER – Safety Training and Lab Agreements

1. Include a copy of all documentation identifying and certifying completion of the online chemical hygiene training for each team member.
    a. This training must be completed annually.
2. Include a copy of the signed EnE Laboratory User Agreement and Waiver form for each team member.
    a. These documents will be provided to you, and filled out, during the lab usage and lab safety meeting held with the lab manager.

FIFTH DIVIDER – Project Activity Log

Each project team member must document their laboratory activities using Project Activity Log forms.

CECMEE Engineering Laboratory and Field Station
Project Activity Log

Project: _____ Name: _____

Date:		**Start Time:**		**End Time:**	
Work Description					

Project: _____ Name: _____

Date:		**Start Time:**		**End Time:**	
Work Description					

Project: _____ Name: _____

Date:		**Start Time:**		**End Time:**	
Work Description					

Project: _____ Name: _____

Date:		**Start Time:**		**End Time:**	
Work Description					