



**STATE OF COLORADO  
DEPARTMENT OF PUBLIC HEALTH  
AND  
ENVIRONMENT**

**WORK PLAN**

**GEORGE E. DAVIS MILL REMEDIATION PROJECT  
HMWMD-RAD-01**

**GATEWAY, MESA COUNTY, COLORADO**

**PREPARED BY:**

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**APRIL 2006**



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April 21, 2006

Mr. Robert W. Terry

State of Colorado  
Department of Public Health and Environment (CDPHE)  
HMWMD-RP-B2  
4600 Cherry Creek Drive South  
Denver, Colorado 80246-1530

Reference: CDPHE RFP Number HMWMD-RCP-01  
Gateway, Colorado – Davis Mill Site Remediation

Subject: Transmittal of George E. Davis Mill Site Remediation Project  
Work Plan and Supporting Project Planning Documents

Dear Mr. Terry:

Pursuant to the terms and conditions of the above referenced CDPHE Project Contract, please find enclosed three (3) copies of the George E. Davis Mill Site Remediation Project Work Plan and Supporting Project Planning Documents. The Work Plan and by reference therein; each of the planning document package bears a Professional Engineers Certification; Duane Fehringer, P.E. P.L.S.

The initial site survey topographical drawing (Stamped and Certified by a Professional Land Surveyor – Duane Fehringer, P.E. P.L.S.) is included in this package as Attachment G of the Work Plan. This topographical drawing and its associated survey points will be used as the baseline for excavation volume calculations.

Should you have any questions, you may contact us 303-234-9350.

Sincerely,

Frontier Environmental Services, Inc.

Daniel S. Hinds, CEM, RHSP  
President



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DEPARTMENT OF PUBLIC HEALTH  
AND  
ENVIRONMENT**

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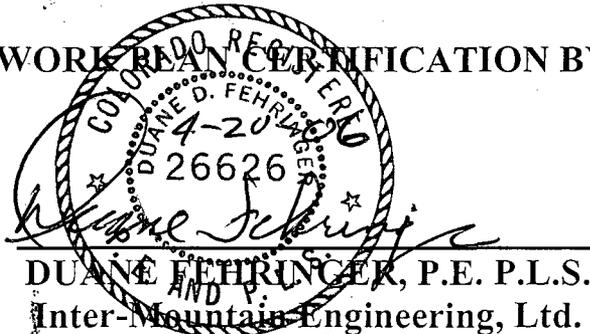
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**WORK BEAN CERTIFICATION BY:**

  
**DUANE FEHRINGER, P.E. P.L.S.  
Inter-Mountain Engineering, Ltd.**

**APRIL 2006**

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**Colorado Department of  
Public Health and Environment  
George E. Davis Mill Remediation Project  
Gateway, Mesa County, Colorado**

**I. PROJECT DESCRIPTION**

The scope of work for the George E. Davis Mill Remediation Project (Project) includes design and construction of a complete remediation of the George E. Davis Mill Site located at 43201 Highway 141, Gateway, Mesa County, Colorado including and consisting of all necessary site improvements for the excavation and transportation of uranium and thorium contaminated soils to the Umetco Minerals Corporation Uravan Site for disposal. The Umetco Uravan facility is accessed off of Colorado Highway 141 approximately 35 miles southeast of Gateway in Montrose County. A separate contract has been implemented between the Colorado Department of Public Health and Environment (CDPHE) and UMETCO for the management and disposal of project excavated and transported materials. Frontier Environmental Services, Inc. (FESI) is the selected design build contractor which will perform site remediation services including building cleaning and demolition, regrading, reclamation, residence relocation, and other work as may be required to successfully implement the project.

**A. Site History and Background:**

As part of an on-going regulatory administrative process; the U.S. Nuclear Regulatory Commission (NRC) is closing old radioactive materials license files that have not been properly terminated by the licensees. The George E. Davis Mill Site ("Site") in Gateway, Colorado, is one such site. The NRC has been mandated by the United States Congress to facilitate a file closure program for about 150 radioactive materials licenses, most of which were issued by the Atomic Energy Commission in the 1950s and 1960s. The program, which is titled "Funding Assistance for Formerly Licensed Sites in Agreement States" provides grants to Agreement States for the purpose of reviewing files, conducting surveys, characterizing and remediating sites formerly licensed by the Nuclear Regulatory Commission. As part of Phase I of the NRC program, the CDPHE reviewed files for 12 sites in Colorado, and directed the NRC to close 11 of the files without further action. In fulfillment of Phase I of the program, the CDPHE conducted a scoping survey of the George E. Davis Mill Site. Based on the results of the scoping survey, on April 30, 2004 CDPHE submitted a proposal to the NRC to conduct characterization of the Site. On September 16, 2004, the NRC awarded a grant to the CDPHE for the "Site Characterization of the George E. Davis (Gateway, Colorado) Mill Site." The initial scoping survey and the site characterization were Phases I and II of a three phase project. The site remediation, to be implemented by the implementation of this Work Plan (Plan), is Phase III of a three-phase CDPHE project that is administrated by the U.S. Nuclear Regulatory Commission Funding Assistance for Formerly Licensed Sites in Agreement States SA-1000.

Phase I of the project was completed under U.S. NRC Grant no. NRC-06-01-301 for File Reviews and Initial Surveys of Eleven NRC Formerly Licensed Sites. The Site Characterization, Phase II, was completed under U.S. NRC Grant no. NRC-06-04-301 for Site Characterization of the George E. Davis (Gateway, Colorado) Mill Site. Phase III has been awarded and contracted to FESI by CDPHE and is funded by U.S. NRC Grant Number NRC-06-05-303 for Site Remediation of the George E. Davis (Gateway, Colorado) Mill Site.

**B. Scope of Work:**

In order to achieve a timely and cost effective remediation of the Gateway - Davis Mill Site Remediation site, CDPHE will have the contaminated soils located at the Gateway - Davis Mill Site removed and disposed of off-site at the UMETCO Uravan Facility. FESI will provide the environmental professionals necessary to prepare environmental clean up plans and design drawings and specifications describing this project's remediation. FESI will then implement the excavation and disposal of approximately 14,000 cubic yards of contaminated soils as the bulk of the cleanup. The project will include all ancillary or peripheral tasks necessary to implement this such as temporary relocation of selected residences and decontaminating some contaminated buildings. The project will include post cleanup verification surveys and calculation and presentation of any post cleanup site risk that might still remain. All deliverables for this project will be submitted to the Nuclear Regulatory Commission (NRC) by the State of Colorado - CDPHE. Final acceptance by the CDPHE will be subject to approval and acceptance of the final report by the NRC and the State of Colorado. A design-build method of construction has been selected in an attempt to contract with knowledgeable and creative teams who can help CDPHE accomplish a timely and cost effective implementation of the remediation of the Gateway - Davis Mill Site. CDPHE previously engaged consulting services to conduct a site characterization/planning study, which resulted in the Preliminary Cleanup Plan Report, dated March 25, 2005, and the Site Characterization Summary Report, dated March 25, 2005, that contain more detailed information about the site and desired remediation of the site. This information was used in the development of this Work Plan.

**C. Design-Build Concept:**

CDPHE has selected a Design-Build concept to provide professional design, management and construction services for the design and construction of the Gateway - Davis Mill Site remediation. The Design-Build concept centers on utilization of a Design-Build Entity (FESI) who has assembled and leads a team composed of the Professional Engineers and other Consultants as required (civil, environmental, radiation and health physicists, structural, and geotechnical), and transporter(s) all under contract to FESI. In a client and owners representative role, CDPHE representatives are a part of the Design Build Team. During the pre-construction/design phase, FESI will provide the required planning and documents and will utilize the skills and knowledge of remediation and construction and will manage the design and provide pre-construction services (i.e., develop schedules, prepare construction plans and specifications, subcontract work, etc.). During the construction phase, FESI will coordinate with its Engineer and Consultants to

assure proper implementation of the desired services as well as provide construction services and manage the project (including the timely procurement and management of all trade contracts throughout the construction/remediation phase). It will be the responsibility of the Design-Build Team to provide the necessary services/work which includes but are not limited to the following:

1. Develop a complete project design and provide all required services in accordance with this RFP, CDPHE standards, and all applicable codes and regulations;
2. Provide all design and construction services to implement the goals of the project, including but not limited to engineering, civil, structural, environmental and safety design services and any required specialty design consultants as required; construction services including scheduling, construction administration and management;
3. Oversee the complete design and construction processes;
4. Develop schedules;
5. Coordinate/communicate the activities of the Team throughout the design and construction process;
6. Construct the project as contracted;
7. Design and construct the project within the total contracted project budget. This includes design, planning, construction administration, excavation and transportation of the contaminated soils, building cleanup and demolition, temporary residence equipment and livestock relocation, regrading and reclamation, verification surveys, and any construction fees, and other soft costs.

The Davis Mill Site Remediation project team and lines of responsibility are illustrated on **Figure 2** and can be found as an attachment to this work plan

## **II. LOCATION:**

The remediation work shall be located at the George E. Davis Mill Site located at 43201 Highway 141, Gateway, Mesa County, Colorado. The Umetco Uravan facility is located off Highway 141 approximately 35 miles southeast of Gateway in Uravan, Montrose County, Colorado. See Figure 1 for an illustration of the George E. Davis Mill Site; Gateway, Mesa County, Colorado.

## **III. PROJECT OBJECTIVES:**

The objective for the project is to:

- Remove soils that exhibit radioactivity above the background range and dispose of them at UMETCO Minerals, Uravan, Colorado site. The UMETCO facility is located approximately 35 miles southeast of Gateway on Colorado Highway 141.
- Perform the Project expeditiously and within allotted timeframe and as necessary to complete disposal of the contaminated materials by June 30, 2006.
- Perform the project in compliance with all state and federal laws and regulations, including compliance with state Radiation Control Program requirements and federal Nuclear Regulatory Commission (NRC) requirements.

- Perform the cleanup project in a manner that is agreeable to the owner of the site and includes appropriate coordination with such owner and the actions needed to temporarily relocate persons and animals as necessary during the cleanup.
- Regrade and complete the cleanup in a manner that completes the cleanup with appropriate site grades and configuration.
- Prepare professional cleanup plan(s) to guide the implementation of the project and serve as documentation of the work to be performed.
- Perform verification surveys to demonstrate the condition of the completed cleanup, and provide as-built information documenting the project as implemented.

#### **IV. DESCRIPTION OF THE CONTAMINATED MATERIAL**

The volume and weight of material based on data presented in the Site Characterization Summary Report for the George E. Davis (Gateway) Mill Site dated March 25, 2005, is estimated to be approximately 10,300 cubic meters (13,444 cubic yards) of material which exhibits radioactivity above the background range. The purpose of this project is to remove this in-place material and transport it to the Umetco Uravan facility for disposal. FESI's Scope of Work and contract with the CDPHE is to be based on the rounded number of 14,000 in place (or bank) cubic yards. Loose cubic yards or compacted cubic yards as placed in the disposal location are not to be used as a means of calculating amount of work performed or payable, unless conversions from "in place" un-excavated (bank) cubic yards is established and agreed upon by CDPHE prior to use of such alternate means of measuring the amount of contaminated materials. Based on a conversion factor of 1.5 grams per cubic centimeter for sandy loam, the estimated dry weight of the material is 15,450 metric tons (17,000 short tons). Based on the presence of an estimated additional 10 percent by weight moisture, the total weight to transport is estimated at 17,000 metric tons (18,700 short tons). The Radionuclide Activity of the material based on data presented in the Site Characterization Summary Report for the George E. Davis (Gateway) Mill Site dated March 25, 2005, has an estimated average radionuclide activity of: U-238 decay chain radioisotopes: 33 pCi/g each x 14 isotopes = 462 pCi/g, U-235 decay chain radioisotopes: 1.5 pCi/g each x 11 isotopes = 16.5 pCi/g Th-232 decay chain radioisotopes: 1 pCi/g each x 10 isotopes = 10 pCi/g. Therefore, the estimated average total activity is 489 pCi/g. Other contaminated materials include portions of the Mill building and associated sheds. Materials other than soils must be properly sized to conform to Umetco's license requirements.

#### **V. SCHEDULE**

Project completion time is of the essence. The contract with CDPHE requires that site remediation tasks be completed by June 30, 2006. The revised project is illustrated in Figure 3 contained within this Work Plan. In summary the project schedule is:

- Contract signed by FESI on March 6, 2006 and by the State of Colorado on March 28, 2006
- Notice to Proceed issued by CDPHE on March 29, 2006
- Preconstruction/Design complete April 21, 2006

- Excavation and Disposal complete June 30, 2006
- Reclamation and physical construction completed July 28, 2006
- Project Closeout reports September 30, 2006

Other contracts related to the project and/or site has been pursued by CDPHE separately. CDPHE has contracted directly with Umetco Minerals Corporation for receipt and disposal of the contaminated solids. At this point no other contracts by CDPHE with other entities are anticipated.

The project schedule system will include regularly established job coordination meetings participated in by FESI and/or Subcontractors, and the CDPHE. Once the project is in the remediation phase; job coordination meetings will be held on-site, once a week. It will be critical that disposal of all materials that are to be disposed of at the Umetco Minerals Corporation facility occur and be completed by June 30, 2006.

CDPHE and State Buildings Programs representatives may conduct routine inspections on the project site during the course of construction/remediation. The CDPHE project manager (Mr. Robert W. Terry; CDPHE Radiation Management Program) will serve as the liaison between the Design Build Team and CDPHE for the day-to-day coordination.

Contract drawings and specifications must be approved by the CDPHE and State Buildings Programs prior to the start of construction/remediation. The Design Build Entity is responsible for obtaining all the necessary approvals and/or permits. It is anticipated that a stormwater permit will be required.

The completion end date for the project is September 30, 2006, however site remediation construction activity must be completed with off-site disposal by June 30, 2006, because CDPHE's arrangement with Umetco provides that disposal at the Umetco facility must be complete by that date.

## **VI. DAVIS MILL REMEDIATION WORK PLAN**

### **A. Design and Project Planning:**

FESI has completed the development of the following project documents and site specific action plans. A copy of each is included as part of this Work Plan as its own stand-alone plan.

1. FESI has obtained written permission from property owner to enter the Site and conduct the work. A copy of this written agreement is presented in **Attachment A** of this Work Plan
2. FESI has submitted to CDPHE-WQCD an application for construction stormwater permit. A Colorado Discharge Permit System – Stormwater Certification COR-039 754, Mesa County; Gateway – Davis Mill Remediation was issued on March 28, 2006. A copy of this permit and the Davis Mill Remediation Stormwater Management Plan are presented in **Attachment B** of this Work Plan.

3. FESI has prepared project and site specific planning documents for the project, these include a project schedule (Figure 3); an operations plan (indicating who will do what, responsibilities, and indicating how communications will be handled) – contained and described in this work plan; and a Radiation Health and Safety Plan (RHSP). A copy of the RHSP is included as **Attachment C** of this Work Plan.
4. FESI has submitted to the State of Colorado Department of Transportation – Grand Junction Region; an application for Special Use Permit for highway access and neighboring CDOT site yard access. On April 3, 2006 CDOT issued a Special Use Permit (Permit Number 12,996) to FESI pertaining to Colorado Highway 141 access; and the associated work at the Davis Mill Site with access to the CDOT Gateway facility yard. A copy of the Special Use Permit is attached to this Work Plan as **Attachment D**.
5. FESI has prepared a Traffic Control Plan for the Davis Mill Remediation Project. The Traffic Control Plan was developed in accordance with the project scope of work and to meet the conditions of the CDOT Special Use Permit discussed in paragraph VI.4 of this plan. A copy of the project Traffic Control Plan is included in this Work Plan as **Attachment E**.
6. FESI has met with UMETCO personnel to discuss project schedule and the project's transportation plan and traffic schedule. A project specific Bill of Lading has been developed for transport custody control and material transfer information. It is anticipated that approximately 32-loads of site material will be transported to the UMETCO facility each work day utilizing 10-transport vehicles. A copy of the project specific Bill-of-Lading is included in this Work Plan as **Attachment F**.
7. FESI has prepared project specific design documents as discussed in the above paragraphs. FESI's sub-contractor Inter-Mountain Engineering, LTD has provided a site specific topographical survey and a corresponding site drawing. The site topographical drawing (0.5-foot contour interval) is presented as **Attachment G** to this Work Plan. This topographical survey data along with post-remediation survey data will be used to calculate cut volumes for materials removed from the Davis Mill Site as a result of implementation of the scope of work objectives.
8. FESI and MFG, Inc. have performed a site specific radiation survey as a reference of pre-remediation activity. A copy of the site radioactivity scan survey is illustrated in **Attachment H** of this Work Plan.
9. FESI and MFG, Inc. have developed a Davis Mill Site specific sampling and analysis Plan (SAP) which outlines the methods that will be used to evaluate remediation activities of performance meeting the project objectives. A copy of the SAP is presented as **Attachment I** to this Work Plan.

The above described planning documents being transmitted with this Work Plan; are being submitted to CDPHE for approval. On site work shall not begin until approval of the documents is obtained from CDPHE.

## **B. Site Remediation**

The following project tasks will be implemented as described below:

1. Frontier Environmental Services, Inc. (FESI) has provided for project mobilization of construction equipment; site security control; establishment of a field office; decontamination trailer; temporary electrical power; personnel and tools. FESI has established decontamination facilities, equipment areas, site management and field laboratory facilities. The project office/laboratory complex will be outfitted with temporary sanitary facilities. Site communications will be provided for by satellite telephone. The project decontamination trailer is equipped with lockers for storage of "street clothing" and showers with the ability to provide heated water for bathing.
2. FESI has made provision with the agreement of the property owner (Mrs. Kathryn Willis) for the relocation of persons, livestock and equipment located in the areas requiring cleanup to other areas on the property.
3. FESI has provided for the survey of the pre-excavation topography of the site by a professional land surveyor (Duane Fehringer, PLS, PE of Inter-Mountain Engineering, LTD.) and establishment of background radiation levels and soil radionuclide concentrations by a qualified radiation specialist (Randall Whicker of MFG, Inc.). Site survey control will be "tied" to existing survey control located adjacent to the site; i.e., CDOT survey monument (Highway 141) and USGS Dolores River Gauging Station survey monument.
4. FESI will provide equipment and personnel to implement the remediation of the Davis Mill site including areas surrounding residences and other site structures. Physical cleaning of the Mill building and associated sheds will be accomplished concurrent with site remediation activities.
5. FESI will mobilize earth moving equipment [CAT 330 Excavator; CAT 950 Front-End Loader(s) and CAT-D6-N Dozer] for the systematic excavation and ten (10) over-the-road transport vehicles for the off-site shipment of elevated radionuclide soil materials. All cleanup activities will be overseen by FESI and MFG, Inc. personnel who are qualified for radiation sites. Such personnel will monitor the work methods and progress. Silt fences and other erosion protection devices will be installed as required by the planning documents (Stormwater Management Plan). FESI will stake the outlines of the areas where soil is to be removed, highlighting where removal to different depths is expected to be required to reach the cleanup criterion. Dust control procedures will be implemented to control exposure. Standard dust control measures typical to the construction industry are anticipated, i.e. spraying with water. Prior to leaving the Site, truck will be decontaminated on the decontamination pad and tarps made secure. Qualified FESI and/or MFG, Inc. radiation personnel will verify decontamination before trucks or equipment leave the Site.
6. FESI will provide for the efficient loading of transport vehicles at a specially managed loading and decontamination pad. A bill-of-lading for the materials being transported shall be issued for each load. Each transport vehicle will be radiologically scanned and if necessary decontaminated prior to departure from the site.
7. FESI and Inter-Mountain Engineering, LTD (Duane Fehringer; PLS, PE) have prepared for the post-excavation topographic survey of the site for purpose of establishing quantities transported and disposed. In addition, FESI has outfitted the CAT 950G Front-End Loader with a load-cell, which will allow for the routine tare of each transport vehicle loaded. This weight will be used to evaluate the day-to-day

amount of material excavated and transport in relation to the overall expected materials to be managed by the project scope of work.

8. FESI will provide equipment and personnel to facilitate the final Site grading including fill of some areas. Importation and placement of suitable on-site backfill and topsoil materials to result in a well graded site (acceptable to the landowner) that is stable. Initial site topographical and post-remediation surveys will be used to establish a site grading plan to promote site stormwater drainage similar to pre-remediation drainage patterns. The impacted areas that are subject to erosion will be managed consistent with the Stormwater Management Plan and Permit to prevent erosion and result in an acceptable finally stabilized site.
9. FESI has prepared for the repair or replacement of disturbed or temporarily removed fences concurrent with the property owner.
10. FESI will manage on-site generated cleanup and disposal of wash water and miscellaneous materials with materials excavated and removed from the site. Decontamination water will be allowed to evaporate in containment basins down-gradient of the Mill Structure. Residues from decontamination activities will be managed with other materials designated for transport to the UMETCO facility in Uravan, Colorado.
11. FESI will provide for the unconditional release demobilization of construction equipment and decommissioning of the field facilities by systematically cleaning and radiological scanning of site specific remediation equipment. Residues from equipment decontamination will be managed with other materials designated for transport to the UMETCO facility in Uravan, Colorado.
12. FESI will provide for the relocation of persons and livestock back to the Davis Site in the approximate pre-remediation location(s).

### **C. Sequencing of Davis Mill Site Remediation**

FESI will implement the project scope of work in a sequenced manner to facilitate the effective and efficient removal of materials of concern at the Davis Mill Site. The sequence of site activities is to:

1. Provide initial site radiological scan to validate initial site characterization results and to establish remedial areas and their delineation from non-remediation areas;
2. Construct of site stormwater control features pursuant to the CDPHE Stormwater Permit;
3. Construct temporary access/egress through the Gateway, Colorado CDOT Facility Yard;
4. Relocate property owner materials and equipment to designated non-remediation areas;
5. Construct temporary livestock pins and fenced areas for the relocation of livestock by the property owner during site remediation;
6. Construct decontamination retention catches for equipment decontamination and Davis Mill structure pressure wash water collection;
7. Excavate and consolidate of mill site radiological containing materials for transport material load-out and transport;

8. Decontaminate by pressure washing of the Davis Mill Structure and associated out-buildings;
9. Relocate resident property materials and equipment from remedial areas to temporary locations to facilitate site remediation surrounding residences, and;
10. Excavate residence soils and re-location of resident's property.

## **VII. REMEDIATION VERIFICATION**

### **A. Final Site Characterization Report**

FESI and MFG, Inc. will prepare a Final Site Characterization Report using methods approved by CDPHE. The final report will summarize the final cleanup of the Mill building and associated sheds. FESI and MFG, Inc. personnel who are qualified for radiation sites will monitor the progress of all cleanup activities, and will monitor the exposure of personnel to contaminants and will assist with the preparation of the final site characterization report. The Final Site Characterization Report will summarize the following activities:

1. Removal and pressure washing of equipment and debris from the mill building and associated storage sheds, Removal of dirt, process fines and other loose granular materials from inside the mill, beneath the mill trestle and from inside the associated storage sheds. Trucks used for transporting materials are to be tarped prior to leaving the site.
2. Construction and Quantity Surveys: Topographic surveys to determine quantities will be provided by FESI and Inter-Mountain Engineering, LTD. (IME). Prior to initiating the excavation work, FESI will have a topographic survey (with baseline cross-sectional information) done by Duane Fehringer; a Colorado Registered Professional Land Surveyor and Professional Engineer and conducted in coordination with CDPHE so that the existing topography of the Site can be agreed upon. Interim pay estimate quantities may be made on load counts and/or quantity surveys conducted by FESI-IME in coordination with the CDPHE. Final quantities will be determined by comparing the original (verified) topographic survey with topographic survey provided the FESI-IME from final surveys conducted by IME on completed segments of the Work. In all cases, unless otherwise directed, the minimum amount of material requiring excavation will be taken. Over-excavation for the convenience of the project or due to error, carelessness or lack of control will not be measured for payment, unless such over excavations are directed and approved by CDPHE. The quantities for payment will be computed by the average end area method from surveys conducted before and after excavation operations. FESI will notify CDPHE of any and all such quantity determination surveys so that the CDPHE may participate in the survey. FESI-IME Design Build Entity shall provide copies of all survey work and supporting data and calculations to CDPHE.
3. Excavation with powered equipment of radiological materials from designated Davis Mill Site locations as based upon the Site Characterization Report.
4. Disposal at the Umetco facility shall be performed in compliance with Umetco's requirements.

5. Cleanup and Disposal of Wash Water and Miscellaneous Materials; Water collected during pressure washing the building interior walls and from decontaminating trucks and equipment at the Gateway – Davis Mill Site will be managed in a manner compliant with CDPHE Water Quality Control and Radiation Control rules and regulations.
6. Final site grading, including site regrading, and placement of suitable on-site materials as backfill in select areas to grade the site to final grades acceptable to the property owner and CDPHE. Common backfill material is obtainable from on-site locations.
7. Final stabilization shall be performed pursuant to the Stormwater Management Plan.
8. Demobilization and Decommissioning of the Field Facilities; temporary facilities used during the project will be decommissioned and removed. The decontamination pad may be left in place only if requested by the property owner.
9. The persons and, livestock that were relocated from one part of the property to another to facilitate the cleanup will be relocated.
10. Decontamination Techniques that may be used during site cleanup; decontamination techniques may include, but are not limited to:
  - Pressure washing
  - Removal of loose material by vacuuming
  - Hand removal of materials in some areas
11. The Site-Specific Radiation Health and Safety Plan contain procedures for the analysis of potential health and safety hazards, and an Emergency Response Plan. The Site-Specific Radiation Health and Safety Plan address FESI and MFG, Inc. actions through all aspects of the project including work at the Gateway Site, in transit, and for disposal and unloading at the Umetco Uravan site. The Site-Specific Radiation Health and Safety Plan also provides for the analysis of required personal protective equipment. The HSRP is compliant with Part 4 of the Colorado Rules and Regulations Pertaining to Radiation Control. Radiation Health and Safety issues may include, but are not limited to the following:
  - Exposure of workers to direct.
  - Exposure of workers to dirt and dust containing metals and/or radionuclides – the primary contaminant of concern is uranium and its daughters, and the primary routes of exposure are via inhalation and ingestion.
  - The Radiation Health and Safety Planning should include an evaluation of radiation hazards including airborne hazards.
  - The evaluation must provide an analysis of potential radiation doses to both occupational exposure settings and to non-occupational settings.
  - The Radiation Health and Safety Plan shall include measures to assure that allowable limits, as stated in Part 4 of the Colorado Rules and Regulations pertaining to Radiation Control are not exceeded.
  - Dust control measures, such as water sprays, may be advisable.
  - Eating, drinking, and smoking will be prohibited within the work zone.

## **B. Verification for Project Close-Out**

FESI and MFG, Inc. will perform a Final Status Survey that will be performed following MARSSIM (Multi-Agency Radiation Survey and Site Investigation Manual) guidelines. Remediation criteria that have been established as the endpoint of site remediation are designed to reduce the above background radiation dose to the average member of the critical group to less than 25 mrem per year. Based on results of a RESRAD model run for a hypothetical post-cleanup unrestricted use scenario, an average residual soil Ra-226 activity of 0.44 pCi/g above the top of the background range is estimated to result in a dose less than 25 mrem/yr.

### **1. Major Activities Required for Verifying and Documenting the Completion of Site Cleanup.**

In terms of the major requirements for verifying and documenting the completion of site cleanup, a Final Status Survey will be performed following MARSSIM, NUREG-1575, Rev.1, August 2000) guidelines. Major elements of the verification survey include the following items:

- Survey Preparation
- Evaluate the extent to which existing data can be used to identify survey units
- Select representative background areas
- Select survey instrumentation and techniques
- Prepare area if necessary
- Establish reference coordinate system.
- Survey Design
- State the DQOs
- Specify sample collection and analysis procedures
- Determine the number of data points for statistical tests
- Specify sampling locations
- Provide information on survey instrumentation and techniques
- Specify methods of data reduction
- Provide quality control procedures
- Document the survey plan.
- Conduct Surveys
- Perform background area measurements and sampling
- Conduct survey activities
- Perform and document any necessary investigation activities
- Document measurement and sample locations
- Document any observations, abnormalities, or deviations from the Quality Assurance Plan of Standard Operating Procedures.
- Evaluate Survey Results
- Review DQO's
- Analyze samples
- Perform data reduction on survey results
- Verify assumptions of statistical tests

- Compare survey results with regulatory DCGL's
- Prepare final status survey report
- Obtain an independent review of the report.

**C. Davis Mill Site Remediation Project Completion Deliverables**

Site cleanup includes application of the information that was provided by the site characterization report to removal of all radioactive contamination on the site, excavation and hauling of contaminated material to the disposal site, conformance with all applicable laws, regulations and contract requirements, submittal of a final report that demonstrates that site cleanup has met the project objectives, and recommendations for future institutional controls, if institutional controls are needed.

The following list of deliverables is intended to be a non-inclusive list of items CDPHE requires to be addressed as the project proceeds. FESI; MFG, Inc. and IME will perform any and all work that may be reasonably inferred as necessary to produce the intended overall project.

The Final Site Characterization Close-Out Report will include provision for the discussion of:

**1. Planning and Design:**

- a. Project Work Plan. This will be based primarily on FESI and MFG, Inc. RFP Submittal, and outline how the project will be implemented and managed.
- b. Proof of Access Permission. Evidence that the property owner has given permission to perform all field work, moving of improvements on the property, cleanup, excavation, hauling, regrading and restoration to buildings, fences or other improvements, that is needed for removal of radioactive contamination from the site.
- c. Description of health and safety issues that will require attention during site cleanup, and site specific Health and Safety Plan for the project, covering site planning, constructions (excavation and transportation), verifications surveys and project closeout. As part of the design and planning the following shall be addressed:
- d. Summary of applicable requirements from the following:
  - i. Funding Assistance for Formerly Licensed Sites in Agreement States SA-1000
  - ii. NUREG/CR-5512 Residual Radioactive Contamination From Decommissioning
  - iii. NUREG/CR-5849 Manual for Conducting Radiological Surveys in Support of License Termination
  - iv. U.S. NRC Grant no. NRC-06-05-303
  - v. CDPHE criteria for license termination and release for uncontrolled use under RH 4.61 of the State of Colorado Rules and Regulations Pertaining to Radiation Control
  - vi. County and local permit requirements for movement or alterations of buildings

- vii. Federal and state permit requirements for transportation and hauling of radioactively contaminated materials
- e. Design Criteria assumptions including, identification of criteria that will be used to establish the endpoint of site cleanup, approved by an ABHP Certified Health Physicist.
- f. The Design assumptions and parameters should include indication of references and highlight the reliance on information from references such as the following references:
  - i. Phase I scoping survey report for the Gateway Mill Site that was provided by the Colorado Department of Public Health and Environment, in fulfillment of U.S. NRC Grant no. NRC-06-01-301 for File Reviews and Initial Surveys of Eleven NRC Formerly Licensed Sites;
  - ii. Phase II site characterization report and preliminary site cleanup report for the Gateway Mill Site that was provided by the Colorado Department of Public Health and Environment, in fulfillment of U.S. NRC Grant no. NRC-06-04-301 for Site Characterization of the George E. Davis (Gateway, Colorado) Mill Site;
  - iii. Other previous site reports that will be provided to the project by CDPHE, following award of the contract;
  - iv. Agreement with disposal site for disposal of material from Gateway site, and;
  - v. Other information that will be gathered by the contractor during project planning.
- g. Maps, diagrams and drawings that are needed to show where excavation will be performed, with instructions as to depth of excavation and special procedures that may be required.
- h. Maps, diagrams and drawings that are needed to show where decontamination of property improvements, equipment and hauling equipment will be performed, with written procedures that may be required.
- i. List of major activities that will be required for verifying and documenting the completion of site cleanup, approved by an ABHP Certified Health Physicist.
- j. Tabulation of property, improvements, easements, and other details that will be affected by site cleanup.
- k. Final site cleanup survey based on the site characterization report and preliminary site cleanup report, with operational instructions for excavation, hauling and disposal, and regrading and restoration of buildings, fences or other improvements, that satisfy all applicable laws, regulations and contract requirements. (Plans and specifications describing the cleanup project)
- l. Project Work Plan indicating items such as number of trucks, staging, staffing plan, hours of operation. This plan should evidence the coordination with UMETCO to

assure the plan is consistent with UMETCO requirements, and the appropriate approval/agreement with Umetco is in place so that the project can be implemented.

- m. Evidence that the Planning and Design Documents have been reviewed and approved by CDPHE, and any required permits required to be obtained by FESI prior to the written notice to proceed with the project implementation phase.
  - i. County and local permit requirements for movement or alterations of buildings
  - ii. Federal and state and local permit requirements for transportation and hauling of radioactively contaminated materials
  - iii. Stormwater or Erosion Control Plan Permit

#### **D. Reporting of Site Remediation Activities**

The Final Project Characterization Close-Out Report will include provisions for documenting project implementation pursuant to the approved planning and design documents. Progress shall be documented by letter reports as implementation proceeds that highlight the work progress compared to the anticipated schedule and indicate the percentage complete based on a reasonably detailed schedule of values. Such letter reports shall accompany requests for progress payments.

##### **1. Final Report, verifications and "As Built" information:**

- a. Site cleanup summary report (25 copies), approved by an ABHP Certified Health Physicist and the Engineer of Record for the project.
- b. Narrative description of work that was completed for site cleanup, As Built drawings, and notation of deviation from approved planning documents.
- c. Description of the size and depth of the contaminated area(s) that was excavated or cleaned.
- d. Description of decontamination techniques that were used during site cleanup.
- e. Evidence of proper treatment of wash water and other products of decontamination.
- f. Cross-sectional surveys of the cleanup area, both before and after cleanup activities, with a PLS certified statement of the total volume (in place bank volume) of contaminated material that was ultimately transported to the waste disposal site.
- g. Evidence of completion of all assigned work that is called for in the site cleanup plan. (Certification by the Engineer of Record that the project has been implemented as called for by the plans and specifications or other approved contract documents).
- h. Summary of disposal of contaminated material and evidence of final acceptance of all material at the disposal site.
- i. Summary of post-cleanup sample collection and tabulation of measurement/analysis results.
  - i. Borehole/core drilling & sample collection (minimum 3 and as prescribed by MARSSIM requirements).
  - ii. Groundwater well drilling & sample collection (minimum 3 and as prescribed by MARSSIM requirements).
  - iii. Surface material and building material sample collection (as prescribed by MARSSIM requirements).
  - iv. Near-surface sample collection (as prescribed by MARSSIM requirements).

- v. Surface and ambient gamma radiation measurements (as prescribed by MARSSIM requirements).
- j. Site map (or overlay) showing results of post-cleanup external gamma radiation surveys.
- k. Summary and site diagram (As Built drawings) of all regrading and drainage work, fences and gate work after site cleanup.
- l. Site map (or overlay) showing locations of all post-cleanup samples that were collected for field or laboratory analysis.
- m. Site map (or overlay) showing remaining areas of post-cleanup contamination, if present.
- n. Tabulation of property, improvements, easements, and other details that were impacted during site cleanup.
- o. Summary of all activities that were performed during site cleanup including excavation, hauling and disposal, and regrading and restoration of buildings, fences or other improvements, that satisfy all applicable laws, regulations and contract requirement.
- p. Summary of the volume and weight of material that were removed in order to decommission the site.
- q. Summary of final disposition of all property, improvements, easements, and other details that will be affected by site cleanup.
- r. Tabulation of site-specific values that are used as parameters in the U.S. DOE RESRAD model, approved by a person who has substantive experience in the use of the U.S. DOE RESRAD model and an ABHP Certified Health Physicist.
- s. Results of U.S. DOE RESRAD model run(s) and of other model runs of consultant's choosing, if needed.
- t. Calculation of the average post-cleanup gamma radiation dose rate at the surface in areas where cleaning and excavation are performed.
- u. Tabulation, comparison and summary of the dosimetry model results.
  - i. Estimation of the post-cleanup radiation dose rate to the resident and worker populations that is attributable to remaining on-site contamination, approved by an ABHP Certified Health Physicist.
  - ii. Estimation of the size and location of radioactive contaminated areas that could cause the radiation dose rate to the resident and worker populations to exceed applicable limits for release from institutional controls, approved by an ABHP Certified Health Physicist.

## **E. Periodic Project Progress Reporting**

FESI and MFG, Inc. will prepare and transmit to CDPHE monthly written progress reports within 10 days after the end of each month. These reports may be in letter format and shall also accompany progress payment requests.

### **1. Report Format Requirements**

Final Site Characterization and Progress reports will be submitted on 8½ by 11 inch sheets, and as .pdf files that are formatted to be printed on 8½ by 11 inch sheets. All maps, overlays, diagrams, charts and tables will be submitted on 8½ by 11 inch sheets,

and will be included in the .pdf file that contains the progress report, or as separate .pdf files that are formatted to be printed on 8½ by 11 inch sheets. In cases where complete maps, overlays, diagrams, charts or tables cannot be presented in a legible format in a manner that would properly fit on 8½ by 11 inch sheets, then the information should be organized and presented on continuation sheets, in order to conform to this format requirement. The report, including all maps, overlays, diagrams, charts and tables, must be submitted in black/white/grayscale. If a color presentation is considered essential for proper understanding of the information provided, then supplementary color versions may also be provided, IN ADDITION TO the black/white/grayscale submittals. The report must not be submitted in binders; all copies must be perfect bound, side-stitched, or loose leaf.

## **2. Data Package Requirements**

Laboratory reports, field data reports, borehole and well drilling notes, QA/QC reports, and related supporting information must be provided as a separate document with the report. Radiometric measurement reports must conform to the recommendations that are described in NUREG-1576/EPA 402-Bb-001A/NTIS PB2004-105421 Multi-Agency Radiological Laboratory Analytical Protocols Manual (MARLAP). Non-radiometric measurement reports must conform to the requirements that are described by EPA Contract Laboratory Protocols Level III.

**FIGURE 1**

**GEORGE E. DAVIS MILL SITE  
LOCATION MAP**

# Davis Mill Site Property Boundary



Mesa County GIS.



Mesa County GIS  
544 Rood Ave.  
Grand Junction, CO 81501

**DISCLAIMER :** The Geographic Information System (GIS) and its components are designed as a source of reference for answering inquiries, for planning and for modeling. GIS is not intended or does not replace legal description information in the chain of title and other information contained in official government records such as the County Clerk and Records office or the courts. In addition, the representations of locations in this GIS cannot be substituted for actual legal surveys.

## LEGEND

- |   |                 |  |   |
|---|-----------------|--|---|
| + | Hospitals       |  | Colorado National Monument                  |
| ★ | Police Stations |  | BLM Special Areas                           |
| ▲ | Fire Stations   |  | Black Ridge Canyons                         |
| ↓ | Schools         |  | COLORADO CANYONS NATIONAL CONSERVATION AREA |
|   | State Highways  |  | BLM   |
|   | Roads           |  | National Forest                             |
|   | Lakes           |  |   |
|   | Canals          |  |   |

FIGURE 1: DAVIS MILL SITE PROPERTY BOUNDARY

**FIGURE 2**

**PROJECT ORGANIZATIONAL CHART**

Frontier Environmental Services, Inc.  
 Project  
 Organization Chart  
 CDPHE Gateway, Colorado  
 Davis Mill Project

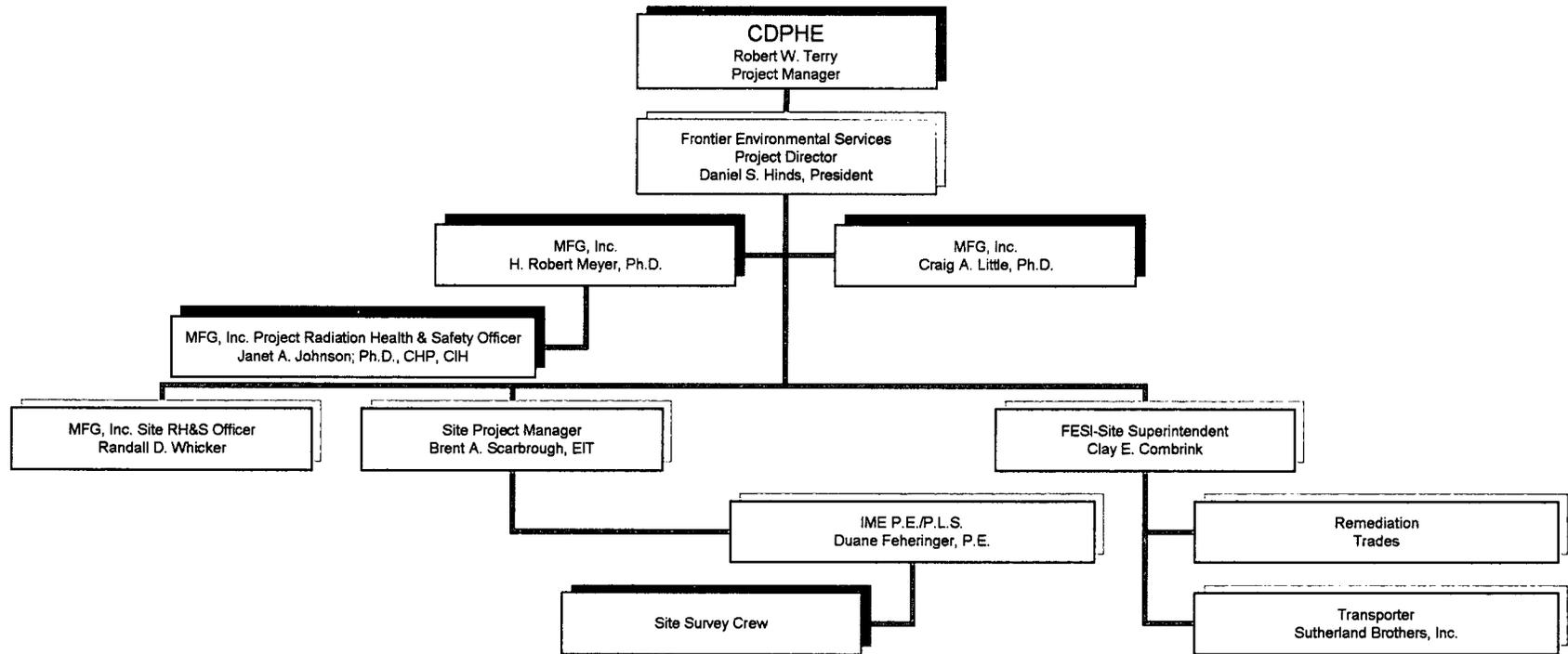


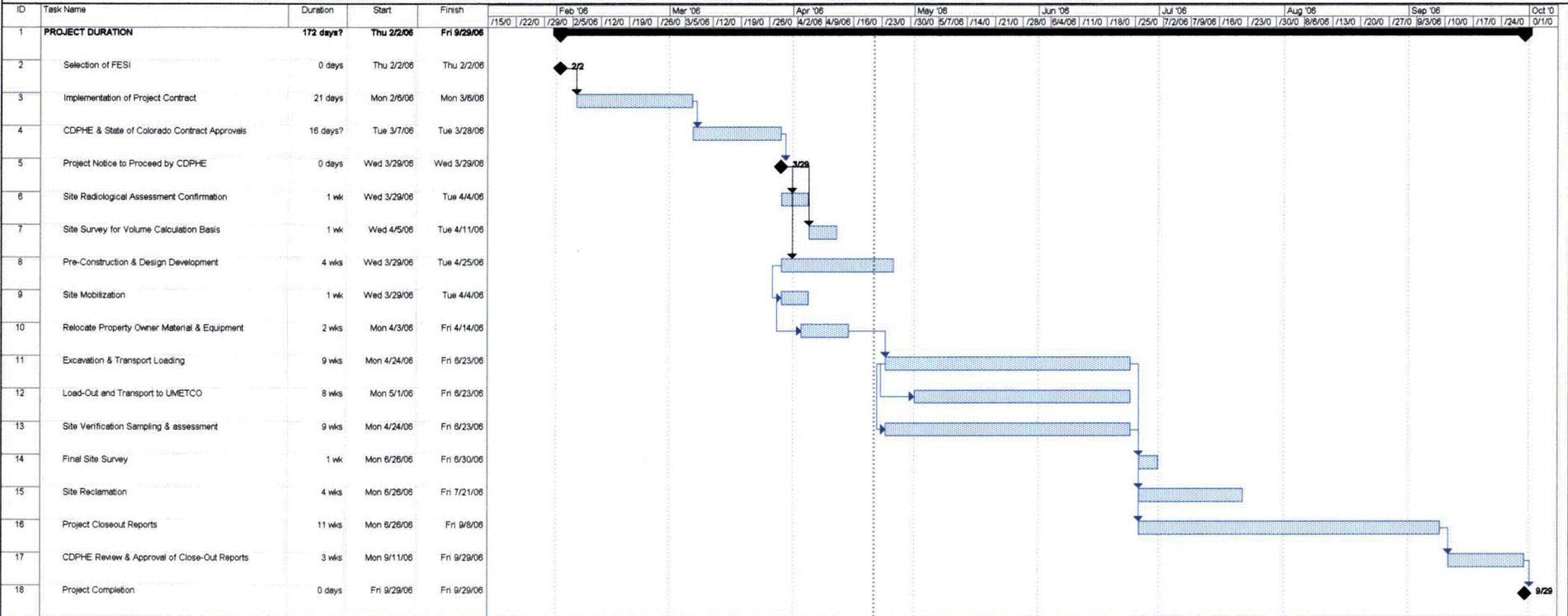
Figure 2

**FIGURE 3**

**PROJECT GNATT CHART SCHEDULE**

**FIGURE 3**

Frontier Environmental Services, Inc.  
Proposed Project Schedule  
CDPHE Gateway, Colorado Davis Mill  
HMWMD-RCP-01



Project: Davis-Mill-Schedule  
Date: Fri 4/21/06

Task [Task bar] Progress [Task bar] Summary [Task bar] External Tasks [Task bar] Deadline [Task bar]

Split [Task bar] Milestone [Milestone diamond] Project Summary [Task bar] External Milestone [Milestone diamond]

**ATTACHMENT A**

**SITE OWNER  
ACCESS AGREEMENT**

CONSENT FOR RIGHT OF ENTRY FOR REMEDIATION ACTIVITIES

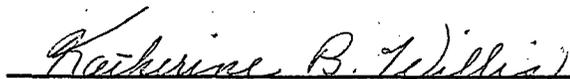
At The  
Davis Mill Site  
Gateway, Colorado

Mrs. Katherine B. Willis hereby represents to The State of Colorado, Department of Public Health and Environment (CDPHE), that the undersigned is the land owner of the following real property located in the County of Mesa and the State of Colorado: the Davis Mill physically located at 43201 Colorado Highway 141; Gateway, Colorado.

As such, the undersigned hereby grants to the agents and employees of the State of Colorado, Department of Public Health and Environment and its Contractor - Frontier Environmental Services, Inc. and their sub-contractor(s), permission to enter upon such property and land to remediate and mitigate past mine milling practices and to do all things necessary or expedient for the protection of human health and environment by the systematic removal of radiological materials from the Davis Mill Site.

Consent is given to enter upon the above described property for the length of time necessary to remediate the Davis Mill Site and to adequately re-grade the site post-remediation pursuant to the Contract entered into between the State of Colorado; Department of Public Health and Environment and Frontier Environmental Services, Inc. (Contractor). Reference: CDPHE Project Number HMWMD-RAD-01 and Contract Number FEA-06-00043.

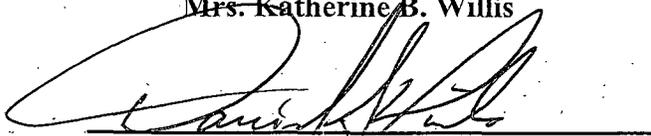
The land owner has a responsibility to ensure that any existing physical assets not specifically addressed by the Contract are identified by the undersigned or their agent as not to be addressed or acted upon by the Contractor - Frontier Environmental Services, Inc.



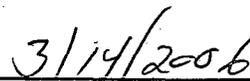
Mrs. Katherine B. Willis



Date



Witnessed By:



Date

**ATTACHMENT B**

**COLORADO DISCHARGE PERMIT SYSTEM  
CERTIFICATION COR-039 754  
AND  
DAVIS MILL REMEDIATION SITE SPECIFIC  
STORMWATER MANAGEMENT PLAN**

# STATE OF COLORADO

Bill Owens, Governor  
Dennis E. Ellis, Executive Director

Dedicated to protecting and improving the health and environment of the people of Colorado

4300 Cherry Creek Dr. S.      Laboratory Services Division  
Denver, Colorado 80246-1530      8100 Lowry Blvd.  
Phone (303) 692-2000      Denver, Colorado 80230-6928  
TDD Line (303) 691-7700      (303) 692-3090  
Located in Glendale, Colorado

<http://www.cdphe.state.co.us>

3/28/2006



Colorado Department  
of Public Health  
and Environment

Daniel S. Hinds, President  
Frontier Environmental Services, Inc.  
5171 Ward Road Unit 1  
Wheat Ridge, CO 800331940  
303/234-9350

**RE: Final Permit, Colorado Discharge Permit System – Stormwater  
Certification No:      COR-039754, Mesa County  
                                 Gateway - Davis Mill Site Remediation**

**Local Contact:      Daniel S. Hinds, President, 303/ 908-7577**

**Anticipated Activity: 04/17/2006 through 05/31/2007  
On 27.435 acres (8 acres disturbed)**

Dear Sir or Madam:

Enclosed please find a copy of the permit certification that was issued to you under the Colorado Water Quality Control Act.

Your certification under the permit requires that specific actions be performed at designated times. You are legally obligated to comply with all terms and conditions of your certification.

Note that the stormwater permit for construction activities now covers construction sites disturbing down to one acre (the previous threshold was 5 acres). Effective July 1, 2002, any construction activity that disturbs at least 1 acre of land (or is part of a larger common plan of development or sale that will disturb at least 1 acre) must apply for permit coverage.

Please read the permit and certification. If you have any questions please visit our website at <http://www.cdphe.state.co.us/wq/permitsunit/wqcdpmt.html>, or contact Matt Czahor at (303) 692-3575.

Sincerely,

Kathryn Dolan  
Stormwater Program Coordinator  
Permits Unit  
WATER QUALITY CONTROL DIVISION

Enclosure

xc: Regional Council of Governments  
Mesa County Health Department  
District Engineer, Technical Services, WQCD  
Permit File  
Fee File

**CERTIFICATION**  
**CDPS GENERAL PERMIT**  
**STORMWATER DISCHARGES ASSOCIATED WITH**  
**CONSTRUCTION**

---

Construction Activity: Commercial Development - Site Remediation

This permit specifically authorizes: **Frontier Environmental Services, Inc.**

to discharge stormwater from the facility identified as Gateway - Davis Mill Site Remediation

which is located at: 43201 Highway 141  
Gateway, Co

latitude 38/40/47, longitude 108/58/42 in Mesa County

to: Delores River

effective: 03/28/2006

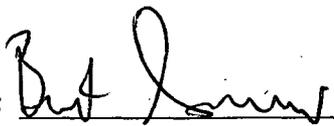
Annual Fee: \$270.00 (**DO NOT PAY NOW**. You will receive a prorated bill.)

**GATEWAY - DAVIS MILL SITE REMEDIATION  
HMWMD-RAD-01**

**43201 HIGHWAY 141**

**GATEWAY, CO – MESA COUNTY**

**STORM WATER MANAGEMENT PLAN**

Signed:  Brent Scarbrough  
Project Engineer

*Revised*  
March 31, 2006

**Prepared By:**

**Frontier Environmental Services, Inc.  
5171 Ward Road, Unit 1  
Wheat Ridge, Colorado 80033  
Telephone Number: (303) 234-9350  
Telefax Number: (303) 234-9371**

**GATEWAY - DAVIS MILL SITE REMEDIATION  
HMWMD-RAD-01**

**GATEWAY, CO – MESA COUNTY**

**STORM WATER MANAGEMENT PLAN**

**1. Site Description**

The Davis Mill Site is located in Mesa County at 43201 Highway 141 in Gateway, Colorado as shown on Figure 1. The remediation activities occurring on the site will include relocation of livestock and equipment located in the areas requiring cleanup to other areas of the property, survey of the pre-excitation topography and soil radionuclide concentrations, cleanup of the mill building and associated out buildings, excavation and off-site shipment of elevated radionuclide soil materials, post-excitation verification surveys, final site grading, site stabilization, and the relocation of livestock and equipment back to the site.

The sequence for these activities will be to clear the site, perform baseline surveys for topography and radionuclide concentrations, install storm water controls, excavate soils and transport for off-site disposal, perform verification surveys for both quantity and radionuclide concentrations, final site-grading, site stabilization per this Storm Water Management Plan, and relocation of livestock and equipment back to the site.

The total area of the site is approximately 27 acres including the access roads, trailer court area, the mill building area, and the pasture land as shown on Figure 1 of this SWMP. The area of the site to be disturbed will include approximately 8 acres. These areas include the areas adjacent to the historical mill building, the top of the hill adjacent to the historic trestle, and the areas adjacent to the access road. Figure 2 shows the areas adjacent to the mill building which will require remedial actions. Figure 3 is a gamma scan of the property delineating areas of the site which will require soil excavation. The areas with concentrations above 40  $\mu\text{R/hr}$  will require excavation and off-site disposal. These areas are represented on the gamma scan by the orange, red, and brown regions.

The runoff coefficient for the site on most of the areas to be disturbed prior to construction is 0.2 for unimproved areas. The coefficient of the access roads is higher at around 0.6. The runoff coefficients for the site after the remedial actions have been performed and the site has been finally stabilized will be approximately the same as before.

The Davis Mill site property is composed of three distinct use areas: the trailer court area, pasture land, and the area adjacent to the historic mill building. The areas of the site where soil remediation activities will have to occur is generally limited to the area adjacent to the historic mill building. There will be some remediation that will occur in the vicinity of the trailers. The area adjacent to the mill building is also currently used for storage of debris, used material and

used equipment. These materials will be relocated to areas of the property not impacted by NORM waste. Several gravel roads and driveways exist throughout the property which is devoid of vegetation.

The existing ground cover in the area adjacent to the mill building is characterized as mixed desert shrub and pinyon-juniper woodlands interspersed with a salt desert community consisting primarily of Sage, Rabbit-brush, and Four-Winged Saltbush. Exotic weeds such as Russian Thistle and Kochia are also abundant. Cottonwoods and willows are associated with the riparian areas of the property and dry season grasses such as the Bromes, Wheatgrass, and Grama are present. The area adjacent to the mill building has approximately 40 to 50 percent coverage, while the south facing hillside has approximately 30 percent existing coverage. The pasture land is near 100 percent coverage but it is not anticipated that it will be impacted.

A staging area will be utilized adjacent to the former mill site in an area that is determined to be "clean" by the preliminary radionuclide screen. This area will be used for an office trailer, an equipment trailer, a decontamination trailer, and sanitary facilities. All chemicals and fertilizers will be stored off site until needed. A clean haul road will be constructed and maintained adjacent to the site excavation. The haul road will serve as a delineating boundary between the "clean" and "hot" zones. Soils containing elevated levels of NORM waste will be stockpiled on the north end of the area adjacent to the historic mill building. Trucks will enter the site through the CDOT Gateway, CO facility adjacent to the site and will stay on the "clean" haul road while they are loaded with soils. The trucks will exit the site on the Willis property adjacent to the northeast fence line of the CDOT yard. The construction equipment will also be fueled and serviced from site vehicles in the "clean" zone.

No additional discharges are expected on the site from any source other than storm water.

The runoff from the site excavation area will eventually drain into the Dolores River which runs along the southwest border of the property.

## **2. Site Map**

Several site maps have been included which show the project site boundaries, anticipated areas of excavation, contaminated soil stockpile area, truck load-out lane, surface water bodies, and the boundary of the 100-year flood plain. Included are the site boundaries, the areas of soil disturbance, the storage and staging area, and the erosion control features of the site. There are two surface water bodies on the site which have been identified in blue on Figure 2. The site maps consist of aerial photographs, Mesa County site maps and flood plain maps, and a Gamma Scan performed by MFG, Inc; Fort Collins, Colorado.

### **3. Erosion Control Plan**

Frontier Environmental Services, Inc. will install all erosion control features as directed prior to beginning work on the project. Erosion control measures will be maintained throughout the duration of the project.

Frontier Environmental Services, Inc. will comply with all regulations of the Colorado Water Quality Control Act, Title 25, Article 8, CRS and regulations promulgated there under and all additional requirements in the Contract Specifications and Drawings.

### **4. Best Management Practices**

This Storm Water Management Plan is prepared in accordance with the guidelines established by the State of Colorado General Permit Application for Discharges Associated with Construction Activities as attached to CDPHE Final Permit; Colorado Discharge Permit System – Stormwater; certification number; COR-039754, Mesa County.

This Storm Water Management Plan identifies Best Management Practices (BMPs) that will be used to reduce the potential for pollutants in storm water discharges associated with construction activities including, but not limited to, structural practices (straw bales, silt fences, dikes, swales), and non-structural practices (seeding, mulching, geotextiles, preservation of existing vegetation).

#### **4.1 Sedimentation and Erosion Control**

Sedimentation control will be comprised of:

- Silt fencing;
- Straw bale placement, and;
- Temporary catch basin construction (if necessary)

The installation of sediment control devices or the construction of diversion or collection units will be performed prior to the initiation of the Gateway – Davis Mill Site Remediation scope of work. Placement or construction of sediment control devices or catch basins shall be done to control erosion and detain sediment movement, where possible. The goals of the storm water management plan are to:

1. The primary goal of the storm water management plan is to control erosion and collect and limit sediment movement on all cut and fill operations, excavation, backfill or other construction activities within the limits of the site.
2. The second primary goal is to protect undisturbed areas and sites throughout the Gateway-Davis Mill Site Remediation project area.

Frontier will furnish all labor, materials, equipment and incidentals necessary to perform all installation, maintenance, removal and area cleanup related to sedimentation control work as specified herein. The work shall include installation of temporary access ways and staging areas, silt fences, sediment removal and disposal, device maintenance, removal of temporary devices, and final cleanup.

## **4.2 Material Handling and Spill Prevention**

### **4.2.1 Material Handling and Good Housekeeping Measures**

Materials delivered to the site will be loaded and unloaded using equipment located on site or located on the delivery truck. All materials that will be delivered for this project will be handled appropriately and under the supervision of Project Management. The only material that will be delivered to the site that has the potential for contributing pollution to runoff will be the diesel fuel that is covered in section 4.2.2.

Construction equipment will be inspected daily for loose connections, leaking fuels or oils, grease and other components of daily equipment wear. Inspections will be made of the fueling and servicing area and any materials that may have leaked onto the ground will be removed and disposed of at an approved facility.

All trash and debris on the site will be stockpiled and shipped for off-site disposal at the Umetco facility in Uravan, Colorado as needed to maintain a clean work area.

### **4.2.2 Spill Prevention**

This section describes those measures which are applied by Frontier Environmental Services, Inc. at the Gateway – Davis Mill Site Remediation to reduce the potential for the release of diesel fuel to local water courses or receiving streams.

The work area is described as the property adjacent to the historical Davis Mill building. The Dolores River bounds the site along its southwest border, and all storm water received at the site will eventually drain into the river.

Frontier Environmental Services, Inc. will store all materials such as grease and other oils in a steel container that will offer no potential for contributing pollutants to runoff. The only material stored on site that could contribute pollutants to runoff will be diesel fuel. Frontier will use transfer tanks mounted in site work trucks to fuel mobile equipment and generators.

Fueling of the equipment will be only done by experienced personnel and will be under constant supervision to eliminate any spillage. Project personnel will be on site when any fueling operations occur. Overfill of the tanks is prevented through the use of automatic shut off nozzles. Frontier Environmental Services, Inc. will be responsible for cleanup of any spill. Any

fuel that may be spilled outside of the containment area will be cleaned up according to all applicable State and Federal Regulations.

All other construction materials that will be stored on site will not have the potential for contributing pollution to runoff.

### **4.3 Schedule for Erosion Control Activities**

Erosion control BMP's will be constructed and implemented prior to any earthwork occurring at the site. Erosion control activities will be updated throughout the project to address any issues that may arise during the construction phase. Sediment fencing will be maintained and inspected until permanent erosion control measures are stabilized according to terms of the permit. These terms indicate final stabilization has occurred when all soil disturbing activities have been completed, and uniform vegetative cover has been established with a density of at least 70 percent of pre-disturbance levels, or equivalent permanent, physical erosion reduction methods have been employed.

### **4.4 Products and Materials**

#### **4.4.1 Silt Fence**

Prefabricated Silt fence composed of polypropylene black fabric manufactured with 2" square oak stakes 42" long will be used for erosion control where specified in the project plans.

Engineer is to approve all sediment control device materials prior to installation.

#### **4.4.2 Straw Bales**

Straw bales will consist of those which are readily available from local sources

#### **4.4.3 Erosion Control Blanket - Straw/Coconut Blend (if needed)**

Manufactured from 70% wheat straw and 30% coconut fiber by weight, the erosion control blanket shall be a machine fabricated mat, covered on both sides by netting, and sewn together with maximum two inch centers. Bottom netting shall be photodegradable, with an approximate weight of 1.65 lb/1000 SF. Top netting shall be treated with UVI inhibitors to resist photodegrading with an approximate weight of 3 lb/1000 SF. The blanket shall be sewn with biodegradable or photodegradable thread.

#### **4.4.4 Fertilizer**

Fertilizer will conform to Association of Official Agricultural Chemists and all other Federal and State regulations. Fertilizer will be stored off site until needed.

#### **4.4.5 Seed**

An appropriate seed mix for the area will be developed and applied as appropriate for the region.

### **5. Implementation of Storm Water Management Methods**

Frontier will construct, operate, and maintain all temporary facilities to intercept and manage storm water as specified by the construction drawings and specifications.

Frontier will divert runoff from entering or accumulating in excavations. Excavations will be graded to prevent ponding of water where practical.

Frontier will control runoff, such that excavation to final grade is made "in-the-dry" and softening or instability of, or disturbance to, the subgrade due to the presence or seepage of water does not occur.

### **6. Maintenance and Inspections**

#### **6.1 Inspections**

Frontier will make visual inspections of all sedimentation control devices and storm water management systems once every 14 days and promptly after every rainstorm. If such inspection reveals that additional measures are needed to prevent movement of storm water or sediment to offsite areas, Frontier will promptly install additional devices as needed. Sediment controls in need of maintenance will be repaired promptly.

#### **6.2 Maintenance**

##### **6.2.1 Silt Fences and Straw Bale Sediment Catches**

- Remove accumulated sediment once it builds up to one-half of the height of the fabric or bale.
- Replace damaged fabric, or patch with a 2-ft minimum overlap.
- Replace broken or partially broken straw bales.
- Make other repairs as necessary to ensure that the sediment catch is filtering all runoff directed to the sediment catch.

Add crushed stone to access ways and staging area as necessary to maintain a firm surface free of ruts and mud.

## **7. Removal and Final Cleanup**

Once the site has been stabilized against erosion, remove all sediment control devices (including those remaining from previous work performed by others) and all accumulated silt. Re-grading to site topographical grades will be performed and revegetation will be established pursuant to project scope of work specifications. Silt and waste materials will be disposed of in accordance with the construction specifications and regulatory requirements. Frontier will re-grade all areas disturbed during this process and stabilize against erosion with surfacing materials as indicated on the Construction Drawings.

## **8. Record Keeping**

Record keeping for items pertaining to the SWMP will be documented in the Frontier Daily Report. At a minimum the following will be documented:

- Implementation of specific items in the SWMP,
- Dates of inspections,
- Any incidence of non-compliance,
- Measures taken to mitigate non-compliance and prevent future incidents of non-compliance,
- Notes on need for and performance of preventative maintenance,
- Records of spills, leaks, or overflows.

# Davis Mill Site Property Boundary



Mesa County GIS.



Mesa County GIS  
544 Rood Ave.  
Grand Junction, CO 81501

**DISCLAIMER :** The Geographic Information System (GIS) and its components are designed as a source of reference for answering inquiries, for planning and for modeling. GIS is not intended or does not replace legal description information in the chain of title and other information contained in official government records such as the County Clerk and Recorders office or the courts. In addition, the representations of locations in this GIS cannot be substituted for actual legal surveys.

## LEGEND

- |   |                 |  |   |
|---|-----------------|--|---|
| + | Hospitals       |  | Colorado National Monument                  |
| ★ | Police Stations |  | BLM Special Areas                           |
| ▲ | Fire Stations   |  | Black Ridge Canyons                         |
| Ⓡ | Schools         |  | COLORADO CANYONS NATIONAL CONSERVATION AREA |
|   | State Highways  |  | BLM   |
|   | Roads           |  | National Forest                             |
|   | Lakes           |  |   |
|   | Canals          |  |   |

FIGURE 1: DAVIS MILL SITE PROPERTY BOUNDARY



-  SURFACE WATER BODY
-  HAUL ROAD
-  SOIL STOCKPILE & LOADOUT AREA
-  SILT FENCE
-  CDOT YARD

## GATEWAY-DAVIS MILL SITE

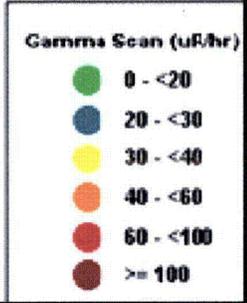
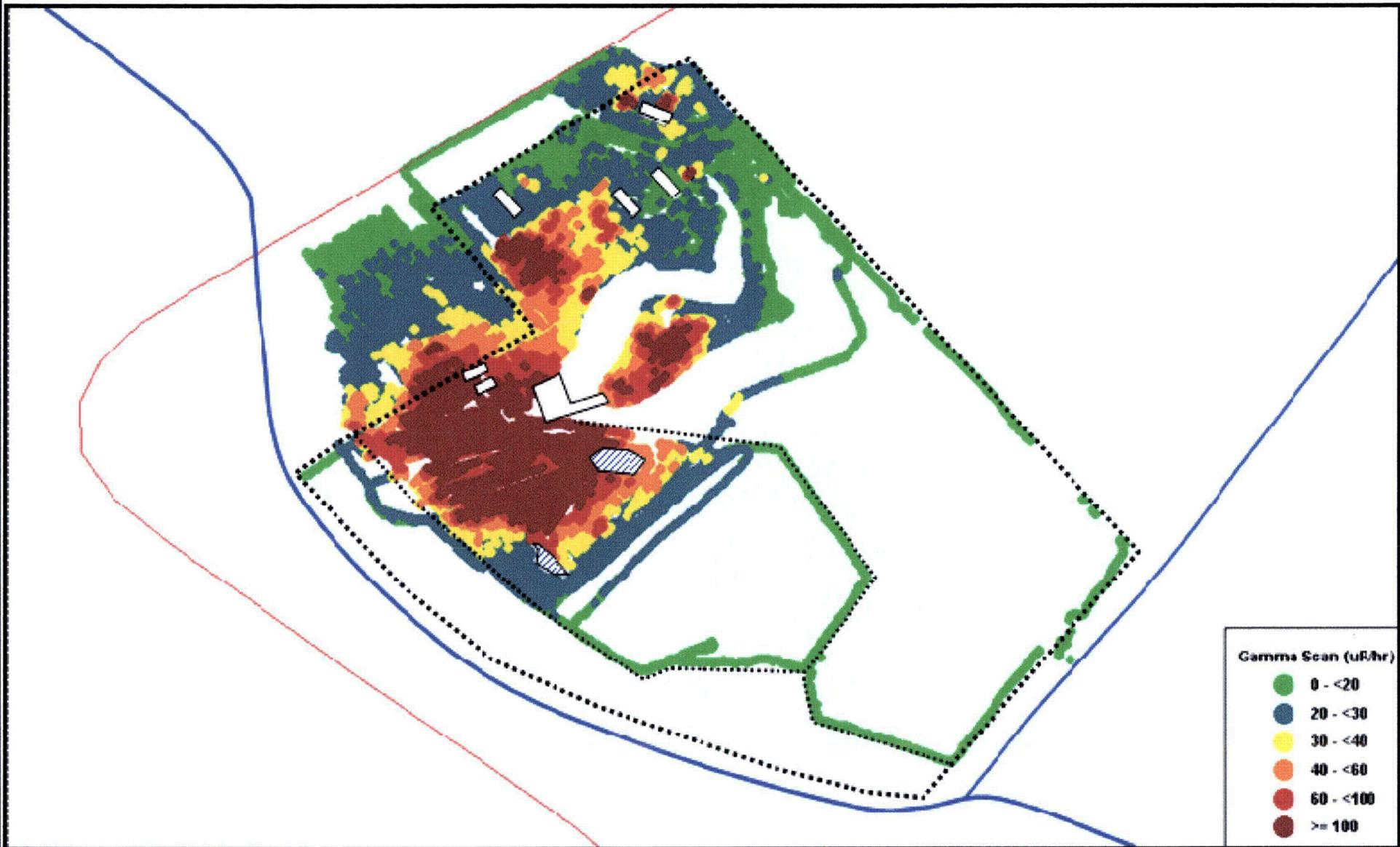
Figure: 2

### AERIAL SITE MAP



Frontier Environmental Services, Inc. Created on: Mar. 31, 2006

Checked By: D.S.H.  
Created By: B.A.S.



- SURFACE WATER BODY
- HWY 141
- Property Boundary
- Dolores River

## GATEWAY-DAVIS MILL SITE

### Attachment H GAMMA SCAN



**ATTACHMENT C**

**RADIATION HEALTH AND SAFETY PLAN**

# **FRONTIER ENVIRONMENTAL SERVICES, INC.**

**COLORADO DEPARTMENT OF  
PUBLIC HEALTH & ENVIRONMENT**

**GATEWAY, COLORADO – DAVIS MILL SITE REMEDIATION  
Mesa County, CO**

**PROJECT RADIATION HEALTH AND SAFETY PLAN**

**FRONTIER ENVIRONMENTAL SERVICES, INC.  
5171 WARD ROAD, UNIT 1  
WHEAT RIDGE, COLORADO 80033-1940**

**TELEPHONE NUMBER: (303) 234-9350**

**FAX NUMBER: (303) 234-9371**

*Revised  
April 2006*

**FRONTIER ENVIRONMENTAL SERVICES, INC.  
PROJECT RADIATION HEALTH AND SAFETY PLAN**

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**FRONTIER ENVIRONMENTAL SERVICES, INC.  
PROJECT RADIATION HEALTH AND SAFETY PLAN**

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PROJECT RADIATION HEALTH AND SAFETY PLAN**

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**FIGURE 1.1: PROJECT ORGANIZATIONAL CHART**

**ATTACHMENT A: RADIATION SAFETY PLAN**

**Gateway – Davis Mill Site Remediation**  
Radiation Health and Safety Plan  
Certification

Pursuant to the terms and conditions of the contract (HMWMD-RAD-01) between Frontier Environmental Services, Inc. and Colorado Department of Public Health and Environment, The Project Radiation Health and Safety Plan has been developed in accordance with Appendix G of the Request for Proposal (RFP) - Contract Scope of Work Description.

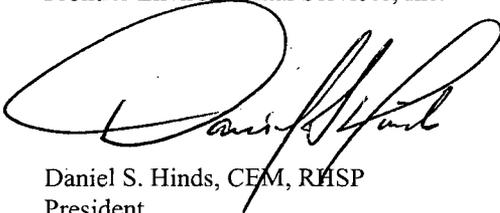
Frontier Environmental Services, Inc. has designated MFG, Inc. of Fort Collins, Colorado as its Radiation Control Safety Official for the project for evaluating work activity hazards and assigning level of personal protective equipment selection associated with the potential exposure to radiological containing soils and mill tailing materials. The certified health physicist - industrial hygienist is:

Ms. Janet A. Johnson, Ph.D., CHP, CIH  
MFG, Inc.  
3801 Automation Way; Suite 100  
Fort Collins, Colorado 80525  
Telephone Number: (970) 223-9600  
Facsimile Number: (970) 223-7171

As designated by the President of Frontier Environmental Services, Inc., the Project Radiation Health and Safety Officer is Mr. Randy Whicker, M.S. of MFG, Inc. Mr. Whicker has the authority to manage and implement the CDPHE Gateway, Colorado Davis Mill Remediation Project Radiation Health and Safety Plan. See Figure 1-1 Organizational Chart for line of communication and authority.

The undersigned have reviewed and agree to the appropriateness of this Radiation Health and Safety Plan with respect to its implementation on the Davis Mill Remediation Project. As described in the Hazards Analysis Section, Person Protective Equipment selection has been determined by on-site radiological survey, assessment and evaluation of data derived from the analyses of ionization samples collected on-site.

For:  
Frontier Environmental Services, Inc.



Daniel S. Hinds, CEM, RHSP  
President

For:  
MFG, Inc.

Janet A. Johnson; Ph.D., CHP, CIH  
Project Radiation Health and Safety Officer

# **FRONTIER ENVIRONMENTAL SERVICES, INC. PROJECT RADIATION HEALTH AND SAFETY PLAN**

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## **I. FRONTIER ENVIRONMENTAL SERVICES, INC. PROJECT RADIATION HEALTH AND SAFETY PLAN**

### **A. Introduction**

The Frontier Environmental Services, Inc. ("Frontier") Project Radiation Health and Safety Plan (RHASP) has been written to establish programs, develop plans and implement procedures which will comply with 29 CFR 1910.120 (p) and meet or exceed the requirement for the protection of Frontier personnel, vendors, sub-contractors and visitors.

This Radiation Health and Safety Plan have been designed to identify, evaluate and control safety and health hazards encountered on Frontier projects for the purpose of employee protection. The RHASP provides guidelines for emergency response in accordance with 29 CFR 1910.120 and to address as appropriate site analysis, engineering controls, maximum exposure limits, hazardous waste handling procedures and uses of new technologies. The implementation of the Radiation Health and Safety plan will help provide Frontier employees, sub-contractors and the client with a safe and healthy working environment.

Protection of human health and the environment has been the prime objective in performing project site activities. The realization of this objective during project activity depends on the efforts and attitudes of management, and the cooperation of all employees.

Work at Frontier project sites will be performed according to all applicable federal, state and local regulations and Frontier Environmental Services, Inc.'s Standard Operating Procedures.

Frontier is an environmental design, engineering, remediation and construction company, which in the course of its business will handle, treat and store hazardous wastes including heavy metal contaminated soils and debris, and industrial wastes such as filter cake solids and metal plating sludge prior to permanent waste management alternatives.

Special employee work procedures and special handling requirements for ignitable, incompatible and reactive wastes are described in the site specific

Radiation Health and Safety plan. These work procedures and special handling procedures will effectively minimize the development of emergency situations.

**B. Scope**

All operations that involve management of hazardous materials or have the potential for exposing project personnel to potential dangerous materials will be subject to this Radiation Health and Safety Plan. All personnel will be responsible for continuous compliance with established safety procedures during the performance of their work.

In no case will work be performed in a manner that conflicts with the Radiation Health and Safety instructions described in this RHASP, any standard operating procedures or other programs, plans and procedures in place for any activity at a Frontier project site. After having received warnings, personnel violating safety procedures may be subject to disciplinary action, which may include written reprimand, suspension without pay or termination of employment. All site employees will be instructed in the Radiation Health and Safety Plan standards.

The organizational structure of Frontier is described below and identifies those individuals responsible for all hazardous waste operations and the individual who has the authority and responsibility to develop and implement the site Radiation Health and Safety Plan and to verify compliance.

**President: Daniel S. Hinds, CEM, RHSP**

The President of Frontier has overall responsibility for Frontier project operations and for the Radiation Health and Safety of employees, sub-contractors and visitors.

**Project Manager: Brent A. Scarbrough; M.S. EIT**

The project Manager is responsible for regulatory and permit compliance for the project scope of work.

**Project Superintendent: Clay E. Combrink**

Responsible for day to day Frontier project operations.

**Radiation Safety and Health Officer: Janet A. Johnson; Ph.D., CHP, CIH  
And Randall D. Whicker; M.S.**

The on-site project Radiation Safety and Health Officer is responsible for the implementation, documentation and supervision of site safety and health policies, programs and procedures. The Radiation Safety Officer is responsible for implementing and managing the site Radiation Health and Safety Plan.

**Frontier Site Management and Supervisory Staff:**

Each person on the project staff is responsible for the safety of individual employees in their work areas, work practices and hazard exposures.

**Subcontractors:**

Frontier holds their subcontractors responsible for following and complying with the Frontier project/site management for safe work practices and procedures as described in this plan.

**Employees:**

Avoiding adverse health effects and injuries is dependent on the active participation of all personnel. The person directly responsible for the employee's health and safety is the individual employee.

## II. SITE RADIATION HEALTH AND SAFETY PLAN

### A. Objective and Purpose

Frontier Environmental Services, Inc. ("Frontier") intends to provide a safe and healthy working environment for all of its employees. Achieving voluntary compliance with Radiation Health and Safety regulations can only be accomplished through cooperation on the part of all personnel. The effectiveness of the Frontier RHASP is dependent upon the efforts of management with the full and willing participation and cooperation of all Frontier employees.

To aid and effect the implementation of this plan, Frontier has implemented the following RHASP objectives:

- To provide guidelines for uniform implementation of safety and health standards, which ensures strict compliance with regulatory requirements;
- To develop and implement special safety and health procedures for work efforts not normally covered by regulatory guidelines;
- To establish requirements for continuing safety and health education, including but not limited to new-hire orientation, periodic general safety education, special hazard recognition and control, Contingency Plan implementation and emergency response;
- To establish the requirements for Frontier emergency medical and first aid procedures and facilities;
- To use hazard analysis to develop engineering controls; identify job and design related safety and health concerns; evaluate new technology for systems currently in place and for new systems prior to their implementation; and
- To eliminate injuries, lost time accidents, other accidents, property damage and equipment failures.

### B. Scope

The Frontier Environmental Services, Inc. Project Radiation Health and Safety Plan includes policies for the safe operation of equipment, material handling, analyses of engineered systems, hazard recognition, work behavior and on-site personal conduct of employees. The procedures, duties and responsibilities

outlined in this plan will be in effect for the duration of Frontier operations. The plan may be amended as necessary.

### C. **Safety Objectives**

It is the responsibility of Frontier management to enforce all applicable codes and regulations, which pertain to safety and health. Frontier safety and health policies and procedures are guides to realize the following principles:

- **Management is ultimately responsible for safety.** When senior management exerts sustained leadership in establishing consistent safety practices and establishes accountability for safety and health performance at the immediate supervisory level, a health and safety plan will be very effective. At Frontier, responsibility extends from the top executive, through middle management to a point of focus at first-line supervision. Effective health and safety management necessitates continuous management involvement and consistent employee implementation.
- **It is good business to prevent injuries and illnesses.** Accidents have a great impact on employee morale, operational effectiveness and the economic success of the company. Direct costs of accidents are far exceeded by hidden and indirect costs of loss of time, redirection of management effort and employee distraction.
- **All injuries are preventable.** This is a realistic goal, not a theoretical objective. Utilizing this premise, accidents can be prevented. All work place exposures, which may result in injuries, can be controlled; no matter what the exposure is, an effective safeguard can be provided.
- **It is preferable to eliminate the source of hazards.** Where this is not possible or practical, management must enact measures such as engineering controls, special training, administrative controls, specialized safety equipment or other personal protective equipment.
- **Safe work practices are a condition of employment.** The safety of each employee depends upon the attention, knowledge and prudent action of everyone. Therefore, the employees' acceptance of responsibility for their own safety and the safety of others is a prerequisite for continued employment.
- **Corrective discipline will be used as a sanction against safety violators in order to achieve acceptable performance.** Employees who habitually

or arbitrarily engage in unsafe work practices will be disciplined using reprimand, suspension or dismissal.

- **Frontier Environmental Services, Inc. requires that all employees be thoroughly trained to work safely.** An awareness of safety often does not come easily. Employees require training in order to meet realistic goals. Management will provide training in safety and health practices, policies, work methods and procedures. Training will help to ensure employees are able to work safely and respond effectively to emergency or other unexpected situations.
- **Keeping employees informed of safety and health hazards is an integral part of training.** Classroom and on-the-job training will be used effectively to teach, motivate and sustain safety knowledge and awareness. Through use of these methods, injuries can be eliminated.
- **Safety audits must evaluate performance in the work place to assess safety and health plan success.** Safety audits provide an ongoing assessment of safety and health conditions, procedures, and practices, and permit timely correction of any deficiencies. Without prompt corrective action to rectify an observed deficiency, risk of injury will increase and the credibility of the safety plan will suffer. Additionally, safety audits detect specific problems, identify weaknesses in safety and health management efforts and initiate corrective processes.
- **People are the most critical element of the Radiation Health and Safety Plan.** People provide the solutions to any safety problems. Management involvement in safety is a dynamic learning and teaching process, which serves as a stimulus for employee cooperation and participation. Providing opportunities for individual participation in safety management enhances both the plan's effectiveness and the employee's attitude about safety. Intelligent, trained and motivated employees are the company's greatest resource.

#### D. **Standards of Conduct**

In order to provide the safest work environment possible for Frontier employees, contractors and visitors, the following rules and standards of conduct must be adhered to:

1. As directed by management, safety equipment must be worn at all times. For employees and sub-contractor personnel this, at a minimum, will be

customary construction dress (shirt and trousers or coveralls), hard hat, steel toed boots or shoes, and safety glasses. Sub-contractor personnel must have their own respirators and comparable safety equipment with them while working onsite.

2. Level D Personal Protective Equipment will be worn when in areas where work activities may be taking place, unless a greater level of protection is deemed necessary by the Project Radiation Safety Officer. Visitors who do not have their own safety equipment will be issued appropriate safety equipment with protective clothing, if necessary.
3. Visitors will turn in all Frontier supplied equipment to the Site Radiation Safety Officer prior to leaving the site.
4. Because of the nature of the work and the numbers of people who will work at and visit the Davis Mill Site, it is very important for everyone to work and behave in a professional manner. Care must be taken to work in the safest way possible. Actions or behavior, which may harm or endanger another person, must be avoided. Pushing, shoving, horseplay, roughhousing, throwing things, practical jokes, and other boisterous or disruptive behavior will not be tolerated. Fighting is grounds for immediate disciplinary action, which may include dismissal.
5. Consumption of controlled substances and alcoholic beverages on a project site being managed by Frontier is strictly forbidden.
6. Firearms are absolutely prohibited on any Frontier project site. Cameras and tape-recorders are prohibited unless authorized by the Site Superintendent or Project Manager.
7. AM/FM-radios, tape cassette or CD players and headphones are prohibited in hazardous materials management areas.
8. Decontamination procedures for work practices will consist of normal personal hygiene, unless a higher level of protection is instituted.
9. No smoking, eating, drinking, gum or tobacco chewing is allowed, except in designated areas as follows:

Smoking will only be allowed in posted areas of the project site.

Eating, drinking, chewing gum or tobacco will only be allowed in the designated break or lunch area, or the project parking lot.

Drinking water is available at locations in various designated project locations.

Absolutely no use of tobacco, food or drink will be allowed within the controlled hazardous materials operations area, exclusion zones, decontamination zones, including site vehicles and equipment except as described above.

10. Equipment will be operated only as described in company training, and then only by fully qualified and trained employees, contractors or vendor personnel. Faulty or inoperative equipment will be reported to management immediately after discovery.
11. Management must be notified when employees or visitors will be working onsite.
12. Employees removing property from a Frontier project must have written authorization from the Site Superintendent or Project Manager and must present it when leaving the project.
13. Unless authorized by Frontier management, employees and contractor personnel will not work alone in areas where construction hazards are present or hazardous materials are managed. Personnel working by themselves or in remote areas of the site must have authorization from their supervisor and a site communications radio in their possession.
14. Confined spaces will absolutely not be entered without a permit from the Site Radiation Safety Officer. If any area is questionable as to whether or not it is a confined space, always ask your supervisor, escort, the Site Radiation Safety Officer or project management.
15. All clothing worn within a project-controlled area, including protective clothing will not be taken from the project by employees. Any personal protective equipment clothing worn into project management areas will stay on site.
16. Violation of established rules, standards of conduct or endangerment of employees, contractors or visitors must be brought to the attention of project management immediately. Safety violations or misconduct can

threaten everyone. Willful disregard of safety cannot be tolerated. Failure to follow these or any other rules or standards of conduct as directed by management may result in removal of visitors, dismissal of contractors or disciplinary action against employees (which may include suspension without pay or immediate dismissal).

Compliance with these standards will help provide a safer work environment for everyone on the Project.

### III. SITE CONTROL

Site control is an important aspect of minimizing the physical and chemical hazards to which personnel may be exposed. In emergency situations site control involves managing the movement of people and emergency response equipment.

#### A. Site Communications

An external communications system will be available to coordinate with outside agencies, (i.e. telephone, radio-telephone).

#### B. Procedure for Visitors

1. After receiving authorization from project management and prior to arrival, the employee expecting the visitor or contractor will notify the Site Radiation Safety Officer of the visitor's name and company name.
2. After the visitor is orientated, the site logbook will keep a record of orientations given.
3. Each visitor will be issued safety equipment, which will include hardhat safety glasses and any other PPE device deemed appropriate for the work area to be visited.
4. A project map showing active areas of the site, routes of evacuation and a list of emergency equipment will be maintained in the field office trailer.
6. Site management will record in the daily activity log the visitor as being on site. The visitor will be allowed to visit an employee, work in a specified area, tour the project site if accompanied by an escort, and move about the project site unaccompanied if approved to do so by site or project management.
7. Visitors not employed by Frontier, MFG, or CDPHE will not be allowed into site waste or hazardous materials operations areas or other active areas.
8. A record of the visitor's name, company, and date they visited the project will be entered into the project sign-in log and project daily log.

9. When visitors are ready to leave, they will turn in their safety equipment. An exit notation, as well as an Alpha particle scan will be logged on the project sign-in and sign-out sheet.

#### IV. RADIATION HEALTH AND SAFETY PLAN

##### A. Industrial Hygiene Monitoring

Industrial hygiene monitoring will be used to determine the existence and concentrations of airborne particulate matter. Air monitoring will be conducted, at the beginning of the project, to determine the necessary level of PPE. This monitoring will be in conjunction with and complement the medical surveillance program.

The Site Radiation Safety Officer is to ensure that monitoring personnel are qualified to operate the necessary equipment. MFG, Inc. will provide independent project industrial hygiene consultation on a need be basis. The certified health physicist and industrial hygienist is:

Ms. Janet A. Johnson, Ph.D., CHP, CIH  
MFG, Inc.  
3801 Automation Way; Suite 100  
Fort Collins, Colorado 80525  
Telephone Number: (970) 223-9600  
Facsimile Number: (970) 223-7171

MFG, Inc. will advise Frontier on what levels of PPE will be utilized. At the beginning of the project activities, MFG, Inc. will perform on-site radiological industrial hygiene monitoring and sampling of representative work activities by conduction air monitoring for radiological ionization from project hazardous constituents of concern, i.e. uranium and vanadium source material. In addition, work area monitoring will be performed using real time airborne suspended solids monitoring to verify dust control methods used on the project, i.e. water spray application to dust generating source areas.

##### B. Air Monitoring

Monitoring will be accomplished according to NIOSH sampling methods. Since Frontier personnel may be exposed to hazardous materials and process hazards, real time and personnel sampling will need to be adjusted for target contaminants as different compounds are brought onto the site.

Personnel monitoring samples taken for contaminant exposure will be analyzed by an on-site laboratory. Monitoring locations and a schedule for monitoring under this plan are as follows:

- Monitoring instruments used for sampling will be calibrated according to the manufacturer's recommendations. Equipment will be calibrated before and after use, with a record kept of all calibrations. Real time readings will be recorded in the project safety and health daily reports with pages initialed and dated at the close of each day's activity. Action limits will be set by specific waste constituent present onsite.

C. **Meteorological Monitoring**

- Temperature
  - Wind Direction
  - Precipitation
1. Weather conditions at the site will vary from pleasantly warm and sunny to hot and windy to extremely cold with blowing snow. Other portions of the Radiation Health and Safety Plan and various standard operating procedures provide guidance for monitoring of employees and responding to emergency conditions, which may result from stressful or inclement weather conditions.

D. **Heat Stress**

During periods of high temperature, the Site Radiation Safety Officer will frequently monitor employees for symptoms of heat stress, especially in areas where protective clothing is being worn. If the body's physiological processes which maintain a normal body temperature fail or are overburdened due to excessive heat exposure, a number of physical reactions can occur ranging from mild symptoms such as fatigue, irritability, anxiety, decreases in concentration, and movement, to unconsciousness and death. Heat-related problems are presented below.

- Heat Rash. Caused by continual exposure to heat and humid air and is aggravated by chafing clothes. Heat rash decreases a person's ability to tolerate heat.
- Heat Cramps. Caused by profuse perspiration with inadequate water intake and chemical electrolyte imbalance. This results in muscle spasm and pain in the extremities and abdomen.
- Heat Exhaustion. Increased stress on various organs to meet increasing demands to cool the body will result in signs and symptoms, including

shallow breathing, pale, cool, moist skin, profuse sweating, dizziness, and lassitude.

- Heat Stroke. The most severe form of heat stress, which must be treated immediately by cooling the body, can result in death. Signs and symptoms include red, hot, dry skin; no perspiration, nausea; dizziness and confusion; strong, rapid pulse; and coma.

One or more of the following control measures can be used to help control heat stress:

- Providing adequate liquids to replace lost body fluids. Employees must replace water and salt lost from sweating. Employees must be encouraged to drink more than the amount required to satisfy thirst. Thirst satisfaction is not an accurate indicator of adequate salt and fluid replacement.
- Replacement fluids can be a 0.1 percent salt water solution, commercial mixes such as Gator-Aid or Quick Kick or a combination of these and fresh water. The company will provide these fluids.
- Establishment of a work regimen that will provide adequate rest periods for cooling down. This may require additional shifts for employees or earlier or later work schedules.
- All breaks are to be taken in a shaded rest area.
- Employees shall not be assigned other tasks during rest periods.
- All employees shall be informed of the importance of adequate rest, acclimatization, and proper diet in the prevention of heat stress.

## V. PERSONAL PROTECTIVE EQUIPMENT

Frontier has selected Level D personal protective equipment (PPE) for the project based on the best information pertaining to anticipated project activities. As determined by each work area hazard analyses, the level of PPE upgrade or down grading will be assessed and determined.

### A. Levels of Protection

As established by the initial project industrial hygiene air monitoring survey, the level of PPE for the project will be set as Level "D". The Project Radiation Safety Officer may upgrade the level of protection to Level "C" if work activity hazards in specific areas cannot be controlled by engineering methods, i.e. dust control or work methods. These two levels are listed below:

1. **Level D** is customary construction clothing and will be worn only in all areas, unless otherwise specified by the Project Radiation Safety Officer. Level D consists of a hard hat, steel-toed shoes or boots, gloves and safety glasses.
2. **Level C** should be worn when the criteria for using respiratory protection is met. Level C consists of:
  - half-face, air-purifying respirator (MSHA/NIOSH approved),
  - chemical-resistant clothing (one-piece coverall),
  - gloves, outer, chemical-resistant,
  - boots, steel toe and shank, chemical-resistant,
  - safety glasses, and
  - hard hat

### B. Clothing and Respirator Storage

Clothing and respirators must be stored properly to prevent damage or malfunction due to exposure to dust, moisture, sunlight, damaging chemicals, extreme temperatures, and impact.

#### a. Clothing

Potentially contaminated clothing will be stored in an area separate from street clothing.

Different types and materials of clothing and gloves will be stored separately to prevent issuing the wrong type or material by mistake.

Protective clothing will be folded or hung in accordance with manufacturer's recommendations.

b. Respirators

Air-purifying respirators will be inspected, washed, and disinfected after each use. Air-purifying respirators should be stored individually in their original packaging or carrying cases, or in resealable plastic bags.

C. **Essential Inventory of Personal Protective Equipment for Frontier Operations**

It is the responsibility of the Site Radiation Safety Officer to ensure that the following personal protective equipment is available prior to the start of daily activities:

- Protective clothing: disposable outer-wear and uniforms
- Safety belts and lanyards
- Respiratory protection equipment consistent with identified hazards
- Safety glasses and goggles
- Hearing protectors
- Foot protection (chemical resistant steel-toed boots)
- Cutting goggles
- Welding hoods and lens
- Welding gloves
- Welding jackets and sleeves

- Chemical-resistant gloves
- Splash protection
- Full face shields

The above list represents the "basic" personal protective equipment, which may be used. Other equipment may be necessary, depending upon the type of work. The Site Radiation Safety Officer will ensure that an adequate inventory of this equipment is maintained.

## **VI. DECONTAMINATION PROCEDURES**

### **A. Designated Decontamination Areas**

If project activities require the use of personal protective equipment, employees will exit the controlled active areas, proceed to designated decontamination areas, and remove gross contamination from boots and gloves before removing any protective clothing or their respirators.

If an employee develops a rip or tear on his/her protective outer wear, the employee will return to a decontamination area, wash any contaminated skin and put on new protective clothing.

### **B. Equipment Decontamination**

Equipment will be decontaminated prior to it leaving the active area(s). Equipment may be cleaned using wash water supplied under pump pressure to remove contamination. Areas washed will include the undercarriage of vehicles.

Site personnel to insure that contaminated material has been removed will inspect all equipment leaving active areas.

All tools used within active areas will be decontaminated prior to being transferred to other areas of the site.

### **C. Routine Procedures for Decontamination**

In the event that the level of PPE is upgraded to Level "C", the following decontamination procedures will be used.

- a. Remove special work boots and chemical protective clothing and wash them thoroughly in a designated decontamination area to remove all visible signs of contamination.
- b. Remove any disposable contaminated clothing by undressing from the top down and from the inside out. Dispose of them in the designated collection containers for personal protective equipment.
- c. Remove the respirator, sanitize it and turn it in for evening cleaning. Cleaning and maintenance of respirators will be performed per manufactures recommendations. At a minimum, cleaning or sanitizing should be accomplished at the end of every work day and after each use.

- d. After completion of the decontamination, employees may dress in street clothing and shoes.

Under no circumstances will contaminated clothing or personal protective equipment leave the project. This includes entering personal vehicles and site vehicles for off-site travel.

## VII. MEDICAL SURVEILLANCE PLAN

Frontier Environmental Services provides Medical Surveillance of all project employees. Medical examinations and procedures performed under this plan will be performed by or under the supervision of the Frontier designated medical clinic at no cost to the employee, without loss of pay and at a reasonable time and place. The results and the examining physician's conclusions for suitability for work assignment as a result of the medical evaluations will become part of the personnel file for each project employee. The designated medical clinic/physician is:

**Concentra Medical Centers**  
**770 Simms Street, Suite 100**  
**Golden, CO 80401**  
**Telephone: (303) 239-6060**  
**Facsimile: (303) 239-6046**

Special emphasis will be placed on: 1) Employees who are or may be exposed to hazardous substances or health hazards at or above the permissible exposure limits or, if there is no permissible exposure limit, above the published exposure levels for these substances, without regard to the use of respirators, for 30 days or more a year; 2) Employees who wear a respirator for 30 days or more a year; and 3) Employees who are injured, become ill or develop signs or symptoms due to possible overexposure involving hazardous substances or health hazards from an emergency response or hazardous waste operations.

Medical examinations will include a medical and work history (or updated history for existing employees) with special emphasis on symptoms related to the handling of hazardous substances and health hazards, and to fitness of the employee for duty including the ability to wear any required personal protective equipment under conditions (i.e., temperature extremes) likely to occur at an Frontier project.

Clinical tests performed on all employees:

- Urinalysis - routine and microscopic and for heavy metal content.
- Cardiovascular screening
- Pulmonary function test (may include FVC and FEV-1)
- Audiometric examination

- Evaluation of the individual's physical ability to perform work involving potential exposure to contaminants and use of respiratory protection equipment.
- Determination of the near and distant visual acuity. If corrective lenses are required, lens inserts for respiratory face masks will be provided. If visual correction is required, prescription safety glasses will be required.

If any of the findings obtained during the examination are outside the normal range, the individual will be referred to his or her personal physician; a copy of the findings will be provided to their physician.

The content of all medical examinations will be made available to employees upon request from the employee or at the direction of the Frontier physician.

Frontier has provided physical examination forms to the clinic/physician, which uses CFR 1910.120 as a reference for the scope of the medical examination. The following additional information about each employee has been supplied or will be supplied as it becomes available:

1. A description of the employee's duties (job description) as they relate to the employee's exposures.
2. The employee's exposure levels.
3. A description of any personal protective equipment to be used.
4. Information from previous medical examinations of employees.

Frontier will obtain a written opinion from the physician for each employee regarding whether the employee has any detected medical conditions which would place the employee at increased risk of material impairment of the employee's health from work in hazardous waste operations, emergency response or from respirator use. The physician's opinion will include any recommended limitations upon the employee's assigned work and a statement that the employee has been informed by the physician of the results of the medical examination and any medical conditions which require further examination or treatment.

Any written opinion about an employee, obtained by Frontier, will not include specific findings or diagnoses unrelated to occupational exposures. Employees will be provided with the results of the medical examination and tests at their request.

If any of the findings obtained during the examination are outside of the normal range, the physician's written opinion may be used by Frontier and the employee to evaluate any question of continued employment.

The frequency of medical examinations will be as follows:

1. Prior to hire and assignment.
2. At least once every 12 months for each employee unless the Frontier physician believes a longer period (not longer than biennially) is appropriate.
3. At termination of employment or reassignment to an area where the Frontier physician determines the employee may have a different exposure. Upon termination, employees will receive an exit examination to determine their physical fitness and to review their occupational exposure histories from the preceding year. Special attention shall be given to the possibility of non-occupational exposures to substances producing effects similar to the effects of hazardous substance exposure.

A complete history will be obtained to identify signs or symptoms, which may be connected to hazardous substance exposure or to other occupational exposures, which could produce adverse acute or chronic effects. In addition to the review and update of occupational and medical histories, other examinations and clinical tests may be performed. These tests may be in addition to any other job specific surveillance tests required based on other exposures.

4. As soon as possible upon notification to Frontier by an employee that the employee has developed signs or symptoms indicating possible overexposure to hazardous substances or health hazards, or that the employee has been injured or exposed above the permissible exposure limits or published exposure levels in an emergency situation.
5. At any time the Frontier physician determines that an increased frequency of examination is medically necessary.
6. As soon as possible following an emergency response action at which an employee may have been injured, received a health impairment, developed signs or symptoms which may have resulted from exposure to hazardous substances resulting from the emergency incident, or been exposed during the emergency incident to hazardous substances at concentrations above the permissible exposure limits or the published exposure levels without the necessary personal protective equipment being used.

7. At additional times, if the Frontier physician determines that follow-up examinations or consultations are medically necessary.
8. At a minimum the following information will be retained in the records:
  - a. The employee's name and social security number;
  - b. Any physician's written opinions, recommended limitations and results of examinations and tests;
  - c. Any employee medical complaints related to exposure to hazardous substances;
  - d. Copies of information provided to the examining physician by Frontier.
  - e. The following is a partial list of reports and records that pertain to this section:
    - Occupational Injury/Illness Case Record
    - Notice to Doctor and Doctors Release
    - Immediate Supervisor's Report of Accident
    - Supervisor's Occupational Injury/Illness Report.
    - Employer's First Report of Injury (Insurance Form)
    - Frontier Monthly Accident Summary
    - OSHA Form 200 - Log and Summary of Occupational Injuries and Illnesses
    - Monthly Safety Summary
    - Medical Surveillance Records
    - Occupational Illness Waiver Forms
    - Daily Injury Log
9. Employee medical surveillance records will be retained for the duration of an employee's employment plus 30 years.

## VIII. FIRST AID AND MEDICAL SUPPORT & ACCIDENT REPORTING

Frontier will provide first aid medical support and arrange emergency transportation for employees and other persons authorized access to the Gateway – Davis Mill Site Remediation Project, who sustain injuries or become ill.

### A. **Medical Support**

#### 1. Facilities

A First aid kit will be equipped and maintained in a professional manner under the supervision of the Site Radiation Safety Officer.

The first aid kit will be utilized to treat minor injuries and stabilize more severely injured or critically ill personnel prior to transporting them offsite.

#### 2. Personnel

At least one fully trained first aid provider will be onsite during site activities. The project personnel file contains the names of those individuals who have the necessary first aid training.

#### 3. Non Emergency Medical Services

**St. Mary's Medical Center**  
**2635 N 7<sup>th</sup> Street**  
**Grand Junction, CO 81501**  
**(970) 244-2273**

#### 4. Emergency Services

In the event that medical attention is needed. Any person needing medical attention will be transported to the nearest medical center, which is the following:

**St. Mary's Hospital**  
**2635 N 7<sup>th</sup> Street**  
**Grand Junction, CO 81501**  
**(970) 244-2273**

A map indicating the route to the hospital is included in *Attachment B*.

**B. Emergency Phone Numbers**

Police: 911

Ambulance: 911

Fire Department: 911

St. Mary's Hospital: 911 *or* (970) 244-2273

Davis Mill Project Site Satellite Telephone: 254-387-7009

Frontier Environmental Services, Inc. Main Office: 303-234-9350

Daniel S. Hinds' Cell Telephone: (303) 908-9577

Brent A. Scarbrough's Cell Telephone Number: (303) 489-7740

**C. Accident Reporting**

If an accident, an explosion or fire, or a release of toxic materials occurs during the course of the project, Frontier shall notify the appropriate local authorities, CDPHE and Frontier Management immediately by telephone. Written notification shall be made to Frontier Management and CDPHE within 24-hours. Within two working days of any reportable accident, Frontier will complete and submit to CDPHE an accident report addressing the following items:

- Name, title, telephone number and location of Frontier Environmental Services, Inc. manager making the report.
- Date and time of the accident.
- Location of the accident/incident.
- Brief summary of the accident/incident giving pertinent details including type of operation ongoing at the time of the accident/incident.
- Apparent cause of the accident/incident, if known.
- Casualties (fatalities, disabling injuries)
- Details of any existing chemical hazard or contamination
- Estimated property damage, if applicable.
- Nature of damage, effect on contract schedule.
- Action taken by Frontier Environmental Services, Inc. to ensure safety and security.
- Other damage or injuries sustained, public or private.

## IX. RESPIRATORY PROTECTION PLAN

This plan establishes the necessary guidelines and general requirements for use of respiratory equipment at the Gateway – Davis Mill Site Remediation Project.

It is the objective of this plan to establish guidelines, which will minimize work related respiratory risks to Frontier employees. After having been provided the properly selected, fitted and maintained respiratory equipment, employees will be able to accomplish their assigned tasks as efficiently as possible.

### A. Procedures

#### 1. Issue of Respirators

Employees at Frontier will be assigned a suitable respirator for their exclusive use during the performance of their specific job function. Replacement respirators will be issued to them, should a respiratory device become unserviceable.

#### 2. Visitors and Contractors

Frontier will not supply visitors with respiratory protection. Visitors will not be allowed in areas where respiratory protection is required, unless specifically instructed to do so by CDPHE.

Contractors will need to furnish their employees with their own respiratory protection while they are working at a Frontier project site. In addition, the subcontractor prior to their employees being allowed to work at Frontier will present documentation of respiratory fit testing and protection to the Site Radiation Safety Officer.

#### 3. Respirator Selection

Respirators issued to Frontier employees will only be of the NIOSH/MSHA approved type respirator. The selection of respirators shall be reviewed by the Site Radiation Safety Officer and shall be based on the following criteria:

- Nature of the Hazard—The chemical, physical, toxicity and concentration properties of the hazardous material.

If there will be exposure to materials for which OSHA has mandated specific respirators to be used, i.e. carcinogens, personnel will use that respirator or one which provides greater protection.

## **B. Respirator Inspection Cleaning, Maintenance and Storage**

Standard Operating Procedures have been established which describe the methods for cleaning, inspecting and repairing respirators, including the following:

- Inspection for respirator defects and/or deterioration
- Cleaning and Disinfecting
- Repair
- Proper Storage

### **1. Inspection and Maintenance**

All respirators will be inspected routinely before and after each use. Respirators maintained for emergency use must be inspected and sanitized after each use, as well as inspected at least monthly. A record will be kept and maintained by the Safety Supply Clerk indicating the following:

- Inspector Name
- Date of most current inspection
- Respirator type

### **2. Cleaning and Storage**

Respiratory equipment that is used routinely will be cleaned, sanitized, inspected and repaired on a regular basis by a qualified individual. Respirators will be cleaned, sanitized and stored according to manufacturer's specifications and requirements of the OSHA standard.

Frontier management will ensure compliance of proper cleaning and maintenance requirements by periodic inspections and audits of cleaning and maintenance areas.

## **C. Medical Surveillance**

Medical surveillance for the Respiratory Protection Plan will be provided by the Frontier designated physician. Medical surveillance will be conducted in

accordance with the Medical Surveillance as described in this Radiation Health and Safety Plan.

Before an employee can be issued a respirator, a physician must certify them for respirator use. The physician must certify that the employee is physically able to perform the required work and use the respiratory equipment. The company physician will determine what health and physical conditions are pertinent. After hire, the employee will be re-evaluated for the ability to wear a respirator annually.

**D. Fit Testing**

Each employee at Frontier will be instructed and be required to demonstrate understanding of the methods used in conducting positive and negative pressure checks for each type of respirator assigned. Positive and negative fit checks are required each time the respirator is worn.

Fit testing will be in accordance with the individual respirator manufacturer's recommendations and will follow fit test protocols. Successful fit tests shall be documented and kept with the employee's training file.

**E. Facial Hair**

Frontier has the responsibility under the Occupational Safety and Health Act CFR 29 1910.134 (e) (5) to ensure that all wearers of respirators can obtain a satisfactory seal between the respirator and the wearer's skin.

Facial hair between the sealing surface of a respirator face piece and the wearer's skin will prevent a good seal. Such a condition makes it possible for air contaminants to enter the face piece during inhalation and result in an exposure. Even a few days growth of stubble can permit excess contaminant penetration.

It is the policy of this company that employees who may be required to wear a respirator during the course of their employment shall not have facial hair, which intrudes, into the area where the respirator seals against the face. In addition, these employees shall not be fitted with a respirator. Every employee who is required to wear a respirator will receive the proper respirator, be trained in its use and have it satisfactorily fit-tested. Once an employee is informed they are subject to the requirements of wearing a respirator, it will be their responsibility to ensure that they do not have facial hair in the respirator seal area.

Any employee who refuses to comply with the requirements of this notice shall be subject to disciplinary action up to and including discharge.

**F. Corrective Lenses**

Persons requiring corrective lenses must have kits to hold corrective lenses inside the respirator face piece in such a manner as not to interfere with the seal of the respirator on the wearer's face.

**G. General**

Respiratory protection will only be worn at times designated by the Site Radiation Safety Officer.

Air purifying cartridges shall be replaced as necessary.

Only those persons who have had initial and annual qualitative fit tests will be allowed to work in atmospheres where respirators are required.

Contractors must certify that their employees have received respiratory training and fit testing before their employees are allowed to work at Frontier.

If an employee has demonstrated difficulty in breathing during the fitting test or during use, he or she must have a physical examination to determine whether they can wear a respirator while performing the required duty.

## **X. HEARING CONSERVATION PLAN**

The following plan has been prepared in accordance with the OSHA regulation for occupational noise exposure (29 CFR 1910.95). It establishes standard operating procedures to be followed by all employees. The Hearing Conservation Plan and guidelines will be followed when engineering and/or administrative controls are not feasible and hearing protection devices are being relied upon to protect the employees.

Hearing protection will be provided to all employees exposed to a Time Weighted Average (TWA) of 85 decibels (dBA).

This Hearing Conservation Plan will be implemented and monitoring will be conducted when information indicates that an employee's exposure may be greater than a TWA of 85 dBA. The sampling strategy will be designed to identify employees for inclusion in the Hearing Conservation Plan and to enable the proper selection of hearing protection.

### **A. Sampling**

Procedures for identifying employees who may be exposed to the TWA action level of 85 dBA or above are as follows:

1. Dosimeter monitoring in work areas.
2. Include all continuous, intermittent and impulsive sound levels between 85 and 90 dBA.
3. Calibrate instrument properly prior to each use.
4. Repeat monitoring whenever a production, process, controls or equipment change occurs which may involve additional personnel or render protective equipment inadequate.
5. Employees must be notified if they are exposed at or above the action level.
6. Employees affected shall be provided an opportunity to observe measurements.

### **B. Audiometric Testing Plan and Baseline Audiogram**

Audiometric testing will be made available to all employees as part of their medical surveillance. This plan will be at no charge to the employee.

1. A baseline audiogram is included within the employee's initial medical examination for work at the site.
2. Another baseline audiogram will be established within six months of exposure.
3. The audiometric test will be repeated at the annual medical exam required of all site personnel.
4. The annual test will be compared to the baseline to determine any shifts in the hearing level.

**C. Audiometric Re-Testing**

Procedure to follow when an audiogram shows a significant threshold shift:

1. Retesting will be performed within 30 days to be used as the annual audiogram.
2. Review by an audiologist, otolaryngologist or physician to determine if further evaluation is needed.
3. Inform employee within 21 days.
4. An employee may be fitted for a pair of protective devices and trained in their use and care. An employee already having protective devices, may be refitted and retrained in their use or be provided with alternate hearing protection. Measures will be taken to reduce or eliminate the noise problem. These measures may include any or all of the following: engineering, work practice or administrative controls, and hearing protection.
5. Additional testing may be advised if a medical pathology of the ear is suspected of being caused or aggravated by wearing hearing protection.
6. Additional testing may also be advised for any medical pathology of the ear unrelated to wearing hearing protection.
7. An annual audiogram may be substituted for the baseline when a threshold shift is persistent or if there is significant hearing improvement.

**D. Test Requirements**

Audiometric test requirements will be conducted in accordance with OSHA 1910.96.

**E. Employee Training**

1. Training will consist of initial hearing conservation and annual refresher plans, which will include:
  - effects of noise on hearing,
  - purpose of hearing protectors,
  - Advantages, disadvantages and attenuation of various types, and
  - instructions for selecting, fitting, using and caring for hearing protection devices.
2. Purpose of audiometric testing
3. Explanation of test procedures

**F. Record Keeping**

1. A record of monitoring measurements (other than audiometric testing) will be maintained in the archives and will be available at employees' requests.
2. Audiometric tests will be maintained in each employee's medical monitoring file.

## XI. PERSONNEL TRAINING PLAN

Frontier Environmental Services, Inc. has developed a training program consisting of instructional units including the basic 29CFR1910.120 HAZWOPER 40-hour OSHA course. Except for the HAZWOPER-OSHA 40 course, the training units are designed to be delivered by Frontier personnel on an ongoing basis. Where specialized instructors are required, off-site personnel will be utilized. The HAZWOPER-OSHA 40 classes will be given by an independent qualified organization. Site Specific Radiation Safety orientation will be conducted prior to field assignment to the project. MFG, Inc. Radiation Safety Officer will provide site specific radiation safety training.

At the mobilization of the Gateway – Davis Mill Site Remediation Project and as the project demand for additional labor are demonstrated, Frontier personnel working in areas where hazardous materials are expected, will be HAZWOPER Trained as prescribed by 29 CFR 1910.120 and site specific radiation safety trained. Project personnel files contain training certificates indicating their training status.

For those select project work tasks where contact or exposure to hazardous materials is **not** expected, project personnel working solely in the areas listed below, will not be required to have the 29CFR1910.120 HAZWOPER-OSHA 40 Training.

1. Traffic Control;
2. Placement and handing of geo-fabric erosion control material;
3. Placement and handling of permanent and biodegradable erosion control material; and
4. General office and project administrative functions.

The objective of the Frontier Training Program is to develop and implement the appropriate training courses. The specific goals of the training program are as follows:

- Development, delivery, and updating of a Frontier site specific OSHA-40 hour training course which meets the requirements of 29 CFR 1910.120, and;
- Development, delivery and updating of a program of instruction for site activities, health, safety, environmental concerns, regulatory response, emergency response, and job specific orientation.
- Names of personnel and alternates responsible for safety and health.
- Injury, illness and other hazards present at the project site.
- Safe use of engineering controls and equipment on site.
- Work practices by which the employee can minimize risks from hazards.
- Selection, use, care and maintenance of PPE.
- Site control procedures, including login and logout.

- Site decontamination procedures.
- Standard operating safety procedures.
- Site emergency response plan.
- Procedures for any confined space entries that may be part of the project.

The Personnel Training Program is designed to provide Frontier employees with information they need to safely and efficiently perform their duties. Frontier Site Superintendent and Project Manager will manage personnel training.

The two major objectives of the Personnel Training Program are:

- To thoroughly train all employees in the proper performance of their individual job duties.
- To ensure that all designated employees are capable of effectively implementing the proper emergency procedures, should the need arise.

Accidents and emergency situations can be properly minimized by having a work force, which is trained to perform their jobs properly. If an emergency does occur, its consequences can be minimized through rapid and effective response.

#### A. **On-The-Job Training**

One of the most common and successful methods of personnel training is on-the-job training (OJT). It provides individualized training pertinent to normal daily operations of the project. A major advantage of this type of training is "hands on" experience, with supervision, for specific equipment and processes used on the project. OJT is especially useful for it provides an effective explanation of concepts of the system and visual illustration of those concepts. On-the-job training (OJT) at Frontier is an ongoing process, but will be used primarily for orientation purposes for new hires and transfers. This may be an operating test (performance and written), a verbal test, or other performance evaluation demonstration administered by the site supervisor.

The OJT orientation training will provide the newly hired or transferred employee information pertaining to the correct performance of his job, the hazards associated with the job and the personal protection required. It will also be used to give him general training in emergency procedures and environmental protection.

**B. Formal Training**

Although OJT is effective, Frontier personnel must retain as much of the learned training as possible; therefore, supplemental training will be provided to reinforce basic procedures and precautions to be followed in the various areas of the project. The training will be documented in the employee's development record.

The Frontier training policy requires that all new employees must successfully complete their formal training at the time of their employment or assignment to the project. Upon transfer or promotion of an existing employee to a new position with training requirements that differ from those for the previous position.

Pending satisfactory completion of the specific training required for a particular job, an employee will receive intensive supervision to ensure that the job is performed properly and safely.

On-going continuing education and training will be provided to employees by Frontier. The frequency of continuing education and training activities will vary according to the type of job.

The Personnel Training Program presents an outline of the proposed formal Personnel Training Program along with the schedule for conducting the continuing training and the personnel who would be scheduled to participate. The frequency of formal training activities varies from quarterly for emergency response plan functions, to annually for training which does not relate directly to emergency situations.

**C. Training Program Management**

The training program will be managed by the Frontier Project Manager and coordinated on a daily basis by the Site Radiation Safety Officer. The Personnel Training Program includes instruction which teaches project personnel safety and health policies and procedures and emergency response plan implementation.

**D. Training Schedule**

All personnel will complete the training program at the time of their employment. New hire employees will work under the supervision until site orientation and training has been completed.

**E. Training Program Review**

All Frontier personnel will take part in an annual review of the initial training. Training will be reviewed periodically and modified as necessary. Records of the review shall specify the contents of each evaluation including such topics as:

- Changes in types or quantities of wastes received, accepted and their treatment, storage or disposal processes;
- Changes or revisions to permit conditions, emergency coordinators and general operations;
- Any experience requiring the implementation of the emergency response plan, notification requirements, etc.

Every 6 months, Frontier management will review each employee's personnel file against that person's job description and training requirements, to verify that the frequency and type of training required for that job is being provided.

**F. Record Keeping**

The Site Radiation Safety Officer will maintain documents and records at Frontier which include the following information:

- Job titles for current positions on a Frontier project are outlined on the project organizational chart.
- Written job descriptions for each position listed on the organizational chart are presented in this Site Specific Radiation Health and Safety Plan. These job descriptions include the requisite skill, education or other qualifications, and duties of employees assigned to each position.
- Type and amount of both introductory and continuing training administered to project personnel is summarized in this Site Specific Radiation Health and Safety Plan and itemized on the job description sheets.
- Documentation of training will be accomplished by completing the forms and placed into the operating record.

G. **Training Records**

All records of training on current personnel will be kept on file as a part of the project record. Records of former employees shall be kept for three years after the date the employee leaves the Frontier. Copies of training records of employees transferring to or from other company facilities will accompany them and may be used as a basis for satisfying, in part, Frontier formal training and on-the-job training requirements.

## **XII. HEAVY EQUIPMENT OPERATION AND SAFE MATERIALS HANDLING**

The following information pertains to work around heavy equipment and the safe handling of heavy materials.

- Use common sense.
- Employees should pay attention to what they are doing and what they are being told at all times.
- Maintain visual contact with another person at all times.
- Establish hand signal communication when verbal communication is difficult. Identify one person per work group to give hand signals to equipment operators.
- Maintain secure footing at all times.
- All heavy equipment must have operational backup alarms of some type.
- Only qualified and trained personnel are to operate heavy equipment.
- Use designated chains hoists, straps, and other approved equipment to safely move heavy materials.
- Use proper manual lifting techniques. Employees are instructed to use their legs, not their back. Use the buddy system.
- Employees should never walk directly in back of, or to the side of, heavy equipment without notifying the operator of their presence and intent.
- Never use a piece of equipment unless familiar with its purpose and trained in its operation. This applies to all equipment.
- Be sure that no underground or overhead power lines, sewer lines, gas lines, or telephone lines will present a hazard in the work area.
- Get help when in doubt about a material's weight.

**A. Heavy Equipment Safety**

Heavy equipment is built for safe and economical operation, but it is only as safe as the operator. Therefore, it is the policy of Frontier to establish a heavy equipment safety performance program for the site. Heavy Equipment activities will conform to all federal standards as well as safe practices dictated by the equipment's manufacturer and established safe work procedures.

**B. Site Pre-work Inspection of Equipment**

Frontier will only use equipment that is in safe working order. All heavy equipment brought onto the site will be inspected for structural integrity, smooth operational performance, and proper function of safety devices in accordance with the manufacturer's specifications. If equipment is determined to not conform to applicable operational and safety requirements it will not be put into service until all necessary repairs are made and the Site Radiation Safety Officer releases it for service.

**C. Operator Qualifications**

Only qualified heavy equipment operators familiar with the equipment to be used will be permitted to operate the equipment. Operators for these positions will be screened by the Frontier Site Superintendent or designated representative for proven ability and experience to operate the equipment in a smooth, safe and efficient manner.

**D. Basic Heavy Equipment Operational Guidelines**

Heavy Equipment operation will be according to the manufacturer's specifications and established safe work practices. At no time will improper or unapproved equipment operation be permitted. Basic safety guidelines to be used are as follows:

- Only one individual will issue operational hand signals to the operator unless it is established that relay hand signaling for blind craning situations is required. All hand signals used will be in accordance with American National Standard Institute's (ANSI) B30.5-68 "Basic Hand Signals for Boom Equipment Operation."

E. **Safe Rigging Practices**

Construction and demolition work activities require extensive rigging capabilities. Therefore, Frontier policy dictates that a comprehensive rigging safety and inspection program be implemented. The following procedures will be enforced:

1. General Rigging Safety Inspection

Rigging components used in everyday work activities, will be inspected at least daily by members of the rigging team. If there are six or more, randomly distributed, broken wires in any one lay, or when there are three or more broken wires in any one strand of a lay, the wire rope is to be taken out of service. Wire rope will also be taken out of service when extensive kinking, crushing, bird caging, or any other damage or distortion of the wire rope occurs.

### **XIII. HOT WORK PROCEDURES**

In recognition of the potential hazards associated with hot work (cutting or welding) operations, an established procedure must be designed to minimize the risk associated with such operations. The Occupational Safety and Health Administration (OSHA), in 29 CFR 1910.252, require that procedures and training be provided for these operations. To comply with this regulation, the potential hazards, the safety precautions, personnel responsibilities, permit procedures, and general cutting and welding procedures are discussed in this plan.

As with many flame-producing operations, there are four main hazards that might be encountered while conducting hot work procedures. These include:

- fire,
- explosion,
- burns, and
- toxic substances.

#### **A. Fire**

Whenever an open flame is produced, there is a chance that some adjacent material might be exposed to the flame, and a fire might be started. All of the elements required for a fire are available during hot work - heat, flame, fuel, and oxygen. Extreme caution must be taken to prevent a fire, from the initial set-up to the post-work inspection.

#### **B. Explosion**

Explosions can be associated with a fire, but other types of explosion can occur without fire or flame. Explosions can occur by over-pressurizing a non-vented vessel. During hot work, a non-vented tank might explode due to:

- the heat expanding the gases inside the tank, causing the tank to rupture,
- the flame of the torch ignites the tank's contents, or
- a combination of the heat and flame.

#### **C. Burns**

Burns can occur in conjunction with a fire or explosion, or through careless handling of the torch and heated surfaces. Contacting the torch's flame through

carelessly leaving it lit while performing other operations or touching the surface of the metal being worked on can cause permanent damage and disfigurement, and a great deal of pain. With a little precaution and thought, most burns can be avoided.

**D. Toxic Substances**

Hot work can produce toxic substances through the combination of the acetylene, oxygen, and the surfaces being cut or welded. If the metal surfaces have been in contact with chemicals, the problem can be an even greater threat to health.

Through proper ventilation and surface cleaning, the toxic substance threat can be minimized.

**E. Safety Precautions**

Employees must always take the following safety precautions during hot work:

- wear specialized personal safety equipment,
- wear protective clothing,
- wear respiratory protection,
- practice fire prevention,
- have immediate access to fire protection equipment, and
- pay attention to air monitoring.

**F. Personal Safety Equipment**

Hot work procedures require the wearing of some specialized personal safety equipment, such as:

- welder's goggles or face shield with the correct shading factor,
- fire-resistant apron,
- fire-resistant gloves, and
- safety harness and emergency retrieval line, if required.

G. **Protective Clothing**

The following protective clothing must be worn, as a minimum, during hot work operations:

- clean uniform (free of oil or contamination),
- steel-toed safety shoes with instep guard, and
- if overhead hazards are present, a hard hat.

H. **Fire Prevention**

Whenever possible, the area should be secured so that **NO** flammable material is present within a 50-foot radius. If the flammable material cannot be removed from the 50-foot radius, fireproof barriers and/or fire watches must be present. No ignitable or hazardous materials are allowed within 35 feet of the hot work area.

I. **Fire Protection**

An adequate number of the proper type of fire extinguishers must be present before the hot work operation takes place. With the high probability of fire and/or explosion during hot work activities, immediate access to fire extinguishers is critical for safe operations.

J. **Personnel Responsibilities**

The following personnel have key roles during hot work operations:

- Site Superintendent,
- Radiation Safety Officer, and
- the employee.

1. Site Radiation Safety Officer Responsibilities

The Site Radiation Safety Officer's responsibilities include:

- providing necessary training for employees,
- assisting supervisors with compliance, and
- updating procedures as necessary.

## 2. Site Superintendent Responsibilities

The site superintendent's responsibilities include:

- providing practical training for employees,
- ensuring the safe handling and storage of equipment,
- ensuring that an adequate grounding device is present,
- ensuring that fire extinguishers are present,
- providing necessary safety equipment, and
- securing the area in which the operations will take place. No flammable materials may be present within a 50-foot radius. Combustible materials are not allowed for a 35-foot radius without fireproof barriers and/or a fire watch. No ignitable or hazardous materials present with a 35-foot radius.

## 3. Employee Responsibilities

The employee's responsibilities include:

- abiding by hot work standard operating procedures,
- immediately notifying supervisor of any hazardous conditions or defective equipment, and
- acting as a fire watch, when necessary, in the cutting or welding area.

## K. **General Cutting and Welding Precautions**

The precautions and pointers below are provided to protect equipment and/or personnel from potential fire hazards associated with welding or cutting operations:

- never use acetylene if tank pressure is at or below 7 psi,
- never lift cylinders by their valve protector caps,
- never allow cylinders to lie in horizontal positions,
- never permit grease or oil to come in contact with cylinder valves or hoses (remember, oxygen is a necessary component for any fire: keep oxygen away from combustibles),
- never expose cylinders to extreme heat, sparks, or flames,
- never transport a cylinder by dragging, rolling, or sliding it along the ground,
- IMMEDIATELY notify the supervisor of any damaged or leaking cylinders,

- before moving a cylinder, ensure that the valves are closed,
- never tamper with or attempt to repair cylinder valves,
- keep valves closed on empty cylinders,
- never use a hammer, wrench, or other tool to open cylinder valves; always open by hand,
- keep cylinder caps on when cylinders are not in use,
- always ensure that cylinders are secured (so that they cannot tip over) by attaching the cylinder to a stable object with chains or straps,
- make sure the adjusting screw is released or turned out before the cylinder valve is opened,
- never use oil in the regulator,
- never interchange oxygen and acetylene regulators,
- oxygen hoses are green or black, acetylene hoses are red,
- never use matches or lighters to ignite the torch,
- never face the regulator when opening the cylinder valve,
- never use pressurized gases to remove soil or debris,
- never lay a torch on the ground; always place it in the storage tray,
- when leaving the area, follow all shut down procedures and start over upon returning (this includes breaks, restroom and lunch breaks, as well as any time you will be more than 25 feet away from the equipment),
- never carry a lighter into the work area,
- never place anything on top of a cylinder or use the cylinder as a support or roller even if it's empty, and
- never tamper with numbers or markings on the cylinders.

#### L. **General Cutting and Welding Procedure**

1. Be sure cylinders are secured to the cart.
2. Be sure that all the proper safety equipment is in place and that all personal protective equipment is being worn.
3. Prior to attaching the regulators to the cylinders, be sure that the regulator screws are turned out. NOTE: You need to see at least three threads.
4. Momentarily "crack" the cylinder valve to blow out dust or foreign particles from the valve.
5. Make sure the inlet connection filter is clean and in place.
6. Attach regulators to cylinder valves and tighten snugly. (NOTE: Over tightening will not increase the seal, but will only damage the fittings). Remember that acetylene connections are reverse threads.
7. Check the seal with a test solution. If bubbles form, the seal is not secure. If this occurs DO NOT over tighten the regulator; instead, contact the supervisor immediately.

8. Stand to one side of the regulator and VERY SLOWLY open the cylinder valve on the oxygen all the way. Open the acetylene valve no more than 1/2 turn. Take the T wrench out of the cylinder and keep it close at hand.
9. To adjust working pressure on the oxygen, depress the oxygen lever on the torch while maintaining 40 psi on the pressure gauge.
10. A working pressure of 6 pounds should be maintained on the gauge for acetylene with the acetylene valve open on the torch. The working pressure on the acetylene regulator should never exceed 7 pounds.
11. Keep cylinders as far away from the work area as possible.
12. Open the acetylene torch head and use the striker to ignite. Adjust the flame so that only smoke is visible coming off the torch head (no particles).
13. Turn on the oxygen torch head and adjust to obtain 6 short blue flames at the torch tip. The flame should be no longer than 1/4 inch in length.
14. To cut, hold the torch tip 1/8 to 1/4 inch away to heat the metal. When the metal begins to turn to liquid, depress the oxygen lever full on and slowly advance torch in the direction you want to cut. For best results, keep the torch tip vertical or slightly angled in the direction of the cut.
15. When cutting is completed, turn off the acetylene torch first, and then the oxygen. Turn off regulators and make sure valves at the torch head are closed. Be sure to clean the tips and put the cutting rig back in its proper storage area when the work is finished.

FOR CUTTING, set the acetylene pressure at 5-7 pounds per square inch (psi), and set the oxygen pressure at 40 psi.

ALWAYS SHUT OFF ACETYLENE FIRST, otherwise the flame can make its way up the hose, into the tank and result in an explosion.

#### O. **Fire Watch Procedures**

In rare instances when combustible materials cannot be blocked or removed from the area of cutting or welding, the area supervisor establishes a fire watch. An employee designated as the fire watch acts as an observer of the area to spot fires that the welder or cutter may not see. The sole responsibility of the fire watch is to monitor the area and extinguish any small fires, which may ignite. Welding or cutting will not be allowed if the presence of flammable or combustible materials will endanger personnel.

## **XIV. EMERGENCY RESPONSE PLAN**

### **A. Elements of the Emergency Response Plan**

The Frontier Emergency Response Plan is a combination of this Radiation Health and Safety Plan, the Contingency Plan and the Frontier Training Plan. The training units developed to implement the training plan, describe specific emergency response procedures for responding to situations which result or are likely to result in a release of a hazardous substance or waste.

In addition to these plans, numerous standard operating procedures have been implemented which provide guidance for employee actions involving routine and emergency situations.

Included in these documents are the following elements:

1. Pre-emergency planning and coordinating efforts with local emergency response agencies, such as the Mesa County Sheriff's office, local ambulance services, and local hospitals.

#### **For Emergency Response Notification:**

**Call 911 for local law enforcement**

**Call 911 for fire department assistance**

**Notify Frontier Environmental Services' Superintendent by Radio.  
Or; Frontier Environmental Services, Inc. Project Specific Satellite  
Telephone: 254-387-7009**

**Notify CDPHE (Mr. Robert W. Terry) at (303) 692-3419.**

2. Personnel roles and lines of authority, such as: responsibilities of the Site Superintendent; lines of communication between the Site Superintendent and governmental agencies and the local public; reporting procedures for notification to local, state and federal governmental agencies.
3. Emergency recognition and prevention and preparedness measures.
4. Written directions and maps which identify project site location, evacuation routes; safe reporting locations for emergency response and non-essential personnel; and, evacuation signals for weather-related emergencies.

5. Fire and spill response procedures.
6. Site security, project site access and control.
7. Emergency recognition and control for site emergencies such as spills and fires.
8. Provisions for on-site first aid and off-site transfer for hospitalization and treatment.
9. Decontamination procedures.
10. Personal protective and emergency equipment.
11. Emergency recognition and prevention.
12. Plan amendment requirements.

Emergency procedures will be updated, when necessary, upon review after an emergency occurs which requires implementation of this Emergency Response Plan. The Project Manager, Site Superintendent and the Site Radiation Safety Officer will review the plan and emergency response procedures and make changes, if necessary.

Emergency response training is covered in general during the OSHA 40 training seminar. Employee emergency response training places emphasis on the recognition of Radiation Health and Safety hazards in order for employees to protect themselves and their fellow employees. Training includes methods for minimizing the risk from safety and health hazards; safe use of spill and fire control equipment; selection and use of appropriate personal protective equipment; safe operating procedures for use at the scene of an emergency response incident; techniques for coordinating with other employees in order to minimize risks, such as medical monitoring of emergency responders and injured personnel; appropriate responses to over exposure of themselves or other employees to health hazards or injury; and recognition of symptoms which may result from over exposure.

Frontier provides employees with certifications for training received from third party trainers, i.e. OSHA 40 HAZWOPER and Annual Up-Date Training. Refresher training is provided periodically and the Site Radiation Safety Officer keeps training records.

Implementation of emergency response procedures as described in the above listed documents will be based on the information available at the time of the emergency. The Site Superintendent will evaluate the incident and the site response capabilities and proceed with the appropriate steps to implement the Emergency Response Plan.

**B. Severe Weather Events**

**1. High Winds, Heavy Rains, Hail, Lightning, and Snow/Ice Storms**

If observations at the project site or information from an off-site source, such as the U.S. Weather Service or local radio or TV, indicate that a severe weather event such as lightning, heavy rain or hail storm may be in the area, the Site Radiation Safety Officer will initiate a Severe Weather Watch.

When a Severe Weather Watch is in effect the Site Radiation Safety Officer will personally notify the Site Superintendent and then all Frontier personnel, visitors and contractors in person, by telephone, by the public address system or by two-way radio of the situation.

During a Severe Weather Watch, all personnel will, from time to time, scan the horizon for lightning. If anyone observes a lightning strike near by, they will immediately report this to the Site Superintendent or the Site Radiation Safety Officer by radio. If necessary, the Site Superintendent has the authority to order any visitors, contractors or employees to leave the project.

During a Severe Weather Watch, when lightning is possible, everyone will remain near a building or within hearing of a two-way radio. If lightning, heavy rain or hail is present or expected; everyone will remain inside a vehicle or a building. Movement outside of buildings and vehicles will be kept to an absolute minimum of transfer between a building and a vehicle. Under no circumstances will anyone walk around open areas of the project.

The Site Superintendent may issue a Severe Weather Warning and order the cessation of all outside activities. If a Severe Weather Warning is announced, all personnel will return to the Project Office Trailer from work areas, secure their work area, secure and vacate heavy equipment, halt outside work and seek shelter.

When using outside structures as shelter, pay particular attention to hail and rain. Open exposure to hail can be life threatening. Golf ball size hail has fallen at the site in the past and any size hail can be dangerous. Large amounts of rain can fall quickly and the ditches will carry high volume water flows in a short period of time. Every effort should be made to seek shelter inside before using outside structures.

When the storm event has passed or the Site Superintendent determines the situation has stabilized enough to allow the continuation of normal activities, an All Clear notice will be given to all personnel, and normal activities can resume. This notice will be given in person or by two-way radio.

If a severe weather event hits the site, the Site Superintendent will account for all personnel before any activity is resumed. Everyone will assemble at the Project Office Trailer for an accounting of all employees, contractors and visitors. If anyone is not accounted for, a search will be implemented until the missing person(s) can be found.

The Site Superintendent will take precautions and implement procedures as described in this project Emergency Response Plan. Reporting notices will be given to all agencies designated in the Emergency Response Plan.

The Site Superintendent will assess the area and determine what response is needed. Any emergency response actions will proceed as described in this Emergency Response Plan.

A project management team comprised of the Site Superintendent, project engineer and Site Radiation Safety Officer will inspect the site for hazards and needed remedial activities. The team will develop a corrective action plan to clean and repair the project site.

If there has not been an off-site release or an on-site spill of waste, and if there are no fires, the Site Superintendent will direct personnel to establish clean up crews to clear away debris, repair structures or equipment and prepare the site to return to normal operating activities.

Reports will be drafted, submitted to the Project Manager and subsequently filed with the respective agencies in accordance with permit requirements.

## **XV. HAZARD ANALYSIS, ASSESSMENT, AND CONTROL**

### **A. Hazard Analysis**

Hazards are defined as situations where there exists the potential for harm to human health or the environment. Hazard Analysis is a comprehensive analysis of processes, practices and equipment, which will identify potential hazards and generate recommendations, which will reduce the potential for the hazards to become a detriment to human health and the environment. At Frontier the Site Radiation Safety Officer is responsible for managing the hazard analysis process. These responsibilities include:

- initiating Hazard Analysis requirements in conjunction with safe work practices,
- scheduling and coordinating Hazard Analysis activities,
- obtaining toxicological, industrial hygiene or other relevant data as necessary,
- assisting in implementing recommendations,
- reviewing Hazard Analysis projects to ensure they are carried out and fully documented, and
- providing information to Frontier management.

### **B. Hazard Assessment**

The primary type of waste to be managed by Frontier personnel at the Davis Mill Site will be naturally occurring radioactive material. The radionuclides present at the Davis mill site are limited to uranium and its decay products. Natural uranium (U-nat) consists of three isotopes: U-238, U-234, and U-235.

The health consequences of exposure to these types of materials have been evaluated by MFG, Inc. Health Physicist Janet A. Johnson, Ph.D., CHP, CIH. A Radiation Safety Plan has been prepared for the Davis Mill Site and is included as Attachment A.

## **XVI. JOB SAFETY HAZARD ANALYSIS PLAN**

This program, in conjunction with the rest of the Frontier Radiation Health and Safety Plan, is designed to identify, evaluate and control safety and health hazards relating to specific jobs for the purpose of employee protection. The Job Safety Hazard Analysis Plan will help Frontier management and employees improve individual job safety and the general operation of a project.

Job Safety Analysis will develop information, which will provide detailed knowledge of individual jobs comprising the work performed by Frontier. As a result, safety and training will improve, accidents and injuries will decrease and full regulatory compliance can be realized.

Managers and supervisors are responsible for establishing and maintaining safe work practices, methods and conditions in their areas.

There are a number of things that managers and supervisors can do to carry out this responsibility, such as training, safety surveys, strict enforcement of safety standards, accident investigations, setting an example. Basic to all these activities is a thorough knowledge of all of the individual jobs performed in each area, knowledge of essential job tasks, the accident hazards involved and the safety procedures to be followed for each task.

By developing Job Safety Hazard Analysis, this knowledge can be acquired and put to use.

A Job Safety Hazard Analysis is an evaluation of a sequence of work procedures (tasks or separate activities) that outlines (a) the Radiation Health and Safety hazards that do or can exist, (b) the actions which could result in accidents and (c) the safe procedures to be followed which will eliminate or control such hazards so the work goal can be accomplished safely.

There are certain important assumptions to be made:

- Every job can usually be improved. Jobs, which are revised after Job Safety Hazard Analysis, should improve because of changes in the process, materials and equipment.
- It is important to work with people to change their work methods and behavior. It is important to help employees make improvements in their job.

- Those that do the job can make significant improvements. No one knows the job better than the employee who performs the work.

Four steps are essential to the development of Job Safety Hazard Analysis:

1. Selecting the job to be analyzed.
2. Breaking the job down into tasks.
3. Identifying potential hazards in each task.
4. Development of solutions to eliminate the hazards.

The Site Radiation Safety Officer will determine which jobs have priority for hazard analysis. Jobs selected may have certain characteristics or result in the collection of pertinent information, such as accident and injury statistics; occurrence of serious accidents; repetitive jobs performed by multiple employees; new jobs; 'bottle neck' jobs where material or work piles up and interferes with safe and continuous operations; jobs which are critical to the whole operation; jobs which generate frequent complaints from employees; team or group jobs; isolated hazardous jobs; seasonal, infrequent or non-routine jobs; manual handling or materials handling jobs.

The Site Radiation Safety Officer will draw from a variety of methodologies and obtain the help of different individuals in order to analyze a particular job.

#### **A. Observation and Discussion Method**

Members of management, supervisors or other employees while in progress will make observations of the selected job. These observations will help describe each task and thus contribute to an understanding of the specific hazards involved. Observers will ask questions of the employee performing the work and discuss special methods, problems, difficulties or other individual aspects of the job.

The discussion method may involve a group of interested persons, supervisors, senior employees, safety personnel or any others involved in the job analysis project. These people will meet and discuss the particular job and complete the Job Safety Hazard Analysis away from the immediate job location. This method will tap the experience of many more people, provide wider participation, develop greater acceptance of the results and can be done at times when the process is not in operation. However, some important parts of the job may be missed and therefore certain hazards may not be included in the analysis.

## B. Recall and Check Method

Participants would prepare their analysis material individually or as a group, followed by checking their results at the job location.

Any combination of these methods may be used. The Site Radiation Safety Officer will select the one that works best.

The initial approach to the Job Safety Hazard Analysis will involve dividing the job into individual tasks or steps. Care must be exercised not to break the job down into steps so small as to be meaningless nor so broad that some of the important steps are missed.

For example, assume someone was given a small tree for planting in the yard. How should the job be broken down? It could be (1) dig hole; (2) plant tree. In this analysis the steps listed are too broad. They do not describe any specific work tasks that would reveal hazards. On the other hand, it could be listed (1) pick up shovel; (2) position shovel; (3) put foot on shovel; (4) push shovel with foot, etc. Broken down this way the analysis is too detailed. Between these two extremes is a satisfactory division of job elements that makes sense. Such a breakdown would be as follows: (1) bring tools; (2) dig hole; (3) prepare hole; (4) position tree in hole; (5) back fill, tamp, water; (6) brace tree; (7) return tools. This analysis is a good breakdown, not too many or too few steps. Each one is an action step that can stand by itself. In each case something was done. These task descriptions would be listed in column number one of the Job Safety Hazard Analysis form. This form is included in the Table of Documents.

The next step is to identify all of the accident possibilities inherent in each step. List them in column number two of the Job Safety Hazard Analysis form, opposite the appropriate step. In searching out the possible hazards consider every possible indication of a health or safety hazard or cause of an accident. Appropriate questions to ask are:

1. What machine hazards are there?
2. Is the employee exposed to electrical hazards?
3. What falling or material handling hazards are there?
4. Is there exposure to dusts, fumes, chemicals, heat or gases?
5. What hazards exist from hand tools or portable equipment?

6. Is the work area uncluttered with work surfaces dry and free of tripping or other safety hazards?
7. Can the employee be struck by or contacted by anything?
8. Can the employee get caught in, or between anything?
9. Is there a potential for heat stress, cold stress or severe weather hazards?
10. Are there special personal protective equipment requirements?
11. Are there any confined space, lock-out/tag-out or hot work hazards?
12. Are there special air monitoring requirements?
13. What hazardous materials are used or present and have the applicable MSDSs been reviewed?
14. Is there a need for special emergency response equipment for fire or spill control?
15. Will special decontamination procedures be required?
16. What ergonomic problems or considerations are associated with operation of equipment or controls?

In making the search for possible hazards, do not overlook the use of information about accidents that have occurred on this or similar jobs before. Review the OSHA 200 form and other safety and accident reporting forms maintained by the Site Radiation Safety Officer. There is no hazard too trivial to list. Frequently, a minor hazard can produce a major accident and severe injury.

The Site Radiation Safety Officer and the affected supervisor or manager will use the above information to develop safe work practices designed to eliminate safety and health hazards and control the accident potential. These are listed in column three of the Job Safety Analysis form opposite the corresponding task and hazard. When listing these, the following questions will be asked:

1. How can Radiation Health and Safety hazards be eliminated?
2. What should the worker do to avoid accidents?

3. Exactly how should the job be done?

In determining the best method of doing a job, the following four approaches may be considered:

1. A better solution. An entirely new way of doing the job is developed which will accomplish the same goal but will eliminate hazards, be safer, improve efficiency, conserve resources, minimize waste, save time and save money. Identify the job goal and examine ways of doing the job better. Consider the use of improved personal protective equipment, new tools, materials, equipment and methods.
2. Engineering revision of existing methods. A better solution may not always be possible. Consideration must be given to how individual elements of the job can be improved through engineering changes. For example: relocating a valve to the operator does not have to stand in an aisle or an awkward position in order to operate it; or, installation of a conveyor so material can be mechanically or automatically transferred to or removed from a vessel.
3. Personnel requirements. Ergonomics and required physical abilities need to be evaluated. Physical requirements must be considered, such as visual acuity, suitable reach, sufficient height to accomplish the task without stretching, adequate strength and manual dexterity, and required job skills and experience.
4. Instructions and training. Determine criteria for classroom instruction and on-the-job training. Incorporate findings into the established classroom and on-the-job training program.

The Site Radiation Safety Officer will work with project facility management and supervisors to implement the results of the job analysis. After an analysis is completed, the findings will be incorporated into the applicable classroom and on-the-job training programs.

Copies of the Job Safety Hazard Analysis will be maintained in the general work areas for reference by employees.

Periodic reviews by the Site Radiation Safety Officer will ensure that job revisions have been implemented and are effective in reducing and eliminating hazards and accidents.

Frontier Environmental Services, Inc.  
Project  
Organization Chart  
CDPHE Gateway, Colorado  
Davis Mill Project

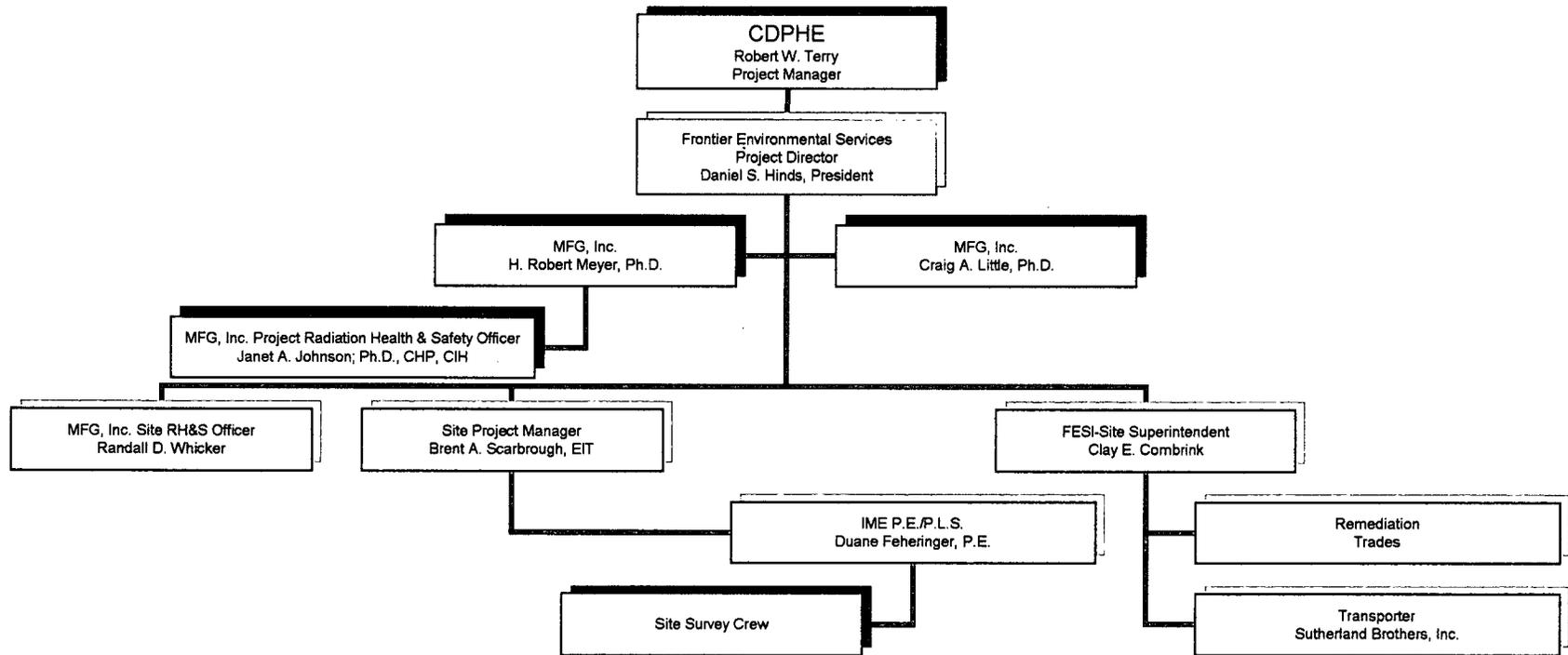


Figure 1.1

**ATTACHMENT A**

**RADIATION SAFETY PLAN**

**GEORGE E. DAVIS MILL SITE CLEANUP PROJECT**  
**GATEWAY, COLORADO**

MFG, Inc.  
3801 Automation Way  
Fort Collins, Colorado 80525

Colorado Department of Public Health and Environment  
Radioactive Materials License No. Colo. 1010-02

## ATTACHMENT A

### RADIATION SAFETY PROGRAM

#### Davis Mill Project Gateway, Colorado

## 1.0 INTRODUCTION

The George E. Davis Mill site in Gateway, Colorado (the Site) has elevated concentrations of naturally occurring radioactive materials in the form of uranium and its decay products in exposed surface materials, sub-surface materials and the remaining portions of the mill structure and debris. The Davis Mill reclamation project (the Project) will be performed by Frontier Environmental Services, Inc. (FESI) under a contract with the Colorado Department of Public Health and Environment (CDPHE). The work is funded by a grant from the Nuclear Regulatory Commission. The site cleanup will be conducted under CDPHE radioactive materials license Colo. 1010-2, issued to MFG, Inc. Janet A. Johnson, PhD, CHP is the MFG, Inc. Radiation Safety Officer. This Radiation Safety Program (RSP) is an attachment to the FESI Project Health and Safety Plan (HASP). All FESI, MFG, and subcontractor employees are responsible for complying with CDPHE radiation control regulations; radioactive materials license conditions, and this site-specific RSP.

### 1.1 Site History

The Site is located on Colorado State Highway 141 in the town of Gateway, Colorado. According to historical data, the mill processed uranium-vanadium ores between 1941 and 1944 (Carter Burgess 2005). The mill processed alabaster for a short period of time after the uranium-vanadium ore processing ceased. The U. S. Atomic Energy Commission issued licenses for source material possession for the purpose of processing uranium for a four year period between 1955 and 1959. The site was purchased by Robert Willis in 1962. Currently, members of the Willis family reside on the site.

The site was characterized in 2005, in accordance with a grant from the U. S. Nuclear Regulatory Commission, The results of the characterization surveys were published in a report to the CDPHE in March 2005 (Carter Burgess, 2005).

### 1.2 Radiological Characterization Results

Soil sample results showed an average Ra-226 activity concentration for samples in the impacted area is 95.4 pCi/g, with a maximum activity of 1009 pCi/g. Carter Burgess estimated the average Ra-226 activity in the soils to be excavated during remediation to be 32.7 pCi/g. The average Th-232 activity concentration in this same area was 1.44 pCi/g, a level consistent with global background. Therefore, only the U-238 decay series radionuclides are addressed in this RSP. The U-238 decay series radionuclides are

assumed to be in equilibrium, i.e., the concentration of each member of the decay series was assumed to be equal to the measured Ra-226 concentration.

### **1.3 Cleanup Project Summary**

The Davis Mill Site will be cleaned up by excavating soil and debris that have radionuclide activity concentrations in excess of the criteria that have been established for the Site. The soils and debris will be transported to Umetco's Uravan site for disposal. To the extent feasible and with consideration for worker safety, structures may be decontaminated by pressure washing. The excavation and cleanup will be performed by FESI.

Analytical and radiation protection services will be provided by MFG, Inc. An independent contractor will be used to haul dirt and debris from Gateway to Uravan.

## **2.0 RADIATION SAFETY PROGRAM**

The Davis Mill project will be performed under radioactive materials license Colo. 1010-1 issued to MFG, Inc. by the CDPHE. The provisions in the RSP are intended to assure compliance with CDPHE radiation control regulations and the specific conditions attached to the MFG, Inc. license and to keep radiation doses As Low As Reasonably Achievable (ALARA) as defined in the Colorado regulations and 10CFR20.

### **2.1 Radionuclides Present at the Davis Mill Site**

The radionuclides present at the Davis mill site are limited to uranium and its decay products. Natural uranium (U-nat) consists of three isotopes: U-238, U-234, and U-235. In addition, in unprocessed rocks and soils the decay products of U-238 and U-235 are generally considered to be in secular equilibrium, i.e., present at activity concentrations equal to the concentration of the parent, U-238 or U-235. (Uranium-234 is a decay product of U-238.) Uranium-235 has a natural abundance of 0.72 percent (by weight) and is present at an activity concentration of 4.5 percent of the activity concentration of U-238. Therefore, the decay products of U-235 are also assumed to be present at an activity concentration of 4.5 percent of the activity concentration of U-238. Based on the historical activities at the Site and the results of the characterization survey, the U-238 and U-235 decay products are assumed to be present in equilibrium concentrations.

As noted in Section 1.3, the average Ra-226 concentration in the soils to be excavated is 32.7 pCi/g. It is assumed that U-238 and all of the decay products are in equilibrium thus are present at concentrations equal to the Ra-226 concentration. The surface concentrations in the remaining portions of the mill structure have not been defined.

### **2.2 Radiation Safety Organization**

The Radiation Safety Organization consists of MFG, Inc.'s Radiation Safety Officer (RSO) who will act in an oversight capacity and a Site Radiation Safety Officer (SRSO) who have the following responsibilities

- Implement and monitor compliance with the Radiation Safety Program.
- Conduct radiation safety training for workers, including sub-contractors, and visitors.
- With the site Health and Safety Officer (HSO), conduct site safety meetings.
- Observe and monitor release surveys as necessary.
- Make adjustments to this RSP, in consultation with the HSO and the RSO, as necessary based on field measurements. Adjustments to the RSP must be approved by the RSO. However, where necessary to maintain radiation doses ALARA or to mitigate an immediate safety problem, the SRSO and HSO may implement such changes prior to formal approval by the RSO.

- Maintain records of radiation exposure rate measurements, personnel and equipment surveys, and worker training.

The MFG, Inc. Radiation Safety Officer is Janet A. Johnson, PhD, CHP. The Site Radiation Safety Officer will be Randy Whicker, M.S.

### 2.3 Worker Radiation Safety Training

All individuals performing work on this project will attend an initial Site Safety Meeting or Training Meeting before commencing field work. The meeting will be conducted by the S RSO (or his designee) and the HSO. The radiological portion of the initial Site Safety Meeting will address the following topics:

- Basic radiation science
  - What is radiation?
  - Types of radiation (alpha, beta, gamma)
  - Naturally Occurring Radioactive Material (NORM)
  - Units of radiation exposure and dose
  - Background radiation levels in Eastern Washington
- Biological effects of radiation
- Risk of cancer
  - Risk of genetic effects
  - Effects on the fetus
- Potential exposures on the Site
  - Inhalation
  - Ingestion
  - Direct gamma radiation
  - Ultraviolet radiation
  - Expected radiation doses
- Basic radiation protection
  - Minimize external gamma radiation exposure
  - Prevent ingestion and inhalation
- Elements of the Worker Radiation Safety Program
  - Work practices
  - Personal monitoring
  - Site-specific requirements
  - ALARA principles
- Emergency Response Procedures

Since many of the individuals who will be involved in the soil cleanup activities have received this type of training in conjunction with other projects, the amount of time spent and emphasis on specific topics will be at the discretion of the trainer.

All women of child-bearing age who may work on this project will receive additional information regarding potential effects of radiation on the fetus and responsibilities and rights of pregnant workers in accordance with CDPHE regulations.

Visitors to the work area (including observers) will be given an orientation which will include a brief description of the radiological hazards and the applicable elements of the RSP and the HASP.

Documentation of training will be kept on file at FESI and in the MFG, Inc. project file.

## **2.4 Restricted Areas**

Excavation of contaminated soils will take place within a temporary restricted area. The restricted area will be delineated with tape or other such warning device. In addition, for the purpose of this RSP, any area being excavated will be considered a restricted area. This does not include areas that may be excavated to provide clean cover or areas excavated for reasons other than soil cleanup.

## **2.5 Work Practices**

### **2.5.1 Eating, Drinking, and Smoking**

Except as required to prevent heat related illness or injury, no eating, drinking, or smoking will be allowed in the temporary restricted area of the Site or other areas being excavated. If water is to be consumed at a designated water station inside the restricted area or in an excavation area, the individual must wash his/her hands and scan them for contamination prior to handling the water bottle. However, due to the limited size of the restricted area, a water station set up outside the areas being excavated may be sufficient.

### **2.5.2 Use of Personal Protective Equipment**

The use of personal protective equipment is addressed in the HASP. It is expected that work will be performed using Level D personal protective equipment. Based on the measured radionuclide concentration in bulk soil, respiratory protection will not be necessary or advisable.

### **2.5.3 Dust Control**

To the extent feasible, excavation will be performed in such a manner as to minimize the amount of dust generated. However, the need to control generation of dust using wet methods must be evaluated against the potential safety problems associated with wet, slick surfaces.

## **2.6 Personal Monitoring**

### **2.6.1 TLD Badges/Dosimeters**

Personal monitoring devices, i.e., TLD badges will be issued to individuals working on this project directly on the site. Personal dosimeters will not be issued to contract truck drivers or visitors to the site. The potential exposures above background are very small and well below any level at which personal monitoring is required by CDPHE radiation control regulations.

Dosimeters are to be worn on the outer clothing, between the shoulders and the waist. Personal dosimeters are assigned to an individual and may not be worn by any other individual. When not in use, the TLD badges shall be stored in an area to be designated by the SRSO or HSO. Personal dosimeters should be stored in a background area.

#### **2.6.2 Urine Bioassay**

Based on the measured radionuclide concentrations on the Davis Mill Site, routine bioassay will not be necessary. The maximum estimated amount of uranium that could be taken into the body through dust inhalation is less than 0.3 mg assuming a continuous dust concentration at the nuisance dust limit of 10 mg per cubic meter. (The calculation is provided on an attached spreadsheet and in section 2.8.) The RSA, at her discretion, may require urine bioassay if site conditions change or unexpected situations arise.

### **2.7 Contamination Surveys**

#### **2.7.1 Personal Scans**

Individuals will scan hands, feet, and clothing with an alpha or beta-gamma survey meter before leaving the temporary restricted area. Scanning stations will be set up at the exit points from the restricted area. Other areas may be set up for scanning if necessary. All individuals involved in the project will be trained in the proper scanning techniques and record-keeping requirements. The SRSO or HSO will also perform random exit scans on workers.

Temporary restricted areas will be set up around areas to be excavated and will be marked with yellow tape or some other method that will remind individuals to take the necessary precautions. The exit scanning station(s) will be equipped with water and soap for decontamination of individuals if necessary.

In the unlikely event the personal scan indicates a reading above the set point on the particular instrument established by the SRSO or HSO, the individual will wash the affected area with water and soap. The area must be dried and rescanned and the process repeated if the survey meter still indicates a reading above the set point. If the meter reading is still elevated above the set point after two or three washings, the HSO or SRSO must be notified. He or she will recommend further action if necessary.

### **2.7.2 Vehicle and Equipment Scans**

Equipment and vehicles to be used on this project will be scanned for contamination prior to the start of the project and each time on leaving any restricted area. Scans will be conducted using a GM pancake probe. Vehicle scans will include at a minimum, tires, wheel wells and interior floor and seat areas where contamination may have been tracked. A measurement 50 counts per minute (c/m) above background will require further action.

It is expected that most equipment will be left on-site for the duration of the project. At the end of the project or whenever equipment goes off-site for unrestricted use, it will be scanned prior to release.

Contractor supplied trucks transporting excavated materials to Umetco's Uravan site for disposal will be scanned prior to leaving the Davis Mill Site restricted area. The scan will include tires, wheel wells and the cab floor. After completion of the project and prior to release for unrestricted use, the trucks will be scanned with the pancake probe and wipe tests will be performed to determine whether removable contamination exceeds the limits required by Colorado radiation protection regulations.

Since the radioactive materials at the Davis Mill Site are limited to uranium and its decay products, the criteria for release are 1000 d/m per 100 cm<sup>2</sup> for removable alpha activity and 5000 d/m per 100 cm<sup>2</sup> for total alpha activity. The SRSO will determine, in advance, the set points for the instruments to be used for scanning at the Site. The HSO or his designee will instruct workers in the proper techniques for scanning.

Contaminated equipment and vehicles must be decontaminated at the Site prior to release for unrestricted use. In general, pressure washing will remove soils that may adhere to equipment surfaces. The RSO will be consulted prior to use of more aggressive methods of decontamination such as sand blasting. Prior to release for unrestricted use, vehicle air filters will be scanned as a method of evaluating the potential for contamination of internal surfaces.

Wash water will be collected and analyzed prior to release to the environment. However, it may be used for dust control purposes without prior analysis.

### **2.8 Estimated Maximum Dose From Inhalation of Airborne Radionuclides**

Because the work will be performed outdoors, radon decay products attributable to the Site will not build in to concentrations that will be of concern for worker radiation doses. A RESRAD analysis of potential radon dose to an occupant of the site spending 100% of his or her time outdoors for a period of 3 working months (510 hours or an occupancy factor of 0.06), was less than 0.02 mrem.

The dose from radionuclides in airborne particulates was calculated assuming a dust concentration at the nuisance dust limit of 10 mg/m<sup>3</sup> and an average bulk U-238 concentration of 32.7 pCi/g in soil. The radionuclide concentrations in airborne dust were assumed to be equal to the concentrations in soil. All decay products were assumed to be in equilibrium with the parent and U-235 was assumed to be present at a mass

concentration of 0.7%. The estimated dose was approximately 10 mrem for a three month exposure at a breathing rate of 10 m<sup>3</sup> per day. The most recent ICRP dose coefficient for the least soluble form of each radionuclide was used in the calculations (ICRP 2001) (See attached spreadsheet.) This is a very conservative dose calculation. In fact, dust control measures will be instituted to reduce airborne radionuclide concentrations well below the nuisance dust level.

Therefore, inhalation of airborne radionuclides will not contribute significantly to the radiation dose to workers or members of the public. Direct gamma radiation is expected to contribute the largest fraction of the worker dose.

### **3.0 TOXICITY PROFILE**

#### **3.1 Biological Effects of Ionizing Radiation**

The principal health hazard from chronic exposure to ionizing radiation is increased risk of cancer. Ionizing radiation has been shown to be a carcinogen at high doses; however, there are no data to show that negligible doses of radiation, in the range of radiation doses anticipated for workers performing activities associated with the Davis Mill Site Remediation Project, cause cancer. The estimated risks of cancer for low doses of radiation are based on risk coefficients derived from human epidemiologic studies of atomic bomb survivors and, in the case of radon decay products, underground miners. The Health and Safety Plan (HASP) was developed assuming that low doses of radiation can cause cancer and that the risk is proportional to the dose.

Other potential adverse health effects of chronic radiation exposure include increased risk of genetic mutations and adverse reproductive effects. Genetic effects have been observed in experimental animals but not in human populations. Potential effects on the fetus due to irradiation in utero at relatively high levels (greater than 1 rem) include increased risk of childhood leukemia and spontaneous abortion. The human epidemiological data show an increased risk of childhood leukemia in children of women exposed to diagnostic x-rays during pregnancy. Increased risk of spontaneous abortion has also been observed in women who are exposed to x-rays during pregnancy.

Alpha, beta, and gamma radiation, commonly termed "ionizing radiation", are emitted by uranium decay series radionuclides. Alphas and betas are particulate radiation, i.e. they have mass. Gamma radiation is a form of electromagnetic radiation, similar to x-rays, visible light, and ultraviolet radiation. Of the types of radiation in the electromagnetic spectrum, only x-rays and gamma rays have sufficient energy to ionize atoms; hence they are also termed ionizing radiation.

Alpha radiation penetrates only very short distances, less than 0.1 mm in tissue; thus alpha particles are not hazardous outside of the body since all of the energy of the alpha radiation is absorbed by the layer of dead cells on the skin surface. However, alpha emitting radionuclides which are taken into the body by inhalation or ingestion can cause damage by coming in direct contact with live cells. Beta radiation is somewhat more penetrating than alpha radiation and can damage the growth layers of the skin. Gamma

rays, like x-rays, are very penetrating, and, depending on the energy can reach any organ in the body.

### **3.2 Radio-Toxicity of Uranium**

All of the uranium isotopes are low specific activity alpha-emitting radionuclides. Uranium-238, because of its very low specific activity, i.e. ratio of activity to mass and high relative abundance exhibits chemical toxicity as well as radio-toxicity.

Thorium-234 and Pa-234 are short-lived beta-emitting decay products of U-238. The target organ for these nuclides is the lower large intestine.

### **3.3 Radio-Toxicity of Th-230 and Ra-226**

The target organ for ingested alpha emitters Th-230 and Ra-226 is the bone surface; for inhaled Th-230, the bone is the target organ; for inhaled Ra-226, the lung is the target organ. Both nuclides have long physical half-lives and, when incorporated into bone, long biological half-times.

The gamma radiation from the uranium decay series, which presents an external radiation hazard, is generally attributed to Ra-226; however, Ra-226 emits a low energy gamma photon in only a very small percentage of its decays and contributes little to the gamma radiation exposure. The gamma radiation attributed to Ra-226 actually comes from the decay of Pb-214 and Bi-214, short-lived beta emitting Ra-226 decay products. These two nuclides account for more than 90 percent of the gamma radiation from the uranium decay series.

### **3.4 Radio-Toxicity of Rn-222 and its Decay Products**

Radon-222 is a noble gas and presents little health hazard by it. However, when it decays it forms several short-lived decay products, Po-218, Pb-214, Bi-214, and Po-214. These nuclides are generated in air as individual atoms which attach to existing aerosols which may then be deposited in the lung. Inhalation of radon decay products has been demonstrated to cause lung cancer in underground miners. The risk is a function of total dose and dose rate. Epidemiologic data for other populations are not conclusive; however, it is prudent to assume that, in general, inhalation of radon decay products causes an increased risk of lung cancer. Smoking and radon are synergistic, i.e. smokers have a greater risk of developing lung cancer due to radon decay product exposure than do non-smokers. No other adverse health effects attributable to inhalation of radon and its decay products have been demonstrated.

Lead-214 and Bi-214 emit gamma radiation as well as beta particles. As noted earlier, they account for more than 90 percent of the gamma radiation from Naturally Occurring Radioactive Material. The whole body is the "target organ" for external gamma radiation.

### **3.5 Radio-Toxicity of Pb-210 and its Decay Products**

Lead-210 is a beta-emitter with a half-life of 22 years. It accumulates in the environment from the decay of Rn-222 in the atmosphere. The target organ for Pb-210 is the bone.

The Pb-210 beta particle has a very low energy, thus produces little damage to tissue. However, Pb-210 decays to a short-lived beta emitter, Bi-210, which, in turn, decays to Po-210, an alpha emitter. Bismuth-210 beta particles have moderate energies. As noted previously, alpha and beta radiation can damage tissues in which the radionuclides are deposited. Radiation effects attributed to Pb-210 actually result from the decay of Bi-210 and Po-210.

Polonium-210 decays to stable Pb-206, ending the U-238 decay series.

### **3.6 Effective Dose**

The target organs and the doses attributable to these uranium decay series radionuclides are a function of their chemical as well as their radiological characteristics. The target organ and the biological half-life of a nuclide are determined by its chemical form. The effective, thus the increased risk of cancer, associated with internal deposition (ingestion or inhalation) of these radionuclides is a function of the amount and distribution of energy deposited in tissue, the length of time the nuclide remains in the organ, and the radio-sensitivity of the organ. Effective dose coefficients for intakes of radionuclides have been derived by the International Commission on Radiological Protection and are published in ICRP Publications 68 (ICRP, 1994) and 72 (ICRP, 1996).

The effective dose from direct gamma radiation is a function of self-shielding of body organs. Due to the nature of the material present at the site and the activities associated with the characterization survey, negligible ingestion or inhalation of radionuclides is expected on this project. Therefore, the only significant contributor to effective dose will be the direct gamma radiation. The direct gamma radiation dose will be measured for individuals performing the work either by survey meter readings or personal dosimetry.

### **3.7 Regulatory Standards**

#### **3.7.1 Radiation Dose Limit**

The Colorado radiation control regulations specify that no worker should receive more than 5,000 mrem effective dose, including doses from external sources of radiation and internally deposited radionuclides, per year. The total dose to any worker involved in the mill site remediation activities is expected to be less than 100 mrem above background.

#### **3.7.2 ALARA Principle**

The system of radiological protection recommended by the International Commission on Radiological Protection (ICRP) incorporates the principle that doses should be kept as low as reasonably achievable (ALARA), economic and social factors being taken into account. The WDOH regulations define ALARA as "making every reasonable effort to maintain exposures to radiation as far below the dose limits...as is practical consistent with the purpose for which the licensed activity is undertaken, taking into account the state of technology, the economics of improvements in relation to benefits to the public health and safety, and other societal and socioeconomic considerations, and in relation to the utilization of nuclear energy, ionizing radiation, and radioactive materials in the public interest." This RSP has been designed to keep radiation doses ALARA.

### **3.8 Basic Principles of Radiation Protection**

#### **3.8.1 Protection Against External Radiation**

The dose to workers on this project would come almost entirely from external gamma radiation. In general, gamma radiation doses can be minimized by:

- 1) Reducing the time spent in the vicinity of the source or in areas with the highest exposure rates (TIME)
- 2) Staying as far from the source as practical (DISTANCE)
- 3) Placing a shield between the source and the receptor (SHIELDING)

Only the first of the three methods of reducing external radiation dose can be practically applied on this project. However, it should be noted that heavy equipment provides a shielding factor of approximately two, meaning that approximately half of the potential exposure is prevented if the equipment is between the worker and the source. Work practices have been developed to take exposure time into account, e.g., workers will take breaks in areas where exposure rates are close to background levels. To the extent practical, office and laboratory facilities will be located in areas where the measured exposure rates are close to background levels.

#### **3.8.2 Protection Against Internal Dose**

The three major routes of intake for radioactive materials are inhalation, ingestion, and absorption through the skin. As noted previously, the potential for exposure from ingestion or inhalation of impacted soil is very low. Absorption through the skin is not a significant route of exposure for naturally occurring radionuclides due to their chemical form which is not likely to be absorbed through intact skin.

### **4.0 REFERENCES**

Carter Burgess. 2005. Site Characterization Summary Report, George E. Davis Mill Site, 43210 Highway 141, Gateway, Mesa County, Colorado. March 25.

Colorado Department of Public Health and Environment (CDPHE). 2006. Rules and Regulations Pertaining to Radiation Control.

International Commission on Radiological Protection (ICRP). 2001. ICRP Database of Dose Coefficients: Workers and Members of the Public. Version 2.01. 2000.

U.S. Federal Code of Regulations. 29 CFR 1910.96

U.S. Federal Code of Regulations. 10 CFR 20.

**ATTACHMENT D**

**STATE OF COLORADO  
DEPARTMENT OF TRANSPORTATION  
SPECIAL USE PERMIT**

**SPECIAL USE PERMIT**  LANDSCAPE  GENERAL CONSTN  SURVEY  OTHER (SITE REMEDIATION)

PERMITTEE Name <b>FRONTIER ENVIRONMENTAL SERVICES / Katherine B. Willis</b>	DEPARTMENT USE ONLY Date issued <b>APRIL 3, 2006</b>
Address <b>5171 WARD ROAD, UNIT 1 / 43201 State Hwy 141</b>	Permit # <b>12,996</b>
<b>WHEAT RIDGE, COLORADO 80033-1940 / Gateway, Colorado 81522</b>	S.H.# <b>141A M.P. 110.95</b>
Telephone <b>303-234-9350/303-908-7577</b> Representative: <b>DANIEL HINDS</b>	District <b>03</b>
	Section <b>02</b>
	Patrol <b>04</b>

**NOTICE TO PERMITTEE:** You must notify owner or operator of underground utility facilities at least two (2) business days prior to making or beginning excavations in the vicinity of such facilities, as required under Section 9-1.5-103, Colorado Revised Statutes. CALL UTILITY NOTIFICATION CENTER OF COLORADO (UNCC), 1-800-922-1987, FOR MARKING OF MEMBER UTILITIES. CONTACT NON-MEMBER UTILITIES DIRECTLY

**ACTIVITY DESCRIPTION (Furnished by Permittee)**

NATURE OF ACTIVITY **ENVIRONMENTAL SITE REMEDIATION OF THE DAVIS MILL SITE. REMOVAL OF NORM MATERIALS AND OTHER WASTE DEBRIS.**

LOCATION: State Hwy. No. **141A** County **MESA** City/Town **GATEWAY**

Mile point(s) **110.95** Intersecting Feature(s): **43201 HIGHWAY 141**

Other Location Information **LATITUDE 38/40/47, LONGITUDE 108/58/42**

ADDITIONAL REMARKS **ACCESS TO CLEANUP SITE WILL BE THROUGH THE GATEWAY CDOT MAINTENANCE YARD. WORK MAY INCLUDE REMOVAL AND REPLACEMENT OF UP TO APPROXIMATELY 800 LINEAR FEET OF CDOT YARD FENCE.**

**SPECIAL PROVISIONS (completed by the Department) The Special Provisions are terms and conditions of this permit.**

Any work shall only be in accordance with the special provisions and other applicable details as set forth in this permit and its attachments.

The CDOT Inspector is: **JOHN DAVID / ROY COLOMBO** Telephone **970-248-7360 / 970-931-2879**

Work is to be completed on or before: **JULY 31, 2006** or within \_\_\_\_\_ days, (as applicable)

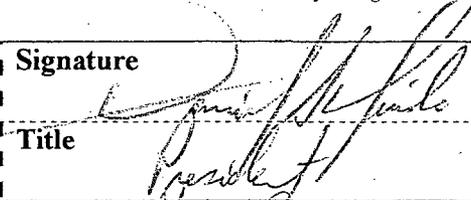
Work time restrictions: **SEE ATTACHED SPECIAL PROVISIONS # 2, 3, 4, 24**

(ALSO SEE ATTACHED STANDARD PROVISIONS, AND ADDITIONAL SPECIAL PROVISIONS), (TRAFFIC CONTROL MUST CONFORM TO THE MUTCD)

Other: \_\_\_\_\_

Permittee is prohibited from commencing any activity within highway ROW prior to issuance of a fully endorsed and validated permit. Permit, insurance certificate(s), and traffic control plan must be available on site during work. High visibility vests are required at all times during working hours.

- Your request to perform the work as described above is granted subject to the terms and conditions of this permit, including the Standard and Special Provisions as shown on the permit and all attachments hereto.
- To the extent authorized by law, the Permittee shall indemnify, save, and hold harmless the State, its employees and agents, against any and all claims, damages, liability, and court awards including costs, expenses, and attorney fees incurred as a result of any act or omission by the Permittee, or its employees, agents, subcontractors or assignees pursuant to the terms of this permit.
- Failure by the Permittee to comply with any of the included terms or conditions may subject this permit to suspension or cancellation, at the discretion of the Department of Transportation.
- THIS PERMIT IS NOT VALID UNTIL FULLY ENDORSED BY ALL PARTIES, WITH DATE OF ISSUE AFFIXED BY AN AUTHORIZED REPRESENTATIVE OF THE DEPARTMENT. A FULLY EXECUTED COPY OF THIS PERMIT MUST BE ON FILE AT THE TRANSPORTATION REGION OFFICE.
- In accepting this permit the undersigned, representing the Permittee, verifies that he or she has the authority to sign for and bind the Permittee, and that he or she has read, understands and accepts all the included conditions.

Attested	Date	Signature	Date
			<b>4/6/2006</b>
Title		Title	
		<b>President</b>	
COLORADO DEPARTMENT OF TRANSPORTATION Chief Engineer	By		Date of issue
		<b>Regional Transportation Director or Designee</b>	<b>4/3/06</b>

## STANDARD PROVISIONS FOR UTILITY and OTHER PERMIT OPERATIONS

The Standard Provisions are terms and conditions of this permit Effective May 2001

Utility work authorized under this permit shall comply with the requirements of CDOT Utility Manual, and applicable federal, state, local, and industry rules and regulations.

Construction of any portion of the highway facility, including the pavement structure, subsurface support, drainage, landscaping elements, and all appurtenant features, shall comply with the provisions of the CDOT Standard Specifications for Road and Bridge Construction, and with the Colorado Standard Plans (M & S Standards).

24-10-114 CRS = Section 24-10-114, Colorado Revised Statutes 1973, as amended

ROW = Right of Way

### COMMENCEMENT AND COMPLETION

Work on highway ROW shall not commence prior to issuance of a fully endorsed and validated permit.

Permittee shall notify the CDOT inspector: 1) 2 working days before commencing work on ROW; 2) When suspending operations for 5 or more working days; 3) 2 working days before resuming suspended work; and 4) Upon completion of work.

Work shall not proceed beyond a completion date specified in the Special Provisions without written approval of the Department.

### PLANS, PLAN REVISIONS, ALTERED WORK

Plans or work sketch (EXHIBIT A) are subject to CDOT approval. A copy of the approved plans or sketch must be available on site during work.

Plan revisions, or altered work differing in scope or nature from that authorized under this permit, are subject to CDOT prior approval. Permittee shall promptly notify the CDOT inspector of changed or unforeseen conditions, which may occur on the job.

### INSURANCE

Permittee shall procure and maintain general public and auto liability and property damage insurance covering the operations under this permit, in the amounts specified in 24-10-114 CRS. Policies shall name the State of Colorado as an additional insured party. Like coverage shall be furnished by or on behalf of any subcontractors. Certificates of insurance showing compliance with these provisions shall be attached to and made a part of this permit; copies must be available on site during work.

### WORK WHERE DEPARTMENT LACKS AUTHORITY

Utility work within municipal boundaries (pursuant to 43-2-135 CRS), on certain public lands, or on private property, may require separate approval of the appropriate jurisdictional agency or property owner.

### INSTALLATIONS ON FREEWAYS

CDOT may permit utility accommodations on freeways, including but not limited to the Interstate System, only in accordance with Utility Manual provisions. Special case exceptions as defined therein may be permitted only in accordance with FHWA-approved Departmental policy.

### JOINT USE ALTERNATIVES

As directed or approved by CDOT, if necessary for the safe and efficient use of the ROW, Permittee shall utilize joint use facilities such as the placement of two or more separate lines in a common trench; or attachment to the same overhead support. The Permittee will be responsible for proper coordination with other affected utilities.

### ATTACHMENT TO HIGHWAY STRUCTURES

Permittee is responsible for designing structure attachments, subject to the approval of the CDOT Staff Bridge Design Engineer.

### DRAINAGEWAYS AND WATERCOURSES

The flow of water shall not ever be impaired or interrupted. Where possible, crossings of ditches, canals or water-carrying structures shall be bored or bridged beneath. Irrigation ditch or canal crossings require approval of the ditch company or owner. Permittee shall repair damage to any drainage facility to the satisfaction of the owner.

### TRAFFIC CONTROL

Whenever the work will affect the movement or safety of traffic, Permittee shall develop and implement a traffic control plan, and utilize traffic control devices as necessary to ensure the safe and expeditious movement of traffic around and through the work site and the safety of the utility work force. High visibility vests shall be worn at all times during work.

The traffic control plan and the application of traffic control devices shall conform to the Manual on Uniform Traffic Control Devices and Colorado Supplement thereto, and with the Department's traffic signing Standard Plans S 630-1 and S 630-2.

Permittee's traffic control plan is subject to CDOT approval prior to commencing work on highway ROW. A copy of the approved traffic control plan must be available on site during work.

### CLEAR ROADSIDE CONSIDERATIONS

CDOT is committed to provide a roadside area that is as free as practical from nontraverseable hazards and fixed objects ("clear zone"). New above ground installations may be permitted within the clear zone only upon a showing that no feasible alternate locations exist. Permittee must utilize appropriate countermeasures to minimize hazards.

Permittee shall remove materials and equipment from the highway ROW at the close of daily operations. The traffic control plan must include protective measures where materials and equipment may be stored on ROW.

Protection of open trenches and other excavations within highway ROW shall be addressed in the Permittee's traffic control plan.

Permittee agrees to promptly undertake mitigating or corrective actions acceptable to the Department upon notification by CDOT that the installation permitted herein has resulted in a hazardous situation for highway users.

### GENERAL CONSTRUCTION REQUIREMENTS

Work shall not be performed at night or on Saturdays, Sundays, or holidays without prior authorization or unless otherwise specified in this permit. CDOT may restrict work on ROW during adverse weather conditions or during periods of high traffic volume.

Those areas within ROW which must be disturbed by permit operations shall be kept to a practical minimum.

Permittee shall not spray, cut, or trim trees or other landscaping elements within highway ROW, unless such work is otherwise specified in this permit, or clearly indicated on the approved plans.

Cleated or tracked equipment shall not work on or move over paved surfaces without mats.

Material removed from any portion of the roadway prism must be replaced in like kind with equal or better compaction. Segregation of material is not permitted.

The utility facility shall be of durable materials in conformity with accepted practice or industry standards, designed for long service life, and relatively free from routine servicing or maintenance.

Construction or compaction by means of jetting, puddling, or water flooding is prohibited within all highway ROW.

Thrust blocks are required on all vertical and horizontal bends in pressure pipes.

Meters shall not be placed on highway ROW except within corporate limits where municipal regulations allow such use.

### ALIGNMENT, COVER, CLEARANCE

Location and alignment of Permittee's facilities shall be only as specified in this permit or as otherwise indicated in the approved plans or work sketch (EXHIBIT A).

Parallel installations will not be permitted within roadways (including curbing and/or shoulders) or median areas, except within corporate boundaries, subject to municipal regulations.

Parallel installations should be located as near as practicable to the ROW line. Crossings shall be as nearly perpendicular to the highway as feasible.

Where no feasible alternate locations exist, parallel installations may be permitted along roadside areas within 15 feet from edge of shoulder or back of curb. In these cases, the facility must be so located and safeguarded as to avoid potential conflict with necessary highway appurtenances (signs, guard rail, delineators, etc.).

Parallel installations shall follow a uniform alignment, wherever practical. Due consideration must be given to conserving space available for future utility accommodations. The standard allowable deviation from the approved horizontal alignment is  $\pm 18$  inches.

Minimum cover shall conform to the Special Provisions. Normal specified cover will be 48 inches or greater; reduced cover may be approved where site conditions warrant, subject to other safeguards as may be specified or approved in the permit.

Minimum overhead clearance shall conform to the Special Provisions, consistent with Utility Manual criteria.

#### PAVEMENT CUTS AND REPAIRS

Paved surfaces shall not be cut unless otherwise specified in this permit. No more than one half the width of the roadbed may be opened at a time, when otherwise permitted. Pavement shall be sawed or wheel-cut to a neat line.

Pavement shall be replaced to a design equal to or greater than that of the surrounding undisturbed pavement structure. Pavement repair shall conform to the Special Provisions or the approved plans.

#### BORING, JACKING, ENCASEMENT

Unless otherwise specified, buried crossings shall be bored or jacked beneath the roadway, at least from toe of slope to toe of opposite slope.

Portals for untruncated crossings more than 5 feet in depth shall be bulk headed. Minimum lateral dimension from portal to edge of pavement is 6 feet, but in any case shall not be less than the vertical drop from roadway surface to top of utility line.

Water jetting or tunneling is not permitted. Water assisted boring may be permitted as determined by the CDOT Inspector.

Boring shall not exceed 5 percent oversize. Resultant voids shall be grouted or otherwise backfilled, subject to CDOT approval. Ends of bored sections shall not be covered before being inspected.

Encasement shall be consistent with Utility Manual provisions. CDOT may require protective casing for shallow installations or certain conduit materials. Encased crossings shall extend at least from toe of slope to toe of slope, or the full width between access-control lines on freeways, including the Interstate System.

#### INSPECTION AND ACCEPTANCE

CDOT will determine the extent of inspection services necessary for a given installation. Permittee shall attend final inspection as may be required.

Unacceptable work shall be promptly removed and replaced in an acceptable manner. Final acceptance does not relieve Permittee of maintenance obligations toward those elements of the highway facility constructed under this permit.

Final acceptance begins the two-year warranty period (see requirement under "Operation and Maintenance" below).

#### RESTORATION OF RIGHT OF WAY

Prior to final acceptance, all disturbed portions of highway right of way shall be cleaned up and restored to their original condition, subject to CDOT approval.

Seeding, sodding, and planting shall be as specified, or otherwise approved by CDOT. Construction, maintenance, and watering requirements shall conform to the CDOT Standard Specifications. Where landscape restoration must be delayed due to seasonal requirements, such work may be authorized by separate permit.

Permittee shall use only certified weed-free seed and mulch. Permittee shall clean equipment before transporting it into or out of the state to prevent the migration of noxious weeds.

#### OPERATION AND MAINTENANCE

Permittee agrees to own and maintain the installation permitted herein. The facility shall be kept in an adequate state of repair and maintained in such a manner as to cause the least interference with the normal operation and maintenance of the highway.

If any element of the transportation facility, constructed or replaced as a condition of this permit, fails within 2 years due to improper construction or materials, Permittee shall make all repairs immediately as notified in writing by CDOT.

Routine, periodic maintenance and emergency repairs may be performed under the general terms and conditions of this permit. CDOT shall be given proper

advance notice whenever maintenance work will affect the movement or safety of traffic. In an emergency, the CDOT Region office and the State Patrol shall immediately be notified of possible traffic hazards. Emergency procedures shall be coordinated beforehand, where possible.

Maintenance activities requiring new excavation or other disturbance within highway ROW may require separate permit.

Where highway construction or maintenance operations so require, Permittee will shut off lines, remove all combustible materials from the highway right of way, or provide other temporary safeguards.

Should any permitted facilities be abandoned, Permittee agrees to promptly notify the CDOT region office and to remove any or all portions of such facilities, as may be directed by CDOT.

#### UNDERGROUND UTILITY LOCATION ASSISTANCE

Permittee may be required to identify the installation with suitable markers, of a type and at locations as specified or otherwise approved. Permittee shall maintain markers for the life of the installation.

Warning ribbon and/or detection wire may be required for buried facilities. "As Constructed" plans showing lines and grades will be furnished to CDOT by the Permittee as directed.

Owners of underground facilities shall participate in a notification association pursuant to 9-1.5-105 CRS.

#### ADJUSTMENTS DUE TO HIGHWAY CONSTRUCTION

If for any transportation purpose it becomes necessary to remove, adjust, or relocate this facility, Permittee will do so promptly, at no cost to the CDOT except as provided by law, upon written notice from CDOT and in accordance with any permit issued to cover the necessary work.

#### SUSPENSION AND CANCELLATION

The CDOT inspector may suspend operation due to: 1) Non compliance with the provisions of this permit; 2) Adverse weather or traffic conditions; 3) Concurrent transportation construction or maintenance in conflict with permit work; or 4) Any condition deemed unsafe for workers or for the general public. Work may resume when grounds for suspension no longer exist.

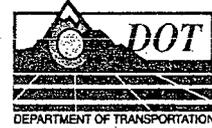
This permit is subject to cancellation due to: 1) Persistent noncompliance with permit provisions; 2) Abandonment or transfer of ownership; 3) Superseded by new permit covering the same installation; or 4) Conflict with necessary planned transportation construction. Permittee must promptly terminate occupancy upon notice of cancellation of permit, unless a new permit is applied for and granted.

Where Permittee does not fulfill an obligation to repair or maintain any portion of the highway facility, or control and safely maintain the flow of traffic thereon, CDOT reserves the right, in lieu of canceling this permit, to accomplish the required work by any other appropriate means, and Permittee shall be liable for the actual costs thereof.

# STATE OF COLORADO

## DEPARTMENT OF TRANSPORTATION

Region 3 Traffic and Safety  
222 South 6<sup>th</sup> Street, Room 100  
Grand Junction, Colorado 81501  
(970) 248-7230 FAX: (970) 248-7294



<u>12,996</u>	<b>Permit No</b>
<u>141A</u>	<b>Highway No</b>
<u>110.95</u>	<b>Mile Marker</b>
<u>3204</u>	<b>Patrol No</b>

### SPECIAL PROVISIONS FOR SPECIAL USE PERMIT – SPILL CLEANUP

THE SPECIAL PROVISIONS ARE TERMS AND CONDITIONS OF THIS PERMIT

#### CDOT IS NOT A TIER ONE UNCC MEMBER

PERMITTED WORK REQUIRES PERMITTEE OR CONTRACTORS TO CONTACT CDOT, (970) 248-7230, FOR LOCATES IF ANY CDOT SIGNALS, FLASHING BEACONS, ELECTRICAL SIGNS, LUMINARIES, OR WEATHER STATIONS ARE LOCATED WITHIN 3000 FEET OF CONSTRUCTION AREA.

#### TRAFFIC CONTROL

1. Advanced warning and construction signs, flashers, barricades and flag people must conform to the Manual on Uniform Traffic Control Devices and, Colorado Supplements, and must be in place before work starts each day. *The permittee is responsible for providing traffic control plans that conforms to and meets the requirements of the Manual on Uniform Traffic Control Devices (MUTCD) and Colorado supplements.*
2. No work shall be permitted at night or on Saturday, Sunday, or holidays without prior authorization or unless otherwise specified in this permit.
3. Work hours for this permit is from one hour after sunrise to one hour before sunset.
4. All work shall cease when weather creates a safety hazard for the traveling public.
5. Permittee is responsible for the safety of the traveling public at all times when work is being done.

#### CONSTRUCTION

6. The permittee must notify the CDOT inspector no less than two (2) days prior to any work on highway right-of-way. CDOT Inspector's name or alternate contact and phone number is on the permit.
7. The complete permit for this work, including approved CDOT permit, construction and traffic control plans, will be kept at the work site at all times.

8. Forty-eight (48) hour notification must be given for the underground location of CDOT owned facilities. Phone (970) 248-7230.
9. Any damage to highway facilities, such as traffic lights, streetlights, concrete walkways, bike paths, asphalt, signing, etc, shall be repaired and reported immediately and notification must be given to the CDOT Inspector.
10. Fences removed or damaged due to this project shall be repaired or replaced in like kind to the original condition or better.
11. All excavations are to meet the requirements of OSHA (29 Code of Federal Regulations, [CFR], 1910, 29 CFR 1926).
12. The cleanup of Hazardous Material shall be performed by certified HAZWOPER personnel [29 CFR 1910.120].
13. All backfill is subject to AASHTO compaction standard T-99 / T-180 as appropriate. Compaction and materials testing reports may be required at the discretion of the Department of Transportation.
14. Material removed from any portion of Cdot property must be replaced in like kind with equal or better compaction. No segregation of materials will be permitted.
15. Areas of CDOT property disturbed during this permitted activity will be restored to the original contour and condition

16. All work and materials to meet or exceed the most current issue of the "*Colorado Department of Transportation Standard Specifications for Road and Bridge Construction*", and with the Colorado Standard Plans (M & S Standards)
17. Permittee shall provide rest room facilities for each work zone. All employees shall be allowed and encouraged to use the facilities.
18. Debris, construction materials, dirt and mud spilled or tracked onto the pavement, must be removed immediately. This includes any closed lanes. Contractor shall be required to maintain a neat and clean work site and shall be responsible for controlling dust. Any damage to the paved surface shall be repaired at once, including pavement markings.
22. The proper disposal of any soils or other material determined to be hazardous and/or contaminated, uncovered or excavated, shall be the sole responsibility of the Permittee and shall be accomplished in accordance with all applicable Federal, State and Local laws and regulations. Such clean up and disposal shall be at no cost to CDOT.
23. Copies of any and all test reports, as submitted to the Colorado Department of Public Health & Environment, shall also be provided to the CDOT Region 3 Permit Office, 222 South 6<sup>th</sup> Street, Room 100, Grand Junction, Colorado 81501.
24. The CDOT inspector may suspend operations due to (1) non-compliance with the provisions of this permit, (2) adverse weather or traffic conditions, (3) concurrent highway construction or maintenance in conflict with the permitted work, or (4) any condition deemed unsafe for the workers or for the general public. Work may resume upon disposal of grounds for suspension.

### MISCELLANEOUS

19. Permittee is prohibited from any illicit or non-stormwater discharges that are prohibited by State Water Quality Laws. If further information is necessary, CDOT shall provide a copy of the Environmental Clearances Summary. Permittee agrees that it shall be responsible for obtaining all necessary environmental clearances and permits from the U.S. Army Corps of Engineers, Colorado Divisions of Wildlife, U.S. Forrest Service, U.S. Bureau of Land Management, Colorado Department of Health and Environment and county health department before commencing any work under this permit. Permittee also agrees to assume all responsibility and liability in connection with potential environmental hazards encountered in connection with its work under this permit. The permittee must show all environmental permits and clearances to CDOT (Utility Inspector or Environmental Officer) on request and prior to construction.
20. The permittee hereby assumes, releases and agrees to indemnify, defend, protect and save the State of Colorado harmless from and against any loss of and/or damage to the property of the State of Colorado, third parties or the permittee's facilities including loss of services, loss and/or damage on account of injury to or death of any person, whosoever, arising at any time, caused by or growing out of the occupation of Colorado State Transportation rights-of-way the permittee's facilities or any part thereof, unless such loss and/or damage is the direct result of any willful and wanton act of the State of Colorado or its employees.
21. Permittee assumes all responsibility for any and all land survey monuments within the permitted area of the right-of-way. If disturbed or destroyed, the permittee bears full cost for replacement. Construction may need to be re-routed to avoid disturbing High Accuracy Reference Network Survey Land Markers. Direct any questions within five (5) days prior to construction to: Region Survey Coordinator, 222 South 6<sup>th</sup> St., Room 317, Grand Junction, CO 81501 at 970-248-7232.
25. To meet conditions encountered in the field, minor changes or additions may be ordered and approved by the CDOT Field Inspector.
26. The expiration date of this permit is noted on the permit. Any request to extend the time frame of this permit shall be made in writing. Submittal of an additional permit application may be required. No work shall proceed beyond the expiration date specified on the permit without written approval of the Department.
27. By law, the State of Colorado requires a "Certificate of Insurance", with the State of Colorado named as additional insured prior to commencing any work on State Highway Right-of-Way. Please facilitate CDOT's receipt of this certificate. (Insurance requirements are shown on Page 2 of the Utility / Special Use Permit Application.) As your various policies expire or are revised, updated information will be required.

**ATTACHMENT E**

**TRAFFIC CONTROL PLAN**

**GATEWAY – DAVIS MILL SITE REMEDIATION  
HMWMD-RAD-01**

**TRAFFIC CONTROL PLAN**

**I. Introduction:**

Frontier Environmental Services, Inc. (FESI) will implement the placement and supervision of project traffic control systems when work is being performed in areas where public transportation, vehicle traffic and pedestrian control are required.

**II. Maintenance of Traffic:**

During the implementation of the scope of work for the Gateway – Davis Mill Site Remediation Project, portions of State Highway 141 will be subject to increased volumes of construction related traffic. Specifically, the work plan anticipates 32-trucks accessing the site per day, during the implementation of the scope of work. Entry and egress of transport vehicles onto Colorado Highway 141 will occur in the town of Gateway, Colorado. Specifically; the Davis Mill Site access road bordering the north fence line of the Gateway, Colorado CDOT facility yard will be used for vehicles leaving the site; and the principal entrance road to the Gateway, Colorado CDOT facility yard will be utilized for transport vehicles entering the site. A “Special Use Permit” has been issued by State of Colorado Department of Transportation for this activity. Road closures and detours are not anticipated for this project, but if necessary will be coordinated with CDPHE; CDOT; MESA County; and the Town of Gateway, Colorado.

Truck traffic will be routed through the Gateway CDOT facility to minimize trucks waiting on the highway. In addition, all excavated material shall be placed so that vehicular traffic may be maintained at all times. FESI will place appropriate signage, “Trucks Entering Highway” and “Trucks Turning,” at the appropriate distances from the entrance and exit of the site.

**III. Public Safety**

If FESI operations cause traffic hazards, FESI shall repair the road surface, provide temporary ways, erect wheel guards or fences, or take other necessary measures for public safety. FESI will take necessary precautions to prevent injury to the public due to open excavation and trenches.

**IV. Implementation**

FESI will provide equipment, signage, and personnel to fully implement this traffic control plan. FESI’s Site Superintendent is responsible for the implementation on this Plan.

Prior to leaving the Davis Mill Site; all equipment, vehicles and materials will meet established release criteria for fixed and removable surface contamination prior to leaving the Davis Mill Site's remediation and/or load-out area. The release criteria are intended to control the spread of radioactive materials off-site and keep personal exposure to these radioactive materials as low as reasonably achievable (ALARA).

All transport vehicles used on the Davis Mill Remediation project are in compliance with all local, state and federal safety rules and regulations, as well as all operational requirements for the transportation of low level radionuclide substances.

All transport drivers will attend the Davis Mill Site and UMETCO radiation health, safety, and operating training sessions.

#### Pre-Entry Surveys:

All equipment, vehicles or tools to be used at the site will be surveyed for beta/gamma and alpha surface contamination by FESI/MFG as soon as possible upon arrival at the site. This pre-entry survey must be completed on all of FESI's equipment, subcontracted sub-contract vehicles and tools prior to use by FESI on this project. The results of these surveys will be documented on appropriate procedure forms and kept on file and will be included as a portion of the Close-Out Report support documentation. If the equipment does not pass the established pre-entry surface contamination criteria limits, FESI/MFG will require that the equipment be decontaminated before allowing it to be used at the site.

#### Conditional Release Surveys:

All heavy equipment routinely leaving the site will be washed or swept to remove visible soils and materials from the tires, treads and/or wheel wells at the Davis Mill site. Heavy equipment will be permitted to leave the site on a routine/or cyclical basis after removal of loose soils and materials without each piece of equipment being scanned for release.

#### Release Surveys:

All heavy equipment which has been operated within the restricted area shall be radiologically surveyed for fixed and removable contamination prior to being permanently released from the site. If the release survey indicates that surface activities exceed the established release limits, decontamination, by washing and cleaning will be required and repeated as necessary until the release limits are achieved. The surface activity limits for each piece of equipment released for unrestricted use will be documented on appropriate procedure forms, signed by the Radiation Safety Office (MFG) and kept on file for inclusion in to the project Close-Out Report support documentation. A copy of the equipment release will be provided to FESI's transporter for all equipment, vehicles and parts permanently leaving the site.





TRUCKS ENTERING HIGHWAY

TRUCKS TURNING

CDOT YARD

DOLORIS RIVER

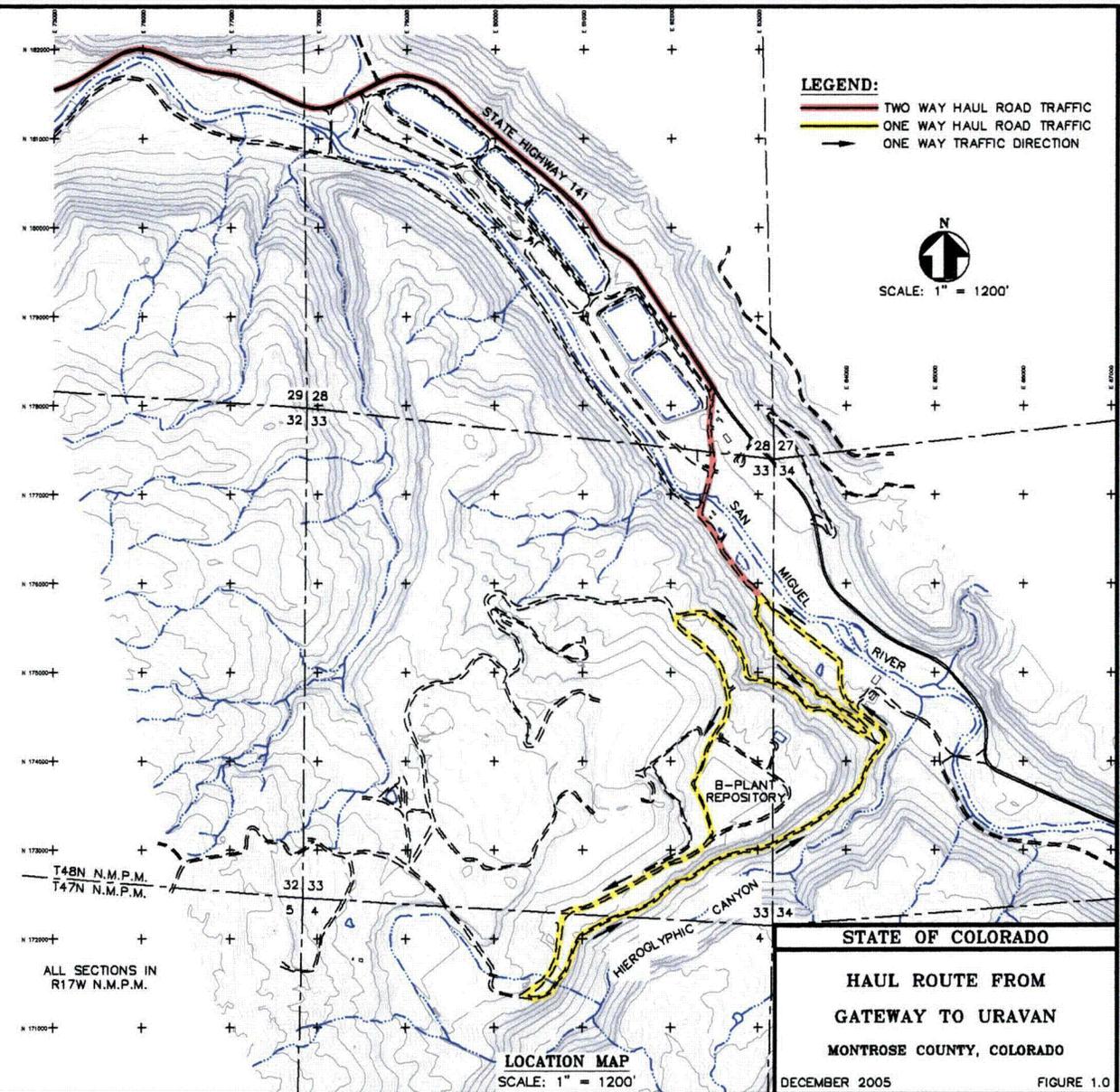
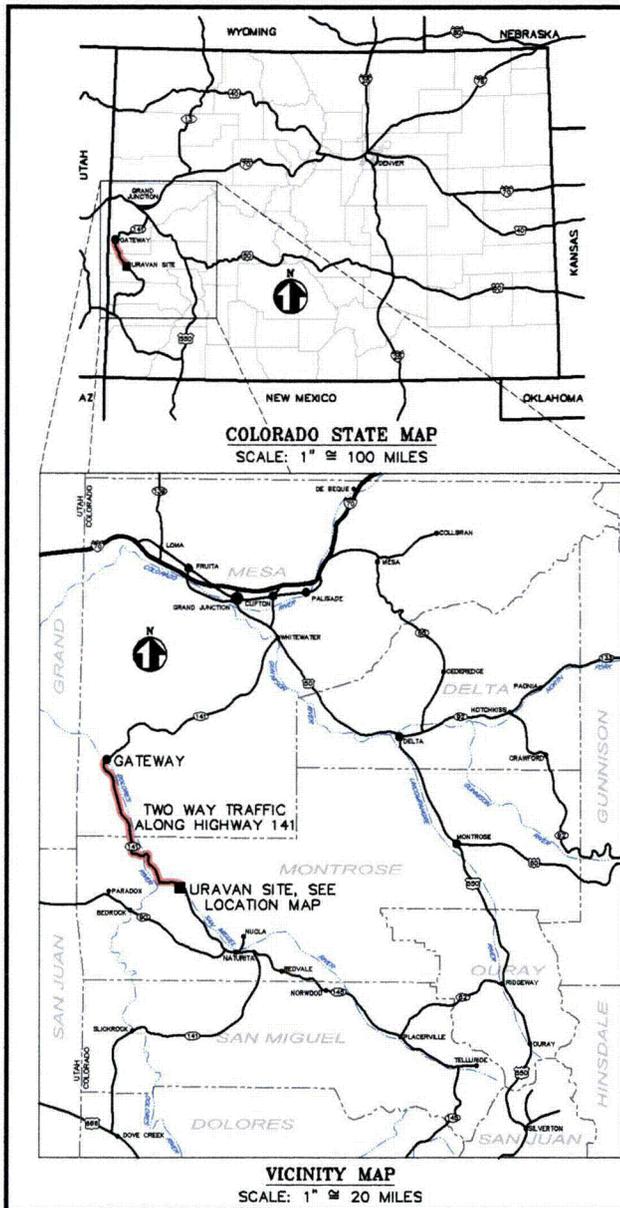
141



-  SURFACE WATER BODY
-  HAUL ROAD
-  SOIL STOCKPILE & LOADOUT AREA
-  SILT FENCE
-  CDOT YARD

## GATEWAY-DAVIS MILL SITE

Figure: 1  
**AERIAL SITE MAP**



**ATTACHMENT F**

**DAVIS MILL PROJECT SPECIFIC  
BILL-OF-LADING**

Frontier Environmental Services, Inc.  
Gateway – Davis Mill Site Remediation  
HMWMD-RAD-01

Trucking Company: Sutherland Brothers Date: \_\_\_\_\_

Driver \_\_\_\_\_

Truck License \_\_\_\_\_

Truck/Trailer # \_\_\_\_\_

Site of Origin: Gateway, Colorado

Destination: Uravan, Colorado

Gross \_\_\_\_\_ Tons

Time in: \_\_\_\_\_ Time out: \_\_\_\_\_ Loader Operator \_\_\_\_\_

Visual inspection for loose material on vehicle runners and trailer ledges \_\_\_\_\_

Liner Installed ? \_\_\_\_\_ Tarp In Place ? \_\_\_\_\_ Exit Scan \_\_\_\_\_ (α)

Trailer Scan (μR/hr.) Right Side \_\_\_\_\_ Left Side \_\_\_\_\_ Rear \_\_\_\_\_

Total Activity \_\_\_\_\_ pCi/g

Scanned By: \_\_\_\_\_

**COPY TO: Rob Terry, CDPHE; Eugene Greenwood, UMETCO; Sutherland Trucking**

**ATTACHMENT G**

**PRE-REMEDICATION DAVIS MILL SITE  
TOPOGRAPHICAL SURVEY DRAWING**

**THIS PAGE IS AN  
OVERSIZED DRAWING OR  
FIGURE,**

**THAT CAN BE VIEWED AT THE  
RECORD TITLED:**

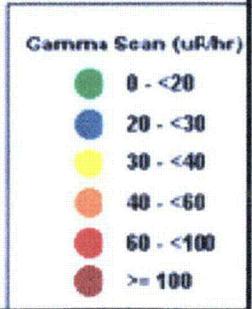
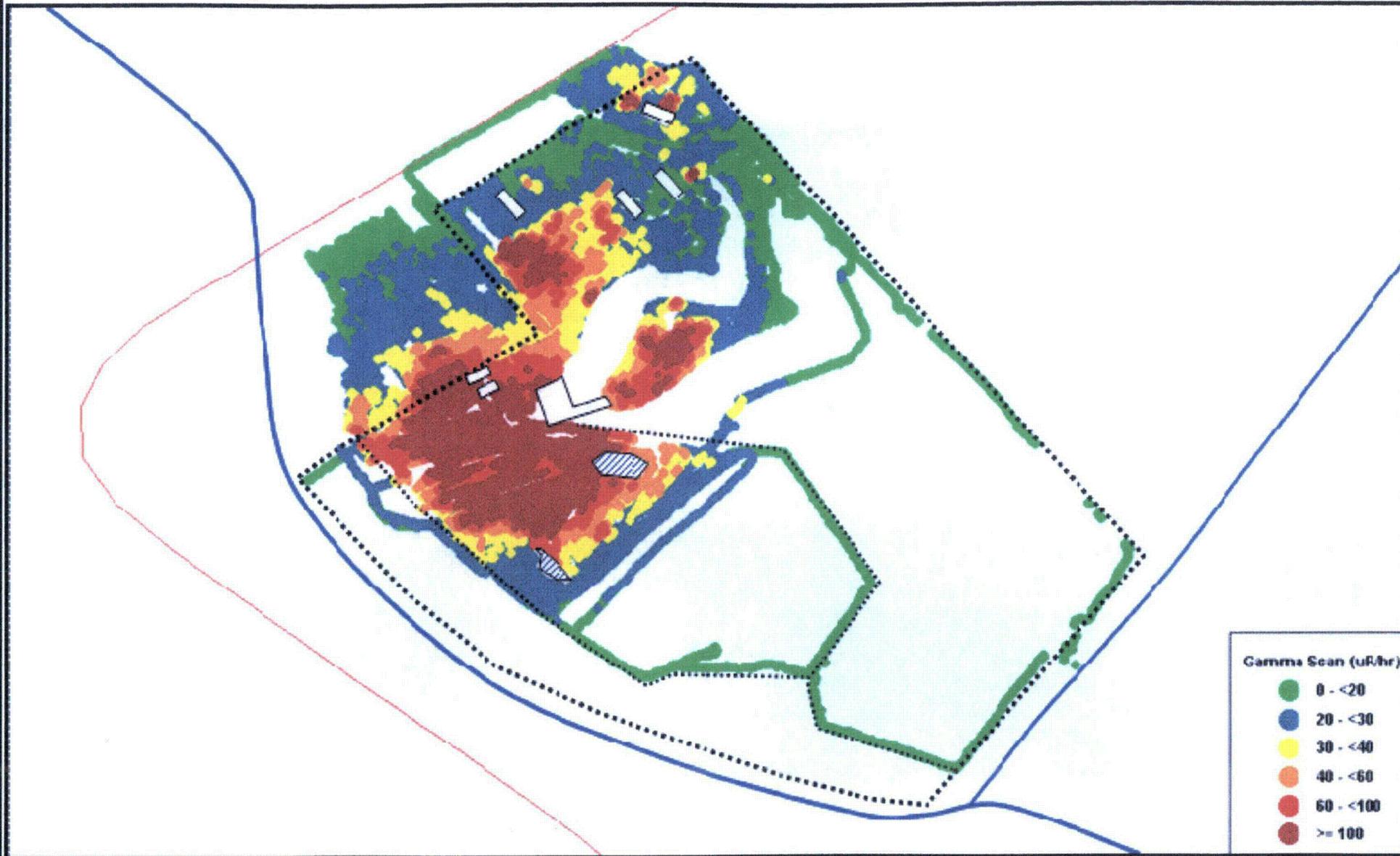
**PROJECT NO.: 06-0021S, SHEET 1 OF 1  
“TOPOGRAPHICAL MAP GATEWAY  
PROJECT MESA COUNTY, CO.”**

**WITHIN THIS PACKAGE... OR,  
BY SEARCHING USING THE  
DOCUMENT/REPORT  
PROJECT NO.: 06-0021S**

**D-01**

**ATTACHMENT H**

**PRE-REMEDICATION  
SITE RADIATION SURVEY**



	SURFACE WATER BODY
	HWY 141
	Property Boundary
	Dolores River

<b>GATEWAY-DAVIS MILL SITE</b>	
Figure: 2	<b>GAMMA SCAN</b>
 Frontier Environmental Services, Inc.	Created on: Mar. 31, 2006
Checked By: D.S.H. Created By: B.A.S.	

**ATTACHMENT I**

**SAMPLING AND  
ANALYSIS PLAN**

**Colorado Department of Health  
And  
Environment**

**George E. Davis Mill Site  
Gateway, Mesa County, Colorado  
Remediation Project**

**Sampling and Analysis Plan**

**1.0 Sampling and Analysis Plan**

The following sampling and analysis plan (SAP) for radiological guidance and final cleanup status and verification at the Davis Mill Site (Gateway, CO) has been developed by Frontier Environmental Services, Inc. (FESI) and MFG, Inc. (MFG) to meet the scope of work described in the request for proposals (RFP) issued by the Colorado Department of Public Health and Environment (CDPHE).

**1.1 Cleanup Criterion Development and Justification**

Development of the "net" Ra-226 soil cleanup criterion of 0.44 pCi/g above the upper range of background (as originally specified in the RFP scope of work) was based on results of analytical sampling and RESRAD analyses described in the Davis Mill Site Characterization Summary Report (Carter & Burgess, 2005). This criterion was developed using RESRAD analyses which included the radon pathway as well as certain default parameters which were not site-specific with respect to the appropriately assigned rural residential future land use scenario.

The FESI/MFG team discussed this issue with CDPHE during a meeting at CDPHE offices in Denver, CO on February 14, 2006. A consensus was reached at that meeting that it would be acceptable to adjust the Ra-226 cleanup criterion for the Davis Mill Site to be more site-specific and consistent with the intent and application of the Nuclear Regulatory Commission's decommissioning standard as set forth in 10CFR20.1402 and as amplified in the Federal Register Notice dated Monday, July 22, 1997.

The decommissioning standard for unrestricted use in 10CFR20.1402 is 0.25 mSv (25 mrem) per year above background. The preamble to the Federal Register Notice makes it clear that the intent of the NRC was to exclude radon from the 25 mrem per year above background criterion. The notice states the following: "...the Commission believes that it is not practical for licensees to distinguish between radon from licensed activities at a dose comparable to a 0.25 mSv/y (25 mrem/y) dose criterion and radon which occurs naturally. Therefore, in implementing the final rule, licensees will not be expected to demonstrate that radon from licensed activities is indistinguishable from background on a site-specific basis. *Instead, this may be considered to have been demonstrated on a generic basis when radium, the principal precursor to radon, meets the requirements for*

*unrestricted release without including doses from the radon pathway*" (emphasis added). [These statements can be found on page 39083 of the July 22, 1997 Federal Register.]

On this basis, and in accordance with an additional requirement for SA-1000 grants which states that funding will not be granted to a site if the "site remediation is proposed for compliance with a more conservative criterion than 25 millirem per year," a more appropriate Ra-226 criterion was developed for cleanup of the Davis Mill Site. Since the NRC's 25 mrem/year decommissioning criterion does not include the radon pathway, inclusion of this pathway in setting the cleanup criterion would appear to violate the cleanup criterion requirement for the NRC grant.

In developing the revised cleanup criterion, MFG applied the RESRAD code with most parameters the same values as those used by Carter-Burgess to develop the original "net" (above background) Ra-226 criterion of 0.44 pCi/g. In this instance, however, MFG deleted the radon pathway, and the NRC's indoor shielding factor of 0.33 was used instead of the RESRAD default factor of 0.7 (NUREG CR 5512 as quoted by EPA, 1996). The resulting estimated dose at ten years was 320 mrem/year for the average current on-site U-238 decay series radionuclide concentration of 32.7 pCi/g for each long-lived member (U-238, U-234, Th-230, Ra-226, Pb-210). Using a ratio of 25 mrem/y to 320 mrem/y, multiplied by 32.7 pCi/g, the appropriate net cleanup criterion is 2.6 pCi/g above background rather than 0.44 pCi/g above background. The cleanup criterion represents an average concentration over the top 15 cm of the soil profile.

Direct radiation and plant ingestion contributed 43 percent and 44 percent, respectively, to the annual dose. Since the current residents do not obtain their vegetables from the site and it is unlikely that any new resident would do so for at least ten years, the doses at  $t=10$  were used in the RESRAD analysis.

As a check, the RESRAD code was run using 2.6 pCi/g as the input concentration for uranium decay series radionuclides. The other naturally occurring series radionuclides (Th-232 and U-235) were reduced proportionally. The estimated dose at  $t = 10$  years, excluding the radon pathway was 25.35 mrem.

The 1.1 pCi/g soil Ra-226 concentration value used in the Davis Mill Site Characterization Report to represent the "upper range" of background (Carter & Burgess, 2005), was based on wet radiochemistry analytical methods. In the same report, Carter-Burgess also provided background Ra-226 results from gamma spectroscopy analyses (Appendix 13) which indicate a significantly higher upper range of background (2.8 pCi/g) compared to the wet radiochemistry results. Adding this gamma spectroscopy-based background value to the revised net cleanup criterion of 2.6 pCi/g, results in a *gross* Ra-226 cleanup criterion of 5.4 pCi/g. This gross criterion value is consistent with NRC decommissioning standards found in 10CFR20.1402 as well as with developmental guidelines found in MARSSIM, the Multi-Agency Radiation Survey and Site Investigation Manual (NRC, 2000).

As indicated in MARSSIM, various analytical methods are acceptable for demonstrating compliance with the cleanup criterion (termed the "derived concentration guideline level" or DCGL in MARSSIM), provided that respective minimum detectable concentration (MDC) values are less than the DCGL (preferably less than 50% of the DCGL). With a previously calculated MDC value on the order of 1 pCi/g (Whicker et al. 2006), the intended gamma spectroscopy methodology described later in this SAP is acceptable for demonstrating compliance with the cleanup criterion at the Davis Mill Site under MARSSIM guidelines, and has many practical advantages over wet radiochemistry methods (simplicity, speed, versatility, cost-effectiveness, etc.).

Finally, additional support for the revised gross Ra-226 cleanup criterion of 5.4 pCi/g at the Davis Mill Site can be found in the US Environmental Protection Agency's "Reassessment of Radium and Thorium Soil Concentrations and Annual Dose Rates" (EPA, 1996). The EPA concluded that a residual (above background) Ra-226 soil concentration of 5 pCi/g would result in an annual above background dose of 19 mrem for a rural residential exposure scenario (the most appropriate scenario for this site). The revised gross criterion of 5.4 pCi/g is conservative with respect to this EPA dose rate assessment.

## **1.2 Remedial Action Support Surveys (excavation guidance)**

A statistical correlation between Ra-226 concentration (pCi/g) and gamma exposure rate (uR/hr) was developed by MFG during cleanup of a uranium mill site in Washington State in 2005. Analysis of this relationship, using methods described in Johnson et al. 2006, indicated that an unshielded gamma exposure rate reading of 30 uR/hr at 2 feet above the ground surface (using a 2"x2" Ludlum® Model 44-10 NaI detector coupled to a Ludlum® Model 2350 rate meter) indicated a 95% probability that surface soils in the immediate vicinity below the detector would have Ra-226 concentrations less than 6 pCi/g (the gross cleanup criterion for that site). Thus, a gamma reading of 30 uR/hr was the target or "cut-off" value for guiding the Washington mill site cleanup.

Using the same survey equipment setup, a 30 uR/hr gamma rate cut-off value will be re-evaluated against site-specific field conditions at the Davis Mill Site and will be adjusted as needed to reflect soil Ra-226 concentrations expected to fall below 5.4 pCi/g with a similarly high degree of confidence. Refinement and verification of the cut-off value may be an iterative process, continually updated based on Ra-226 results from NaI-based gamma spectroscopy analyses performed in an on-site soils lab run by MFG.

Areas at the site with gamma readings above the cut-off value (i.e. exhibiting evidence of soil Ra-226 concentrations exceeding the cleanup criterion) will be excavated until gamma readings fall below the cut-off value. Final verification of the adequacy of the cleanup with respect to the cleanup criterion will be based on soil sampling under MARSSIM protocols and NaI-based gamma spectroscopy analysis in the on-site soils lab. Ten percent of samples will also be analyzed by Energy Laboratories, Inc. (ELI) in Casper, WY (using HPGe gamma spectroscopy) for statistical comparisons with on-site analysis results.

### **1.3 Soil Sampling and Analysis**

The primary analytical evidence of compliance with the Ra-226 cleanup criterion for individual soil samples at the Davis Mill Site will be based on NaI gamma spectroscopy results generated in an on-site soils lab. The lab will be housed in a trailer on the site, with respective functions to include sample preparation, sample analysis, data recording, and data management.

#### **1.3.1 Soil Sample Collection and Preparation**

- Surface soil samples will be collected in a manner consistent with the cleanup criterion (over a soil depth of 15 cm to represent an average corresponding concentration).
- The number of surface soil samples collected and respective locations will be determined according to MARSSIM protocols.
- Three subsurface samples will be collected in areas demonstrated to have among the highest gamma exposure rate readings at the site prior to, and/or after, the cleanup.
- UTM coordinates will be taken at each sample location with a GPS instrument and recorded for mapping purposes.
- Samples will be dried in ovens at about 100° C then sieved to separate any rock fraction greater than 1 cm diameter. The large rock fraction will be discarded. Because Ra-226 has greater association with smaller soil particle size fractions, omitting the larger rock fraction is conservative.
- Aliquots of homogenized samples will be weighed and placed in counting tins. The tins will be sealed with electrical tape.
- At each stage of sample collection and processing, equipment will be thoroughly cleaned to prevent cross-contamination.

#### **1.3.2 NaI-based Gamma Spectroscopy**

On-site soils lab instrumentation for Ra-226 analysis in soils samples will include a 3×3 inch Ludlum® Model 44-20 NaI detector coupled to a PC-based URSA-II® multi-channel analyzer (MCA) system. The MCA unit is small and portable and will be run from an equally portable lap-top computer. Both sample and detector will be shielded from background radiation during counting using a series of lead rings and plates.

Based on previous determinations of optimal sample count time which balances the number of samples that can be analyzed per day against the need to achieve sufficient accuracy (i.e. optimization of spectral resolution, counting statistics, and system detection

limits relative to the cleanup criterion), sample count time will be 20 minutes. Minimum Detectable Concentration limits for this analytical method, previously calculated to be 0.75 pCi/g using methods described in Principles of Radiological Health and Safety (Martin, 2003), will be re-calculated based on measurements of NIST-certified  $^{226}\text{Ra}$  soil reference material standards and a background soil sample from the Davis Mill Site.

Estimation of  $^{226}\text{Ra}$  activity concentrations will involve analysis of the number of counts within three energy regions of interest (ROI's) in soil sample gamma emission spectra. These ROI's encompass energy peaks for short-lived  $^{226}\text{Ra}$  decay chain progeny including  $^{214}\text{Pb}$  (295 and 352 keV) and  $^{214}\text{Bi}$  (609 keV).

Because  $^{222}\text{Rn}$ , a noble gas with a half life of 3.8 days, is an intermediate isotope between  $^{226}\text{Ra}$  and these decay chain progeny, and because the duration of the project is limited, on-site measurements after approximate secular equilibrium between  $^{222}\text{Rn}$  and  $^{226}\text{Ra}$  can be achieved (e.g. 21-day counts) will not be possible. Instead, counts will be taken before significant  $^{222}\text{Rn}$  ingrowth in sealed samples can occur (0-day counts).

Previously established calibration curves, as well as statistical relationships between 0-day and 21-day results (Whicker et al. 2006), will be used to generate "full-ingrowth"  $^{226}\text{Ra}$  estimates without any  $^{222}\text{Rn}$  ingrowth waiting period. Ten percent of all soil samples will be sent to ELI for secondary Ra-226 analysis using HPGe gamma spectroscopy. Results from the ELI analyses will be used to verify the accuracy of this adjustment and/or modify it accordingly prior to final data analysis and reporting. Sealed samples retained on site during the project may be archived in the event subsequent analyses are needed.

## **1.4 Water Sampling and Analysis**

### **1.4.1 Groundwater Sampling**

- Previous groundwater sampling results showed evidence of elevated levels of radionuclides at three well locations, including temporary monitoring wells CB-2 and CB-3, and the existing water supply well on CDOT property as shown in Figure 7 of the Davis Mill Site Characterization Report (Carter & Burgess, 2005). Groundwater from these three locations will be re-sampled at or near the end of cleanup operations to assess any changes.
- Two temporary groundwater monitoring wells will be installed slightly up-gradient of groundwater flow from the previous temporary groundwater monitoring wells CB-2 and CB-3 as shown in Figure 7 of the Davis Mill Site Characterization Report. Groundwater samples from these two wells will be collected and sent to ELI for analysis.
- A third groundwater sample will be collected from the existing water supply well located on CDOT property and sent to ELI for analysis.

- Sampling techniques will be similar to those described in the Davis Mill Site Characterization Report.
- Groundwater sample analytes will include those listed in the RFP scope of work.

#### **1.4.2 Surface Water Sampling**

- One surface water sample will be collected from the pond near the mill building. Sample collection technique will be similar that described in the Davis Mill Site Characterization Report (Carter & Burgess, 2005). The sample will be sent to ELI for analysis, and analytes will include those listed in the scope of work.

#### **1.5 Gamma Mapping Surveys**

In addition to the remedial action support surveys used to guide excavations, gamma mapping surveys will be periodically conducted using a GPS-based data collection system that records both UTM and gamma data. These surveys are different from remedial action support surveys in that data are recorded and mapped to allow subsequent visual assessment of gamma exposure rate status.

Gamma mapping surveys will be conducted before, during, and after the cleanup to allow assessment of the effectiveness of the cleanup. Pre-cleanup gamma mapping surveys will be used to record the initial gamma exposure rate status of the site using the same equipment that will be used to conduct the final status survey, and may also help to further define areas requiring excavation.

At minimum, scanning coverage will be 100% in all survey units for pre-cleanup and final status gamma mapping surveys. Exceptions will be made for any areas within a survey unit that pose an unacceptable safety risk to scanning personnel (e.g. extremely rough terrain), or where scanning is not possible due to existing structures, large debris, or certain vegetation (e.g. trees, thick brush, etc.). Gamma mapping surveys will also be conducted across areas of the site other than the survey units, but scanning coverage may not always be at 100% in these areas.

#### **1.6 Data Quality Control / Quality Assurance**

Soil, groundwater, surface water, and gamma survey sampling activities and related information will be recorded each day in a field book and summarized in the final report. Specific QA/QC protocols for each type of sampling and analysis are outlined as follows:

##### **1.6.1 Soil Sample Measurements**

Because NaI-based radionuclide quantification by MFG's on-site soil lab will be based on previously established statistical relationships with corresponding HPGe measurements performed by ELI, quality assurance is partially related to ELI's accreditation and QC protocols. ELI is certified by the EPA as well as by seven different States. The laboratory follows strict chain of custody protocols, uses NIST-certified

standards for instrument calibrations, and performs measurements on EPA or other certified reference material standards with each set of client samples to provide information on measurement accuracy. ELI also performs duplicate analyses on 10% of all client samples to provide information on measurement variability. MFG observed details of these QC protocols during a visit to ELI's Casper, Wyoming in June, 2005.

A NIST-certified  $^{137}\text{Cs}$  source will be used to energy calibrate the on-site NaI counting system at the beginning of each day and to monitor the system for spectral drift every 1-2 hours. MCA fine-gain settings will be adjusted as needed. Daily system QC checks will also be performed at the beginning of each day. This will involve taking measurements on designated "background" level sample (e.g. 1 pCi/g  $^{226}\text{Ra}$ ) and a designated "source" level sample (e.g. 20 pCi/g  $^{226}\text{Ra}$ ) and recording the number of counts within the  $^{214}\text{Bi}$  energy peak ROI on system control charts. Results falling within  $\pm 3$  standard deviations from the mean of 20 respective initial control chart measurements will indicate that the counting system is working properly. Finally, duplicate measurements will be performed on about 5% of samples, while about 2% of samples will be split for dual analyses to assess sample aliquot variability and the effectiveness of sample homogenization.

Proper chain-of-custody protocols will be performed and documented for all soil samples sent to ELI for secondary analysis.

#### **1.6.2 Water Sample Measurements**

Surface and groundwater sample collection methodologies will be consistent with those used by Carter-Burgess as described in the Davis Mill Site Characterization Report (e.g. collecting unfiltered samples in 2-liter bottles and preserving them with nitric acid). Sample bottles will be properly labeled and placed in an iced cooler for shipment to ELI. Proper chain-of-custody protocols will be performed and documented.

#### **1.6.3 Gamma Survey Measurements**

Quality control protocols for gamma scanning systems will include the following:

- Survey meter/detector pairings will be in current calibration from the manufacturer during the course of the project, and will be maintained throughout as calibrated pairs.
- For each instrument planned for use on a given day, background and check source QC measurements will be performed (prior to field use) in designated areas to verify that the instrument is working properly. This will involve recording the average value of twenty 1-second exposure rate readings on previously established instrument control charts for each instrument pair. Instrument-specific QC measurement location and geometry will be the same each day as initially established in developing respective instrument control charts. A hand-held Garmin iQue PDA instrument, programmed by MFG to automatically calculate the mean and standard deviation of 20 successive readings, will be used to simplify the daily QC procedure and reduce

the potential for human error. Mean readings within  $\pm 3$  standard deviations from the mean of initial control chart measurements will indicate that instruments are working properly. To account for potential additional fluctuations due to climatic variability (e.g. changes in Rn-222 levels due to barometric changes), instrument control charts may be periodically updated to include recent measurements on a "moving average" basis to reflect this additional temporal source of background variability.

- Gamma survey instrument calibration certificates and instrument control chart results will be included in an appendix to the final report.

### 1.7 Final Status Verification Survey

Implementation of MARSSIM protocols for designing a final status survey includes developing a statement of data quality objectives (DQO) in advance. For the Davis Mill Site final status survey, the DQO statement is as follows:

- State the problem:** A characterization survey at the Davis Mill Site has identified residual (above background) levels of radionuclide contamination (Carter & Burgess, 2005). Frontier Environmental Services, Inc. and MFG, Inc. have been contracted by the CDPHE to excavate contaminated soils and transport them to URAVAN for proper disposal. URAVAN will no longer receive materials for disposal after June 30, 2006, so remedial activities at the Davis Mill Site must be completed by this date. A final radiological status survey will be conducted to determine whether or not each survey unit at the site qualifies for unrestricted release under NRC decommissioning standards.
- Identify the decision:** Is the level of residual contamination in a given survey unit below the release criteria.
- Identify inputs to the decision:** Post-cleanup soil Ra-226 data generated by the Frontier/MFG team will be used to determine compliance with the release criterion in a given survey unit. A combination of NRC decommissioning standards and guidelines, as well as pre-cleanup soil radionuclide data from the Davis Mill Site Characterization Report (Carter & Burgess, 2005), were used to develop the site-specific soil cleanup criterion.

D. **Define the study boundaries:**

Based on Figures 4, 6, and 21 in the Davis Mill Site Characterization Report (Carter & Burgess, 2005), five impacted Class 1 survey units have been defined as shown in Figure 1. A non-impacted background reference area has also been defined. An independent pre-cleanup gamma scan will be conducted by MFG prior to cleanup activities. If warranted, the results of this scan could result in modification of survey unit boundaries, though major modifications are not expected.

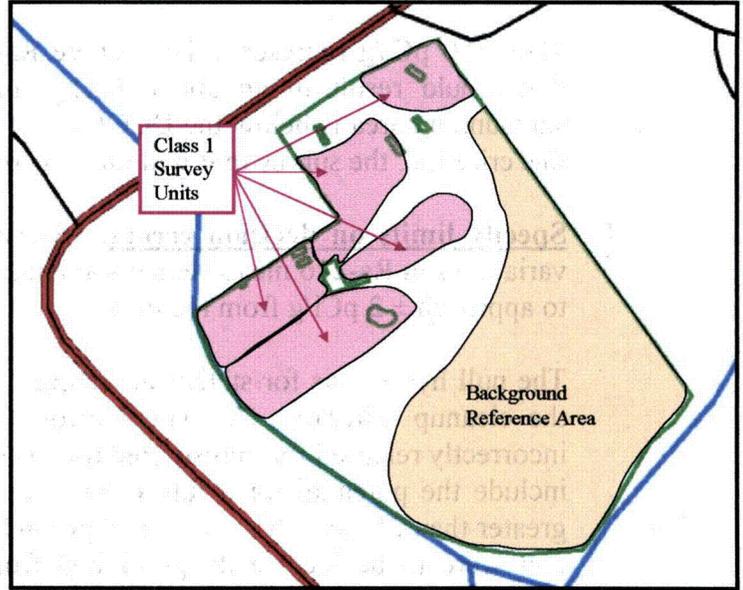


Figure 1. Site map showing Class 1 survey units and background reference area.

- E. **Develop a decision rule:** The Ra-226 soil concentration data in each survey unit will be numerically evaluated against a gross cleanup criterion ( $DCGL_W$ ) of 5.4 pCi/g. As indicated in MARSSIM, if all data in the survey unit are less than this criterion, the survey unit meets the conditions for unrestricted release and no statistical test is required. If multiple samples in a given survey unit remain above the gross criterion, the Wilcoxon Rank Sum Test (WRS) will be used to evaluate whether or not the median *gross* concentration in the survey unit is statistically greater than the median of background plus the *net*  $DCGL_W$  (i.e. background reference area sample result + 2.6 pCi/g).

In addition to evaluations of each survey unit against the  $DCGL_W$ , any areas identified by gamma scans as having potential for elevated Ra-226 levels, will be additionally sampled and evaluated against a secondary “hot spot” criterion. To develop this secondary “hot spot” criterion, termed  $DCGL_{EMC}$  in MARSSIM, RESRAD was first used to calculate a site-specific area factor for Ra-226. Calculations for the area factor and  $DCGL_{EMC}$  for the Davis Mill Site are as follows:

$$\begin{aligned} \text{Ra-226 Area Factor} &= 10000 \text{ m}^2 \text{ dose} / 100 \text{ m}^2 \text{ dose} \\ &= (24.8 \text{ mrem}) / (10.45 \text{ mrem}) \\ &= 2.4 \end{aligned}$$

$$\begin{aligned} DCGL_{EMC} &= (\text{net } DCGL_W \times AF) + \text{background} \\ &= (2.6 \text{ pCi/g} \times 2.4) + 2.8 \text{ pCi/g} \\ &= 9.0 \text{ pCi/g} \end{aligned}$$

Thus, 9.0 pCi/g represents the average Ra-226 concentration within a 100 m<sup>2</sup> area that would result in an above background dose of 25 mrem/yr (assuming the surrounding area is below the DCGL<sub>w</sub>). If no areas of elevated measurement exceed this criterion, the survey unit will meet secondary requirements for unrestricted use.

- F. **Specify limits on decision errors:** Based on past MFG experience, the expected variability in Ra-226 measurements among samples from a given survey unit is likely to approach  $\pm 2$  pCi/g from the mean.

The null hypothesis for statistical testing (if required) is that the survey unit exceeds the cleanup criterion. A Type I error would occur if a survey unit were to be incorrectly released for unrestricted use. The consequences of this type of error would include the potential for a future rural resident living on the site to receive a dose greater than 25 mrem/yr above background. A Type II error would occur if a survey unit were to be incorrectly prohibited from an unrestricted use designation. The consequences of this type of error could include prevention of any future development or use of the site which otherwise might provide economic or other benefits to the local community.

The lower bound on the grey region (LBGR in MARSSIM) is the expected average concentration in a survey unit after cleanup. While somewhat subjective (as it is difficult to estimate this value in advance), the LBGR has an impact on the number of samples required and the probability that a Type II error will occur. For the Davis Mill Site, it is reasonable to follow the MARSSIM default and set the LBGR at  $\frac{1}{2}$  the DCGL<sub>w</sub>, or at 2.7 pCi/g. Type I and Type II error probabilities will be set at  $\alpha = \beta = 0.05$ , meaning only a 5% chance that either type of error will occur.

- G. **Optimize the survey design for obtaining the data:** The two alternatives for data collection design were either to send all soil samples to a commercial laboratory for analysis, or to have an on-site laboratory to perform NaI-based gamma spectroscopy measurements and estimate Ra-226 concentrations. The latter was selected as being advantageous in terms of cost, versatility, and speed. The on-site lab will allow assessment of results on a real-time basis during the cleanup which can improve cleanup strategies and help achieve better endpoint results. Analytical accuracy of the selected approach has been previously established to reasonably approximate that obtained by HPGe gamma spectroscopy in a commercial laboratory.

Use and application of gamma survey data will not be limited to final verification. Survey data collected before, during, and after the cleanup will be mapped to visually demonstrate the effectiveness of the cleanup with respect to external gamma exposure rates and potential Ra-226 concentrations.

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