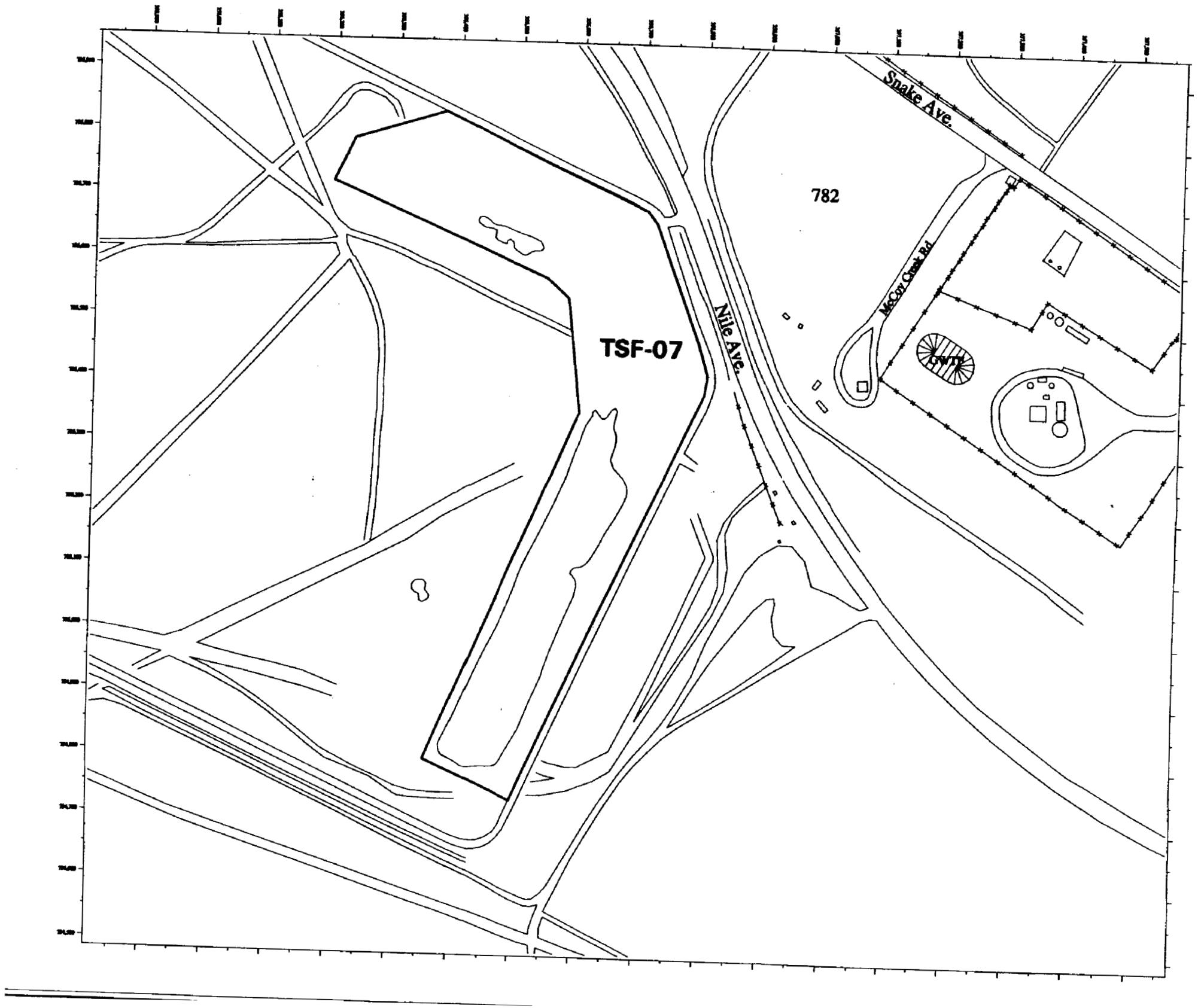
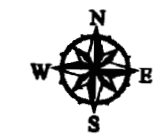
# Appendix A

# Design Drawings for Test Area North, Waste Area Group 1, Remedial Design/Remedial Action, Operable Unit 1-10, Group 1 Sites

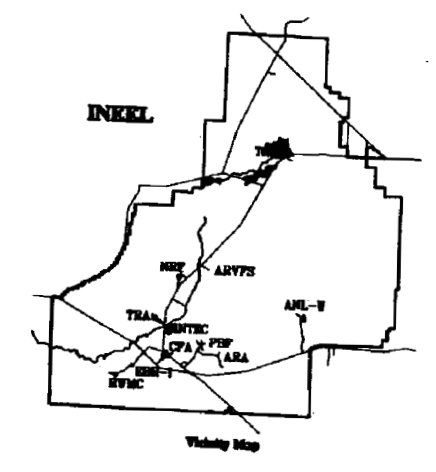



# TSF- 07
## CERCLA Site 2000




**Legend**

- Roads and Buildings
- Fences
- CERCLA Site Boundaries

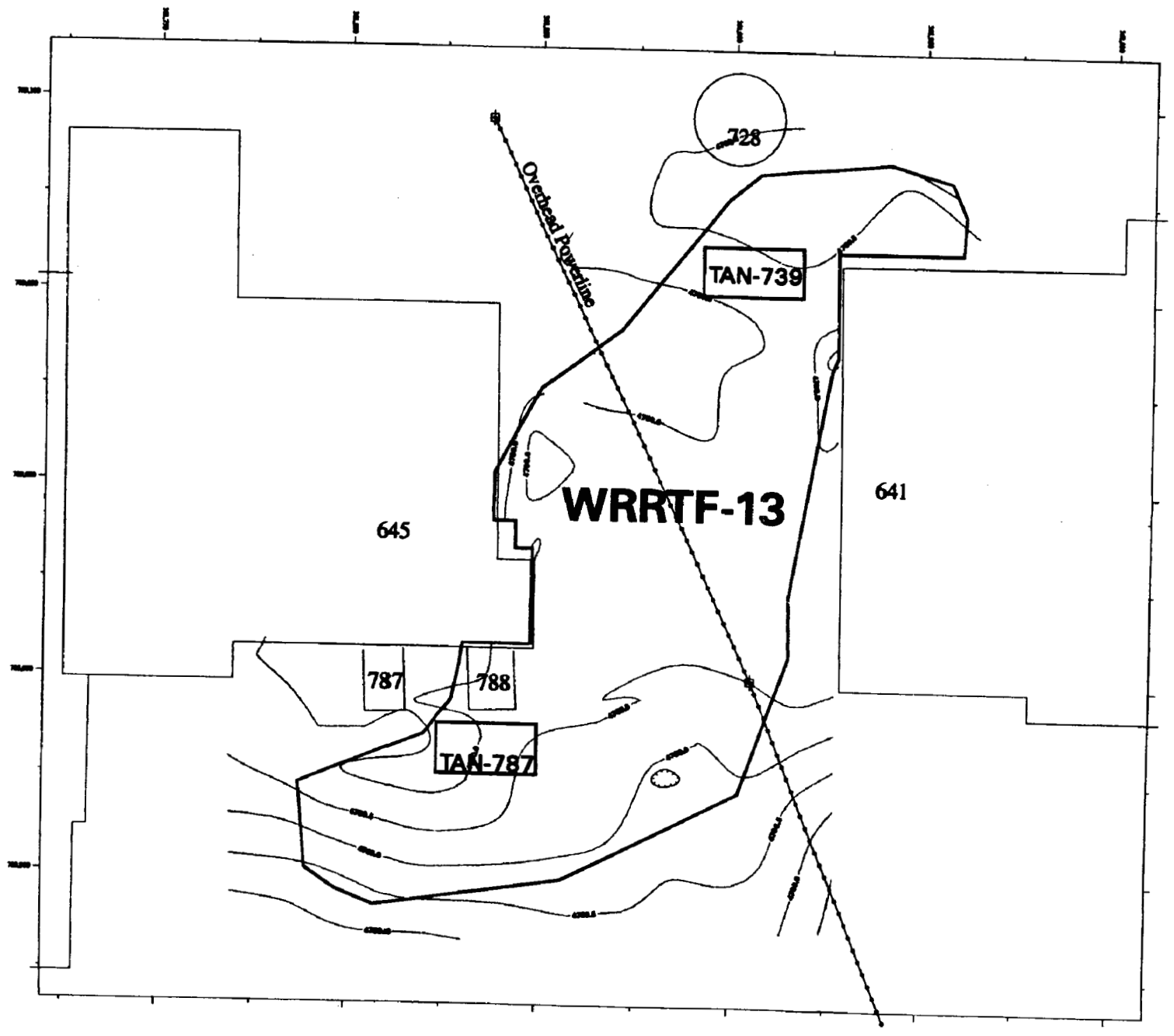



Vicinity Map

Date Drawn: April 20, 2000

**INEEL SPATIAL ANALYSIS LABORATORY**

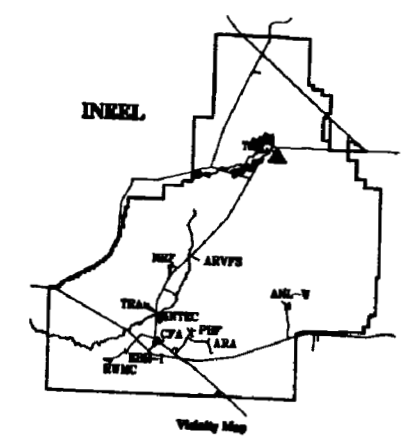
APPLYING TECHNOLOGY TO MEET ENVIRONMENTAL NEEDS




# WRRTF- 13
## CERCLA Site 2000

**Legend**

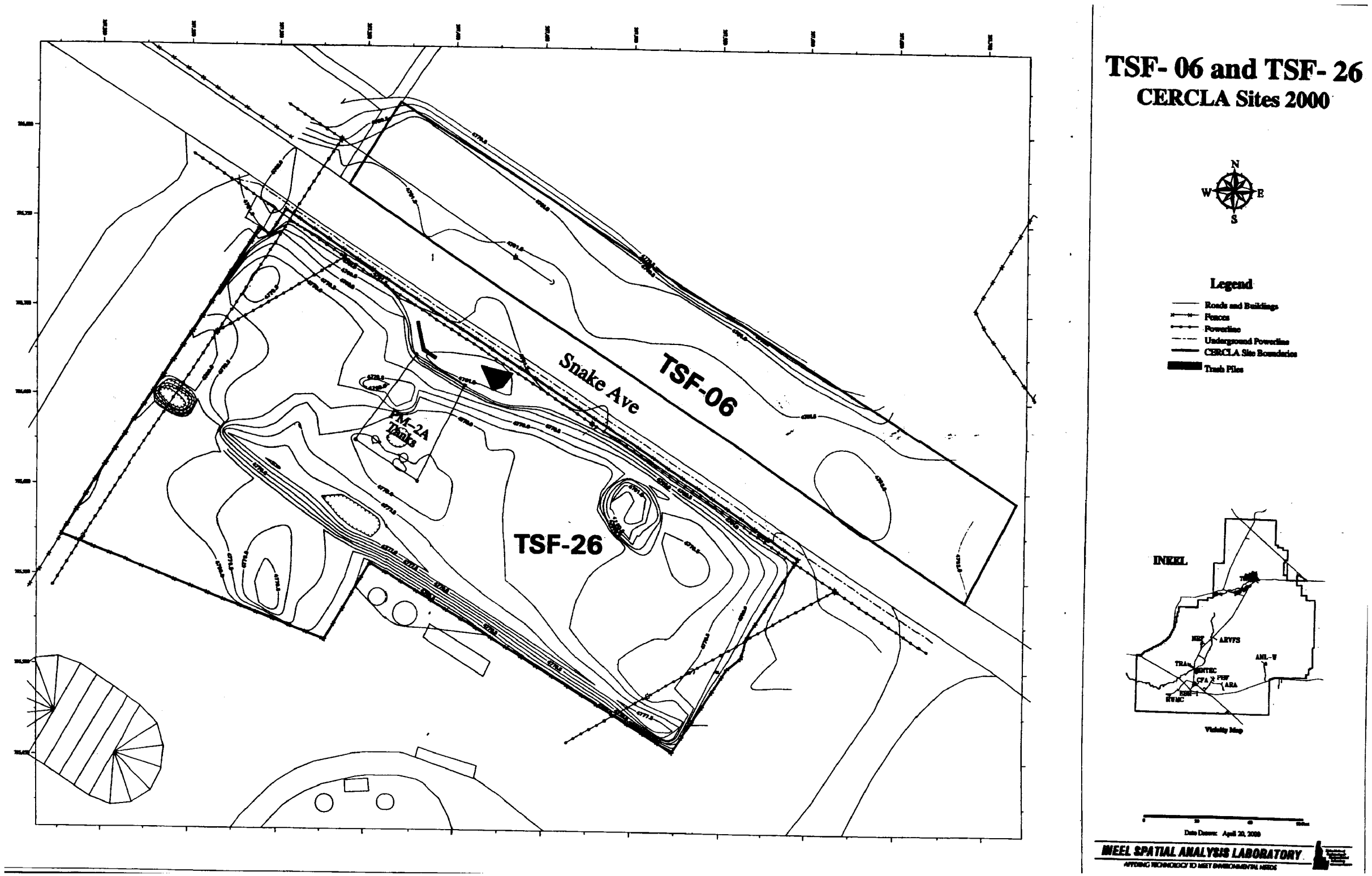
- Roads and Buildings
- Powerlines
- CERCLA Site Boundaries




Date Drawn: April 20, 2000

**INEEL SPATIAL ANALYSIS LABORATORY**

APPLYING TECHNOLOGY TO MEET ENVIRONMENTAL NEEDS


TSF- 06 and TSF- 26
CERCLA Sites 2000
N
W
E
S
Legend
Roads and Buildings
Fences
Powerline
Underground Powerline
CERCLA Site Boundaries
Trash Piles
Snake Ave
TSF-06
TSF-26
PM-2A
Tanks
INEEL
Vicinity Map
Date Drawn: April 20, 2000
MEEL SPATIAL ANALYSIS LABORATORY
APPLYING TECHNOLOGY TO MEET ENVIRONMENTAL NEEDS

# Appendix B

# Technical Specifications for Test Area North, Waste Area Group 1, Remedial Design/Remedial Action, Operable Unit 1-10, Group 1 Sites

# Technical Specifications for Test Area North, Waste Area Group 1, Remedial Design/Remedial Action, Operable Unit 1-10, Group 1 Sites

## Specification Titles

| Specification | Title |
|---|---|
| 01000 | Definitions |
| 02110 | Clearing and Grubbing |
| 02140 | Temporary Diversion and Control of Water During Construction |
| 02200 | Earthwork |
| 02210 | Grades, Lines, and Levels |
| 02222 | Excavation, Trenching, and Backfilling |
| 02930 | Reclamation Seeding and Mulching |

# SECTION 01000

## DEFINITIONS

| | |
|---|---|
| General Conditions | General Terms and Conditions for Construction Subcontractors on the Idaho National Engineering and Environmental Laboratory with Parsons Infrastructure & Technology Group, Inc. January 1996. |
| Operating Contractor | INEEL M&O Contractor |
| RD/RA Contractor | Defined RD/RA Contractor |

# SECTION 02110

## CLEARING AND GRUBBING

### PART 1 GENERAL

1.1 SCOPE OF WORK

1.1.1 Work Included

The subcontractor will furnish all materials, labor, tools, and equipment, and will perform clearing and grubbing during construction activities in accordance with this specification.

1.1.2 Related Work Specified Elsewhere

(a) Temporary Diversion and Control of Water During Construction will be in accordance with Section 02140 of these specifications

(b) Excavation, Trenching, and Backfilling will be in accordance with Section 02222 of these specifications

(c) Earthwork will be in accordance with Section 02200 of these specifications

(d) Reclamation Seeding and Mulching will be in accordance with Section 02930 of these specifications.

1.1.3 Work to be Performed by Others

The contractor will:

(a) Review and approve data submittals as required by this specification

(b) Designate items that require salvage, storage, reuse, and/or relocation

(c) Perform final inspection and confirm acceptance of clearing and grubbing

(d) In addition to inspection by the subcontractor, the contractor may inspect work for compliance with the requirements of this specification.

1.2 REFERENCE DOCUMENTS

(a) Health and Safety Plan (HASP) for the Remedial Action of Waste Area Group 1, Operable Unit 1-10

(b) M&O Contractor Hazards Prevention and Control Document PRD-24

(c) Comprehensive Remedial Design/Remedial Action Work Plan for the Test Area North Operable Unit 1-10, Selected Sites.

1.3 SUBMITTALS

1.3.1 Procedures

The subcontractor will submit a description of materials and/or methods of clearing and grubbing in accordance with the requirements of this specification to the contractor for approval within eight workdays after notice to proceed.

1.3.2 Certifications

The subcontractor will submit a letter to the contractor verifying conformance to the requirements identified in this specification within four work days after completion of the work specified herein.

1.3.3 Records

The subcontractor will submit all records of inspection to the contractor, within four work days after completion of the inspection.

**PART 2 PRODUCTS**

2.1 EQUIPMENT AND MATERIAL REQUIREMENTS

2.1.1 Equipment

(a) The subcontractor will ensure that all equipment used for clearing and grubbing work is fitted with appropriate safety devices that comply with all applicable federal laws and the Project Health and Safety Plan (HASP), and that will adequately protect the operator and minimize exposure of workers and others.

(b) All equipment and tools used by the subcontractor to perform the work will be subject to inspection by the contractor before the work is started and will be maintained in satisfactory working condition at all times.

(c) The subcontractor's equipment will have the capability to perform the indicated clearing and grubbing specified herein.

2.2 ITEMS SALVAGED FOR REUSE, STORAGE, OR RELOCATION

The contractor will designate items that require reuse, storage, or relocation. The subcontractor will properly dispose of all signs in accordance with the contract General Conditions GC-16 and GC-17.

**PART 3 EXECUTION**

3.1 GENERAL

3.1.1 Site Inspection

The subcontractor will inspect the site to determine the nature, location, size, and extent of vegetative material, debris, and obstructions to be removed or preserved, as specified herein.

3.1.2 Protection and Safe

The subcontractor will provide all necessary protection measures per the standards established by INEEL PRD-24.

3.1.3 Traffic

The subcontractor will conduct clearing and grubbing operations to ensure minimum interference with roads, walks, and adjacent facilities. The subcontractor will not close or obstruct roads, walks, or adjacent operational facilities without written permission from the contractor.

3.1.4 Protection of Existing Structures and Facilities

The subcontractor will provide protection necessary to prevent damage to the existing structures and facilities that are to remain in place. The subcontractor will restore or replace damaged property to original condition, or to the satisfaction of the contractor. Items damaged in removal will be repaired and refinished, or replaced by the subcontractor with new matching items as required by the contractor.

3.1.5 Salvageable Items

Items damaged in removal will be repaired, refinished, or replaced by the subcontractor with new matching items as required by the contractor. The subcontractor will save and protect from construction damage all vegetative materials (trees, shrubs, grass, and other vegetation) beyond the limits of the required clearing and grubbing. The subcontractor will restore or replace damaged vegetative materials to the conditions as required by the contractor, in accordance with Section 02930 of these specifications.

3.1.6 Protection of Monuments and Other Pertinent Surface Features

The subcontractor will locate and mark existing monuments, monitoring wells, guard posts, and markers before construction operations commence and will protect such items during construction. The subcontractor will restore or replace damaged items to original condition as required by the contractor.

3.1.7 Dust Control

The subcontractor will at all times minimize the creation and emission of dust. The subcontractor will employ means such as water spray and visual observation to control and minimize dust. The source of water for dust suppression will be specified in the Request for Proposal, Special Conditions.

3.2 CLEARING AND GRUBBING

3.2.1 Clearing and Grubbing

The subcontractor will clear the site of shrubs, vegetation, and debris to the limits of the soil excavations. Stumps, roots exceeding 1-inch in diameter, and other debris exceeding 6-inches in diameter in the top 3-inches of the existing grade will be removed by hand or mechanical means. Removal methods will minimize the disturbance of soils below 3-inches in depth. The subcontractor will follow the requirements of the HASP in determining the appropriate personal

protective equipment (PPE) and material handling requirements of possible contaminated soils and vegetation.

3.2.2 Reclamation Seeding and Mulching

The subcontractor will seed and mulch disturbed areas in accordance with Section 02930 of these specifications.

3.3 INSPECTIONS DISPOSAL OF WASTE AND DEBRIS MATERIALS

3.3.1 Organic Materials

Organic materials, including grass, shrubs, stumps, roots, and other organic debris removed due to clearing activities, will be transported by the subcontractor to an INEEL disposal site. Organic material removed from radiological controlled areas will be surveyed and released by the contractor prior to disposal. The subcontractor will construct stockpiles with surface water runoff controls, in accordance with Section 02140 of these specifications. The subcontractor will protect stockpiles to prevent excessive wind and water erosion.

3.3.2 Disposal

The subcontractor will remove all materials not designated for relocation, reuse, or salvage. These materials will be disposed of as per the Special Conditions.

3.4 DAMAGED AREAS

The subcontractor will confine clearing and grubbing operations to within those areas required for construction of engineered barriers or native soil covers, borrow areas, or as directed by the contractor. Any areas outside the designated areas that are damaged or disturbed by the subcontractor's operations will be reclaimed by the subcontractor. Reclamation will be in accordance with Section 02930 of these specifications.

3.5 ACCEPTANCE

Clearing and grubbing not in accordance with the requirements of this specification will be repaired and/or replaced by the subcontractor at the subcontractor's expense. The subcontractor will submit a description of the repair and/or replacement methods to the contractor for approval before use. Acceptance criteria for repaired and/or replaced clearing and grubbing will be in accordance with the original requirements of this specification.

END OF SECTION

# SECTION 02140

## TEMPORARY DIVERSION AND CONTROL OF WATER DURING CONSTRUCTION

### PART 1 GENERAL

1.1 SCOPE OF WORK

1.1.1 Work Included

The subcontractor will furnish all materials, labor, tools, and equipment for dewatering work areas and controlling surface water prior to and throughout construction operations. Control measures implemented may include berms, swales, ditches, temporary piles, portable pumps, silt fences, sediment traps, or any other measure approved by the contractor in accordance with this specification and as shown on the design drawings.

1.1.2 Related Work Specified Elsewhere

(a) Earthwork will be in accordance with Section 02200 of these specifications

(b) Reclamation Seeding and Mulching will be in accordance with Section 02930 of these specifications.

1.1.3 Work to be Performed by Others

The contractor will:

(a) Review and approve data submittals as required by this specification

(b) Inspect work for compliance with this specification, in addition to inspection by the subcontractor and with the design drawings. The contractor will review pre-placement conditions, placement of controls, and other job conditions during performance of the work.

The contractor will perform final inspection and acceptance of water diversion and control work.

1.2 REFERENCE DOCUMENTS

(a) Health and Safety Plan (HASP) for the Remedial Action of Waste Area Group 1, Operable Unit 1-10

(b) Comprehensive Remedial Design/Remedial Action Work Plan for the Test Area North, Operable Unit 1-10, Selected Sites.

1.3 SUBMITTALS

1.3.1 Procedures

A Storm Water Pollution Prevention Plan (SWPPP) is not required for this specific project. However, this specification provides information necessary to ensure proper procedures are followed with regard to potential impacts due to precipitation effects.

1.3.2 Certifications

The subcontractor will submit a letter to the contractor verifying conformance to the requirements identified in this specification within four work days after completion of the work specified herein.

1.3.3 Records

The subcontractor will submit all records of inspection to the contractor, within four work days after completion of the inspection.

**PART 2 PRODUCTS**

2.1 EQUIPMENT AND MATERIAL REQUIREMENTS

2.1.1 Equipment

(a) All equipment and tools will conform to the safety requirements of the Project Health and Safety Plan (HASP)

(b) All equipment and tools used by the subcontractor to perform the work will be subject to inspection by the contractor before the work is started and will be maintained in satisfactory working condition at all times

(c) The subcontractor's equipment will be adequate and capable of controlling water prior to and throughout construction as required by this specification and the design drawings.

2.1.2 Materials

(a) All materials will be furnished by the subcontractor and will be subject to approval by the contractor

(b) Selection of materials used for controlling storm water are the responsibility of the subcontractor, but will follow the intent of the Storm Water Pollution Prevention Plan and be approved by the contractor.

**PART 3 EXECUTION**

3.1 GENERAL

3.1.1 All standing water outside the construction boundary may be left to infiltrate the soil.

3.1.2 The subcontractor will perform all construction work in areas free of standing water. Suitable water control measures will be constructed at all locations where construction work may be affected by ponded storm water at the time of work.

3.1.3 The subcontractor will divert surface water around the periphery of all construction areas by constructing temporary ditches, berms, or other appropriate means of control.

3.1.4 The subcontractor will be solely responsible for the protection of work against damage, delay, or environmental impact by water flow.

3.1.5 The subcontractor will direct and control water in a manner that protects adjacent structures and facilities.

3.1.6 The subcontractor will ensure that existing storm drainage is not impaired. The subcontractor will temporarily reroute existing storm drains affected by construction activities.

3.1.7 The subcontractor will at all times minimize the creation and emission of duct. The subcontractor will employ means such as water spray and visual observation to control and minimize dust. The source of water for dust suppression will be specified in the Request for Proposal, Special Conditions.

## 3.2 WORK IN EXTREME WEATHER

3.2.1 In the event of extreme storm activity, the subcontractor will provide protective measures to prevent damage to the work by run-on and maintain control of the run-off from the constructed areas. During extreme storm events, the subcontractor will protect slopes by methods approved by the contractor. Promptly after an extreme storm event, the subcontractor will inspect and clean out all temporary control structures of debris and sediment buildup, and repair or replace any damaged areas either in the temporary control structures or in the permanent work areas as approved by the contractor.

## 3.3 INSPECTIONS AND REPAIRS

(a) The subcontractor will inspect temporary water control structures and materials on a daily basis and will record inspection findings in the daily work log. The inspection records will be submitted weekly to the contractor.

(b) The subcontractor will remove debris and sediment build-up from the temporary control structures as required to maintain the intended flow path.

(c) Should overflow or breach conditions be encountered or any other damage observed at the temporary structures, repair and/or replacement of the damaged area will be promptly performed by the subcontractor.

(d) Acceptance criteria for repaired and/or replaced temporary water control structures will be in accordance with the requirements of this specification.

## 3.4 REMOVAL OF TEMPORARY CONTROL MEASURES

Temporary storm water control measures will be removed once the work has been completed and as directed by the contractor. The materials removed will be properly disposed of by the subcontractor, as

directed by the contractor. All areas where temporary control structures are removed will be regraded and revegetated in accordance with Sections 02200 and 02930 of these specifications.

## 3.5 ACCEPTANCE

The subcontractor will submit a description of any repair or replacement work required to the contractor prior to implementation. Acceptance criteria for repaired or replaced water control measures will be in accordance with the original requirements of this specification.

END OF SECTION

# SECTION 02200

## EARTHWORK

### PART 1 GENERAL

1.1 SCOPE OF WORK

1.1.1 Work Included

The subcontractor will furnish all materials, labor, tools, and equipment for all types of earthwork to be performed in accordance with this specification and as shown on the design drawings. Earthwork includes grading and excavation; placement of fill materials; placement of contaminated materials; disposal of unsuitable materials; and reclamation of borrow area.

1.1.2 Related Work Specified Elsewhere

(a) Temporary Diversion and Control of Water During Construction will be in accordance with Section 02140 of these specifications

(b) Grades, Lines and Levels will be in accordance with Section 02210 of these specifications

(c) Excavating, Trenching, and Backfilling will be in accordance with Section 02222 of these specifications

(d) Reclamation Seeding and Mulching will be in accordance with Section 02930 of these specifications.

1.1.3 Materials Procurement Notification

The subcontractor will follow the requirements of the General Conditions GC-2 and Vendor Data Schedule (VDS).

1.1.4 Work to be Performed by Others

The contractor will:

(a) Review and approve data submittals as required by this specification

(b) Review and approve results of quality assurance tests and surveying performed for compliance with this specification

(c) Document and monitor corrective actions

(d) Identify the acceptable onsite borrow locations

(e) Have the option to approve all soil compaction equipment prior to use

(f) Have the option to inspect and approve surface conditions prior to placement of each layer

(g) Have the option to inspect and approve all materials prior to placement

(h) Have the option to perform final inspection and confirm acceptance of earthwork.

## 1.2 REFERENCE DOCUMENTS

Occupational Safety and Health Administration (OSHA)

Code of Federal Regulations, Part 1926, Subparts P and G

INEEL Health. Safety and Hazards Prevention Documents

Health and Safety Plan (HASP) for the Remedial Action of Waste Area Group 1, Operable Unit 1-10

Hazards Prevention and Control Document, PRD-24

*Comprehensive Remedial Design/Remedial Action Work Plan for the Test Area North Operable Unit 1-10*, Selected Sites.

## 1.3 SUBMITTALS

### 1.3.1 Test Reports

The subcontractor will submit test reports at the following frequencies:

(a) Field Placement Tests - Field tests that provide immediate results will be recorded in the Daily Field Report and presented to the contractor by the end of the same day

(b) Field Quality Control Tests - Field tests that provide immediate results will be recorded in the Daily Field Report and presented to the contractor by the end of the same day.

### 1.3.2 Procedures

The subcontractor will submit a work plan describing the equipment, materials, and methods to be employed to meet the requirements of this specification to the contractor for approval 20 calendar days prior to commencement of work. The work plan will be formatted in accordance with the requirements outlined in the contract Special Condition titled Construction Work Plan.

### 1.3.3 Certifications

Prior to final acceptance of the work specified herein, the subcontractor will submit a letter to the contractor verifying conformance to the requirements identified in this specification.

### 1.3.4 Records

The subcontractor will submit to the contractor all field records from surveying, layout, and field inspection activities within four workdays after completion of these activities.

## 1.4 QUALITY ASSURANCE

The subcontractor will comply with PLN-125 Quality Program Plan for the Environmental Restoration Program and submit within 10 workdays after notice to proceed through the vendor data schedule a notice of intent to comply.

## PART 2 PRODUCTS

### 2.1 EQUIPMENT AND MATERIAL REQUIREMENTS

#### 2.1.1 Equipment

All equipment and tools will conform to the safety requirements of the Project Health and Safety Plan (HASP). All equipment and tools used by the subcontractor to perform the work will be subject to inspection by the contractor before the work is started and will be maintained in satisfactory working condition at all times. All soil compaction equipment will be inspected for acceptance by the contractor before the start of construction.

The subcontractor's equipment will be adequate and have the capability to perform the indicated earthwork specified herein.

All equipment brought to the site will be identified to the contractor prior to delivery and will be clean and free of grease and oil spots due to potential equipment contamination. Where applicable, tires will be in like-new condition, free of slits, and cracks. The contractor reserves the right to reject equipment not meeting these requirements.

#### 2.1.2 Fill Material

Fill material will be native soils from borrow locations as designated on the drawings and will be generally free of plant material, roots larger than one inch in diameter, rubble, litter, insect infestation, and other deleterious matter.

#### 2.1.3 Borrow Area Requirements

In situ topsoil will be removed and stockpiled at designated locations prior to the removal of borrow soils. Topsoil will be obtained through the Operations and Maintenance contractor, as needed.

#### 2.1.4 Topsoil

Topsoil borrow will be obtained from the Borrow Area at Test Area North and will meet the following requirements:

(a) Be free of rubble, litter, insect manifestation, and other deleterious matter

(b) Be free of rocks larger than three inches in diameter.

## PART 3 EXECUTION

### 3.1 PROTECTION AND SAFETY

3.1.1 The subcontractor will keep all roads and parking areas adjacent to or part of this project usable at all times. The subcontractor will provide all necessary barricades, temporary walkways, lights, signs, signals, etc., for the protection of the workers and the public, as per the standards established by PRD-24 in the Hazards Prevention and Control Manual and Occupational Safety and Health Administration (OSHA), Construction Safety and Health Regulation 29 CFR, Part 1926, Subpart G, Signs, Signals, and Barricades, whichever of the two is more stringent.

3.1.2 For excavations, trenching, and shoring, the subcontractor will comply with Section 02222, Excavation, Trenching, and Backfilling.

3.1.3 The subcontractor will provide the necessary protection to prevent damage to existing structures and facilities indicated in the drawings or indicated by the contractor to remain in place. The subcontractor will restore damaged property to original condition, and obtain written approval from the contractor.

3.1.4 The subcontractor will clearly mark and post all laydown areas.

3.1.5 The subcontractor will mark or otherwise indicate the location of existing monuments and markers, and protect these structures before construction operations commence. The subcontractor will be responsible for the marking and/or protection of all necessary objects.

3.1.6 During earthwork operations, a representative of the subcontractor will be present at all times to observe and identify any areas requiring investigation. The subcontractor will notify the contractor immediately upon discovery of any field deviations from the drawings or this specification.

3.2 EXISTING UTILITIES

3.2.1 There may be existing utilities within the limits of the construction area as shown on the design drawings. Utilities will be identified by the contractor and the utilities protected by the subcontractor. The contractor will be immediately notified of the discovery of utilities not shown on the design drawings. The subcontractor will follow the guidelines for protection of utilities in accordance with Section 02222 of these specifications.

3.3 DUST CONTROL

3.3.1 The subcontractor will at all times during the activities minimize the creation and emission of dust. The subcontractor will employ means such as water spray and visual observation to control and minimize dust. Source of water will be specified in the Request for Proposal, Special Conditions.

3.3.2 The subcontractor will ensure that unpaved and haul routes are wetted while in use.

3.4 INSTALLATION OF FILL MATERIALS

3.4.1 <u>General Requirements</u>

(a) Stockpiling of clean imported material will be confined to the subcontractor's laydown and storage area as approved by the contractor. Stockpiled materials will have stable slopes and be evenly graded and self-draining. Materials will be stockpiled in such a way that precipitation runoff can be monitored and controlled, if necessary, to prevent escape from the stockpile area. The subcontractor will ensure that the stockpiling and handling of contaminated surface soils, if encountered, are confined within the limits of the work area.

(b) The subcontractor will place all materials to the lines, grades and elevations as shown on the design drawings as specified in Section 02210 of these specifications.

(c) The subcontractor will not begin placement of materials until after acceptance by the contractor of the subgrade and placement conditions for all underlying material layers.

(d) The subcontractor will not place materials on frozen surfaces, in standing water, or when materials contain snow, ice or frozen material.

(e) The subcontractor will slope temporary grades to direct water away from the construction area to reduce the potential for ponding water. The subcontractor will provide erosion protection as specified in Section 02140 of these specifications.

3.4.2 Existing Grades

The existing grade will be prepared as required in Section 02110 of these specifications.

3.4.3 Fill Material

(a) The fill material will be placed in loose lifts to attain a maximum compacted lift thickness of six inches.

(b) Top soil will be compacted with a minimum of three passes of a sheepsfoot roller.

(c) Fill material other than topsoil will be compacted with a minimum of five passes of a smooth steel drum roller. In the event that significant silt or other fine grain material is involved, the contractor may direct that a sheepsfoot roller be used at no additional cost.

(d) Subsequent lifts will not be placed until acceptance by the contractor of the previous lift has been received.

(e) The borrow areas will be graded to minimize erosion and sustain vegetation. Reclamation seeding and mulching of the borrow areas will be in accordance with Section 02930 of these specifications.

3.4.4 Topsoil Layer

(a) Place the topsoil with a moisture content that minimizes dust production

(b) Place the topsoil in maximum eight-inch loose lifts

(c) Place the topsoil layer with the minimal compaction obtained only from the normal passage of construction equipment that occurs during placement and grading operations.

3.4.5 Protection of Underlying Layers

(a) The subcontractor will use placement methods which prevent undue disturbance and which maintain and ensure the integrity of the underlying materials. The subcontractor will submit, for written approval by the contractor, the construction method(s) proposed to ensure the protection of the underlying layers.

(b) Previously installed layers or subgrades disturbed by subsequent construction operations by the subcontractor or adverse weather will be reworked to the required placement conditions specified herein and as otherwise approved by the contractor.

## 3.5 INSPECTION

3.5.1 The subcontractor will be responsible for pre-operation, operation, and post-operation inspection during the performance of all work.

3.5.2 The contractor reserves the right to inspect all work for compliance with this specification.

## 3.6 ACCEPTANCE

The subcontractor will be responsible for documenting the number of compaction passes completed per lift. Placed materials not in accordance with the requirements of this specification will be repaired and/or replaced by the subcontractor. The subcontractor will submit a description of repair and/or replacement methods to the contractor for written approval before implementation. Acceptance criteria for repaired and/or replaced materials will be in accordance with the original requirements of this specification.

Areas that do not conform with the compaction specifications will be investigated by the subcontractor to determine the extent of the nonconformance. Areas that are of a different material type or that have failed the specifications after recompaction efforts will undergo additional testing regardless of the testing frequency guidelines.

Final acceptance will be explicitly detailed by survey locations, layer description, material type, and lift number or elevation. A final report to the contractor will be submitted by the subcontractor within 20 calendar days of the final acceptance detailing all field survey and quality control activities performed during the construction operations.

# SECTION 02210

## GRADES, LINES, AND LEVELS

### PART 1 GENERAL

1.1 SCOPE OF WORK

1.1.1 Work Included

The subcontractor will furnish all materials, labor, tools, and equipment to perform surveying. The subcontractor will perform surveying to ensure that the proper grades, lines, and levels are established as set forth in these specifications and as shown on the design drawings. The construction survey will be completed by either the subcontractor or an independent firm, provided the work is completed under the supervision of a Registered Land Surveyor in the State of Idaho.

1.1.2 Related Work Specified Elsewhere

(a) Earthwork will be performed in accordance with Section 02200 of these specifications

(b) Excavation, Trenching, and Backfilling will be performed in accordance with Section 02222 of these specifications

(c) Reclamation Seeding and Mulching will be in accordance with Section 02930 of these specifications.

1.1.3 Work to be Performed by Others

The contractor will:

(a) Review and approve data submittals as required by this specification

(b) Provide INEEL survey grid information

(c) Provide benchmarks, strategically located, as shown on design drawings

(d) Inspect work for compliance with the requirements of this specification in addition to inspection by the subcontractor

(e) Perform final inspection and confirm acceptance of surveying work.

1.2 REFERENCE DOCUMENTS

INEEL Site Grid

*Comprehensive Remedial Design/Remedial Action Work Plan for the Test Area North Operable Unit 1-10*, Selected Sites.

## 1.3 SUBMITTALS

### 1.3.1 Procedures

(a) The subcontractor will submit within eight workdays after notice to proceed, a plan for the work, including descriptions of survey equipment, procedures used to establish temporary or permanent benchmarks or measurements, field notes, calculations, reductions, closures, and documentation for any benchmarks or monuments to the contractor for approval.

(b) Data will be reduced and plotted by the subcontractor in a form acceptable to the contractor. Legible notes, drawings, and reproducible documentation will be submitted to the contractor for approval. Contour intervals will be 0.5 feet. In addition to the above notes submittals, all plans will also be submitted in electronic format.

### 1.3.2 Certifications

(a) Prior to grading or placing fill at each respective site, the subcontractor will perform a survey of the existing subgrade, if necessary, to confirm to his satisfaction, the adequacy of the existing topo as shown on the drawings, and will submit a letter to the contractor stating acceptance of the accuracy of the existing topo shown on the contract drawings, or will otherwise advise of discrepancies or omissions for further resolution. Construction work in each respective area will not begin until agreement is reached on the adequacy of the existing topo information.

(b) The subcontractor will submit a letter to the contractor within four work days after completion of each respective stage of the work specified herein, verifying conformance to the requirements identified in this specification. The letter will be prepared and executed by a Professional Land Surveyor registered in the State of Idaho.

### 1.3.3 Records

The subcontractor will submit to the contractor for information, all field notes from surveying and layout activities within four work days after completion of each stage of these activities at each respective site.

## 1.4 QUALITY ASSURANCE

The subcontractor will be responsible for protecting and maintaining all horizontal and vertical control points during construction.

The subcontractor will provide an independent survey firm, registered in the State of Idaho, to verify the construction survey.

### 1.4.1 Accuracy

Optical survey, tape measurements, and electronic measurements will have a minimum accuracy of ± 0.1 feet in horizontal locations and elevations, or as superceded by criteria set forth in other sections of these specifications.

Calibration records will be submitted to the contractor eight workdays prior to use. Calibrations will be performed by an INEEL approved calibration laboratory.

1.4.2 Tolerances

Unless superseded by other sections of these specifications, the subcontractor will survey all existing or placed materials to ensure that they are within the tolerances specified below:

| **Description** | **Tolerances** |
|---|---|
| Final Grade | -0.0 to +0.1 feet (elevation) |

**PART 2 PRODUCTS**

None.

**PART 3 EXECUTION**

3.1 GENERAL

3.1.1 All surveying will be performed based upon the project coordinate system for this specific project. Conversion and recording in the INEEL Site coordinate system will be performed by the contractor.

3.1.2 The surveying will be performed by a professional Land Surveyor licensed by the State of Idaho.

3.1.3 The subcontractor will check and verify that as-built thicknesses and elevations match those shown on the design drawings based on the benchmarks, and provide complete as built information by topographic plats and by marking up prints of the design drawings.

3.1.4 The subcontractor is responsible for controlling lift thickness to ensure conformance to the required dimensions. The subcontractor will be responsible for establishing, recording, protecting, and maintaining all permanent and temporary horizontal and vertical control benchmarks.

3.2 SURVEY MEASUREMENTS

3.2.1 Prior to commencement of construction work, the subcontractor will establish survey control points inside the work areas.

3.2.2 Survey control points will be established so that any point within the job site can be accurately reestablished and elevations be obtained to the required tolerances at any time during the construction. The subcontractor will verify all baselines, and horizontal and vertical control benchmarks stipulated in the information provided by the contractor.

3.3 ACCEPTANCE

1) Surveying work not in accordance with the requirements of this specification will be corrected, repeated, or replaced by the subcontractor. The subcontractor will submit a description of the corrective action methods to the contractor for approval before use. Acceptance criteria for corrected actions will be in accordance with the original requirements of this specification.

2) In the event of a survey discrepancy, the area in question will be resurveyed and verified at no cost to the contractor.

END OF SECTION

# SECTION 02222

## EXCAVATION, TRENCHING, AND BACKFILLING

### PART 1 GENERAL

1.1 SCOPE OF WORK

1.1.1 Work Included

The subcontractor will furnish all materials, labor, tools, and equipment to complete excavation, trenching, and backfilling necessary during the construction activities, including excavation, trenching, and backfilling for constructing ditches, swales, and test pits.

1.1.2 Related Work Specified Elsewhere

(a) Temporary Diversion and Control of Water During Construction will be in accordance with Section 02140 of these specifications

(b) Earthwork will be performed in accordance with Section 02200 of these specifications

(c) Reclamation Seeding and Mulching will be in accordance with Section 02930 of these specifications.

1.1.3 Work to be Performed by Others

The contractor will:

(a) Review and approve data submittals as required by this specification

(b) Have the option to perform final inspection and acceptance of excavations, trenches, and backfilling.

1.2 REFERENCE DOCUMENTS

Occupational Safety and Health Administration (OSHA)

29 CFR, Part 1926, Subpart G, Signs, Signals, and Barricades

29 CFR, Part 1926, Subpart P, Excavation, Trenching, and Shoring Pamphlet 2226, Excavation and Trenching Operations.

INEEL Health. Safety and Hazards Prevention Documents

Health and Safety Plan (HASP) for the Remedial Action of Waste Area Group 1, Operable Unit 1-10.

Hazards Prevention and Control Document, PRD-24.

Comprehensive RD/RA Work Plan for the Test Area North OU 1-10, Selected Sites.

1.3 SUBMITTALS

1.3.1 Certifications

The subcontractor will submit a letter to the contractor verifying conformance to the requirements identified in this specification within four work days after completion of the work specified herein.

1.3.2 Records

The subcontractor will submit to the contractor for information, all field notes from excavation, trenching, and backfilling activities within four work days after completion of each stage of these activities at each respective site.

1.4 QUALITY ASSURANCE

The subcontractor will prepare, maintain, and use a contractor-approved, written Quality Assurance/Quality Control Manual for the work performed. The Quality Assurance/Quality Control Manual will be submitted within eight work days after notice to proceed, and will include the requirements to ensure application of the latest design documents and the incorporation of the approved changes. As a minimum, the subcontractor will develop and maintain appropriate records that verify the quality and acceptance of materials, the application of approved procedures, the test and inspection records, and the appropriate approval signatures for acceptance of work performed.

**PART 2 PRODUCTS**

2.1 EQUIPMENT AND MATERIAL REQUIREMENTS

2.1.1 Backfill Material

Backfill material may be any type of clean fill material that is accessible at Test Area North.

2.1.2 Excavated Material

The subcontractor will excavate and handle excavated material regardless of its type, characteristic, composition, or depth condition. All material excavated from trenching operations will be stockpiled in designated areas for eventual reuse.

**PART 3 EXECUTION**

3.1 PROTECTION, SAFETY, AND HAZARDS PREVENTION

3.1.1 The subcontractor will comply with the rules and regulations of OSHA Construction Safety and Health Regulations 29 Code of Federal Regulation (CFR), Part 1926, Subpart P, Excavation, Trenching, and Shoring, and the HASP. The subcontractor will refer to OSHA Pamphlet 2226, Excavation and Trenching Operations, as an additional aid. The subcontractor will comply with the rules and regulations of OSHA Construction Safety and Health Regulations 29 CFR, Part 1926, Subpart G, Signs, Signals, and Barricades.

3.1.2 During excavation and trenching operations, a representative of the subcontractor will be present at all times to observe the activities and identify any areas requiring investigation.

Areas where undefined pipes, utilities, or any soils of peculiar nature are encountered during excavation and trenching will be brought to the immediate attention of the contractor.

3.1.3 The subcontractor will comply with Hazards Prevention and Control Document, PRD-24.

3.2 EXISTING UTILITIES

3.2.1 There are existing utilities within the limits of or nearby the construction area, as shown on the design drawings. The subcontractor will excavate in accordance with the General Conditions.

If excavation is within a minimum distance specified by the contractor of any existing high voltage or high hazard electrical power utility (whether underground, overhead, or at the side of the excavation), Lockout/Tagout or proper preparation will be required. The Subcontractor will provide at least four-work day notice to the contractor so that the contractor can arrange for and perform Lockout/Tagout procedures.

3.2.2 The subcontractor will immediately notify the contractor of any existing utilities encountered during excavation that are not indicated on the design drawings.

3.2.3 The subcontractor will obtain written approval from the contractor before backfilling for existing pipes to be removed or for other existing utilities.

3.3 GENERAL REQUIREMENTS FOR EXCAVATION

3.3.1 The subcontractor will be solely responsible for the safety of temporary cuts and fills.

3.3.2 The subcontractor will contain excavation operations within the designated limits as indicated on the design drawings. If conditions encountered warrant modification to the designated limits, the contractor will be notified prior to proceeding.

3.3.3 The subcontractor will backfill temporary excavations as soon as practical.

3.3.4 Work in inclement weather will be performed at the subcontractor's risk. The subcontractor will replace and rework any materials that become unsuitable as the result of work performed during inclement weather.

3.3.5 The subcontractor will perform excavation and fill operations in a manner that maintains drainage and control at all times, in accordance with Section 02140, Temporary Diversion and Control of Water During Construction.

(a) The subcontractor will excavate in a manner so that the site and immediately surrounding areas will be continually drained away from the excavation. Surface water run-on will not be permitted to accumulate in the excavations.

(b) When ruts of two inches or more in depth are formed, the surface will be reworked with discs, and re-rolled, returned to grade, and retested by the subcontractor at the direction of the contractor. In no case will the subcontractor place any fill materials on an unstable muddy surface.

3.4 TRENCH EXCAVATION

During excavation to remove and/or plug existing pipes, materials and equipment will be handled in a manner that prevents overloading trench banks, slides, or cave-ins.

3.5 BACKFILLING

The subcontractor will not commence backfilling until the excavation work has been approved by the contractor. The subcontractor will place backfill in maximum six-inch compacted lifts. If the subcontractor cannot attain the compaction densities required, the material will be reworked to obtain the required compaction density.

3.6 TESTING

3.6.1 General

The subcontractor will be responsible for the performance of all testing. The subcontractor will submit all test records to the contractor. The degree of compaction will be expressed as a percentage of the maximum dry density obtained in accordance with American Society for Testing and Materials (ASTM) D 698.

3.6.2 Compaction Requirements

In-place densities will be determined in accordance with ASTM D 2922.

The subcontractor will compact backfill to 95 percent of maximum dry density for all trench areas crossing under access roads or areas expected to receive vehicular traffic.

The subcontractor will compact backfill to 90 percent the maximum dry density for all other areas.

The subcontractor will perform a minimum of one field compaction test for each trench for alternate lifts. More frequent compaction tests may be required initially or upon a change in material in order to establish the compaction method and materials.

3.7 INSPECTION

3.7.1 The subcontractor will be responsible for in-process inspection during performance of all work.

3.7.2 In addition to inspection by the subcontractor, the contractor reserves the right to inspect all work for compliance with the requirements of this specification.

3.8 ACCEPTANCE

Excavation, trenching, and backfilling not in accordance with the requirements of this specification will be repaired or replaced by the subcontractor. The subcontractor will submit a description of the repair and/or replacement methods for work not in compliance with this specification to the contractor for written approval before use. Acceptance criteria for repaired and/or replaced excavations, and backfilling will be in accordance with the original requirements of this specification.

END OF SECTION

# SECTION 02930

## RECLAMATION SEEDING AND MULCHING

### PART 1 GENERAL

1.1 SCOPE OF WORK

1.1.1 Work Included

The subcontractor will furnish all labor, materials, labor, tools, and equipment, and place seed and mulch in accordance with this specification and as indicated on the design drawings. This section describes the subcontractor's requirements to provide a final vegetated surface in those areas designated herein or as shown on the drawings. These designated areas will be seeded and mulched as set forth in this section and on the design drawings.

1.1.2 Related Work Specified Elsewhere

(a) Temporary Diversion and Control of Water During Construction will be in accordance with Section 02140 of these specifications

(b) Earthwork will be performed in accordance with Section 02200 of these specifications

(c) Excavation, Trenching, and Backfilling will be in accordance with Section 02222 of these specifications.

1.1.3 Work to be Performed by Others

The contractor will:

(a) Review and approve data submittals as required by this specification

(b) Have the option to inspect equipment, work, and materials for compliance with the requirements of this specification, in addition to inspection by the subcontractor

(c) Have the option to review preseeding conditions and other related job conditions during performance of the work

(d) Have the option to perform inspection and acceptance of the final vegetated surfaces.

1.2 REFERENCE DOCUMENTS

United States Department of Agriculture (USDA)

Federal Seed Act

State of Idaho

Idaho Pure Seed Law, Chapter 4, Title 22, Idaho Code

*Comprehensive RD/RA Work Plan for the Test Area North OU* 1-10, Selected Sites.

1.3 SUBMITTALS

1.3.1 Procedures

The subcontractor will submit a Seeding and Mulching Plan to the contractor for written approval within eight workdays after notice to proceed. The plan will describe the methods of placement and the equipment to be used during operations.

1.3.2 Certifications

(a) The subcontractor will submit eight work days prior to use, the seed vendor's certified statement for the seed mixture required, stating scientific and common names, percentages by weight, and percentages of purity and germination. The subcontractor will submit a signed statement certifying that the seed is from a lot that has been tested by a recognized laboratory for seed testing within six months prior to the date of delivery to the construction site.

(b) The subcontractor will submit a letter to the contractor verifying conformance to the requirements identified in this specification within four work days after completion of the work specified herein.

1.3.2 Records

The subcontractor will submit records of inspection to the contractor within four work days after completion of the inspection.

**PART 2 PRODUCTS**

2.1 GENERAL

Seed, fertilizer, mulch, and equipment will be inspected upon arrival at the job site by the contractor for conformity to type and quality in accordance with these requirements. Unacceptable materials will be removed from the job site by the subcontractor.

2.2 EQUIPMENT AND MATERIAL REQUIREMENTS

2.2.1 Seed Mix

Seed will be labeled in accordance with United States Department of Agriculture rules and regulations under the Federal Seed Act and Idaho Pure Seed Law. Seed will be furnished in sealed bags or containers clearly labeled to show the name and address of the supplier, the seed name, the lot number, net weight, origin, the percentage weed seed content, the guaranteed percentage of purity and germination, pounds of live seed (PLS) of each seed species, the total pounds of live seed in the container, and the date the of the last germination test that will be within a period of six months prior to commencement of planting operations. Seed will be from a current or previous year's crop. Each variety of seed will meet the requirements of the Idaho Pure Seed Law.

The following seed mixture will be used:

| Species | (lb/acre purer live seed) |
|---|---|
| Streambank wheatgrass | 5 |
| Needle and Thread | 5 |
| Lewis flax | 1 |
| Milkvetch | 0.5 |
| False Alfalfa | 0.5 |
| Wyoming big sage brush | 0.25 |
| Winterfat | 0.25 |

2.2.2 Fertilizer

A starter fertilizer containing nitrogen, phosphorous, potassium, and sulfur will be used. A 20-48-10 or contractor approved equal will be acceptable.

2.2.3 Mulch

The subcontractor will furnish all labor, materials, tools, and equipment to place a grain straw (wheat, oats, or barley) mulch on the reclaimed areas.

2.2.4 Equipment

The subcontractor will provide appropriate types of equipment for the performance of drill seeding and mulch spreading. Seeding of the grass species will be done with a rangeland grass drill equipped with multiple seed bins, depth bands, and press wheels. Drills should have agitators to prevent the seed from segregating and lodging in the seed box. The depth bands should be suitable for placing the seed at a depth that does not exceed l/2 inch.

Mulch crimping equipment will properly crimp straw without cutting the straw. Discing equipment is not acceptable.

2.3 PRODUCT DELIVERY, STORAGE, AND HANDLING

2.3.1 Delivery

The subcontractor will deliver seed to the site in the original, unopened containers bearing the container labels or tags stating the producer's guaranteed statement of analysis.

2.3.2 Storage

Material will be stored in areas designated by the contractor. Seed will be stored in cool, dry locations away from contaminants and in accordance with manufacturer's recommendations. Storage times will not exceed manufacturer's recommendations.

2.3.3 Handling

Except for bulk deliveries, the subcontractor will not drop or dump materials from vehicles.

**PART 3 EXECUTION**

## 3.1 APPLICATION PROCEDURES

### 3.1.1 Topsoil Preparation

Prior to seeding, the subcontractor will till the top three inches of the surface into an even and loose seed bed, free of clods in excess of four inches in diameter, and brought to the desired line and grade. The areas to be planted will be free of rills and gullies. All roots larger than one in diameter, litter, and other foreign material will be removed from the area and disposed by the subcontractor.

### 3.1.2 Seeding

(a) The subcontractor will seed remediation areas, laydown areas, borrow areas, and other locations impacted by construction activities.

(b) The subcontractor will apply the seed mix uniformly to the prepared surface by means of drill seeding at the minimum rate specified in Part 2.2.1 of this section.

(c) Seed will be uniformly drilled to a maximum depth of 1/2 inch using equipment specified in Part 2.2.4 of this section.

(d) The subcontractor will seed in a pattern perpendicular to the slope, working from the top of the slope down and using row markers to indicated seeded areas.

(e) The subcontractor will seed the grass mixture in either the spring or the fall. Where feasible, seeding should be done between October 15 and November 15 for optimum results. Spring seeding will be done after the chances of freezing temperatures have passed. Fall seeding will be done before the ground is frozen or covered with snow and before the time that temperatures would be too low for germination.

(f) The stand of grass resulting from the seeding will not be considered satisfactory until accepted by the contractor. Subcontractor will provide a one-year warranty to assure the stand of grass from the seeding. If areas are determined to be unacceptable, the unacceptable areas will be reseeded in accordance with these specifications.

### 3.1.3 Fertilizer

Fertilizer will be applied at the rate of 30 pounds per acre.

### 3.1.4 Mulch

Mulch will be straw spread uniformly at a rate of two tons per acre immediately following seeding. Mulch will be anchored into the soil to a depth of at least two inches with no more than one pass of the crimping equipment. Mulching will not be performed when wind interferes with placement.

## 3.2 MAINTENANCE

### 3.2.1 General

(a) Maintenance during all construction operations will be provided by the subcontractor

(b) Areas damaged by man-made or natural causes, will be restored to the original conditions of this specification by the subcontractor.

3.2.2 Inspections

(a) The subcontractor will perform daily inspections of previously seeded areas during the reclamation activities. The inspection records will be submitted weekly to the contractor.

(b) All inspection findings will be submitted to the contractor in writing including, but not limited to, conditions observed, repairs recommended, and materials recommended. The subcontractor is required to submit a repair report documenting the repairs made and material used.

3.2.3 Warranty

The warranty period will be the Contract Documents. Areas of erosion will be immediately repaired and reseeded by the subcontractor throughout the warranty period or until an acceptable grass stand is established and accepted by the contractor.

3.3 ACCEPTANCE

Seeding and mulching not in accordance with the requirements of this specification will be repaired and/or replaced by the subcontractor. The subcontractor will submit a description of the repair and/or replacement methods to the contractor for written approval before use. Acceptance criteria for repaired and/or replaced seeding or mulching will be in accordance with the original requirements of this specification.

END OF SECTION

# Appendix C

# Quality Level Evaluation

414.02
11/10/98
Rev. 02

# QUALITY LEVEL DESIGNATION AND RECORD

Quality Level Evaluation Performed By: Craig Reese Date: 7/21/00

Facility/Structure/System: TAN RD/RA (OU 1-10) Select Sites Quality Level: 3

| IDENTIFICATION OF ITEM | QUALITY LEVEL DESIGNATION | TECHNICAL JUSTIFICATION |
|---|---|---|
| RD/RA SAMPLING AT OU 1-10 | 3 | PRELIMINARY HAZARDS ANALYSIS |
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Note: Assign and record quality level in accordance with MCP-540, and obtain appropriate approvals. Completed and approved form becomes a quality assurance record. (Master Equipment List may be used as a Q-List.)

| | | |
|---|---|---|
| Quality Assurance Concurrence Printed/Typed Name | Quality Assurance Concurrence Signature | 8-21-2000 Date |
| Facility/Program/Project Approval Printed/Typed Name | Facility/Program/Project Approval Signature | 7-21-00 Date |

# Appendix D

# Air Emission Modeling Results

# Appendix D

## Radionuclide Emissions from Excavation Activities TAN TSF-06, Area B Site and TSF-26

The assumptions and calculations used to determine the air emissions of particulates and radionuclides that could result from planned remediation activities at the TAN TSF-06, Area B site and TSF 26 are presented. These calculations satisfy the requirements of 40 CFR 61.92, 61.93, and 61:94(x) NESHAPs for Emissions of Radionuclides Other than Radon from DOE Facilities and IDAPA 16.01.01.585 and .586 Toxic Substances identified as applicable requirements in the Record of *Decision for Test Area North, Operable Unit* 1-10 (DOE-ID 1999).

Air emissions of particulates and radionuclides from the planned remediation activities were estimated as detailed in Attachment D1. These estimates were then used in the CAP88PC model (DOE-HQ 1997), a DOE developed and EPA approved computer code, to calculate the radionuclide dose to a receptor at the nearest site boundary and nearest community. The outputs from the CAP88PC model are included as Attachment D2.

The TAN TSF-06, Area B site to be remediated consists of a 15- x 30-m (500- x 100-ft) area of soil contaminated by windblown radioactive particles. This area includes a 500-ft section of Snake Avenue, an asphalt road. Contamination is suspected of extending beneath the roadbed. The selected remedy for this site is the excavation of contaminated soil to depths as indicated in Table D-1. The maximum depth of 3-m (10-ft) or the maximum depth at which contaminant concentrations are above the final remediation goals will be remediated based on whichever is less. TSF-26 soils to be remediated include 137- x 53-m (450- x 175-ft) (DOE-ID 1997) to an average depth of 1.5-m (5-ft) consistent with the Group 1 remediation strategy (DOE-ID 1999).

The contaminants of concern (COC) for TSF-06, Area B and TSF-26 are Cs-137 and Co-60. The maximum activities detected for these COCs in samples taken from TSF-06, Area B were 150 and 0.185 pCi/g, respectively. For TSF-26, the maximum activities were 4,400 and 3.6 pCi/g (DOE-ID 1997). The Cs-137 activity was used to estimate emissions for both Cs-137 and its daughter Ba-137m. Other potential contaminants included trichloroethene, 1,1,1-trichloroethane, and carbon tetrachloride; however, these potential contaminants were not detected in soils from these areas. As a result, only particulate and radionuclide emissions were calculated.

The maximum volumes to be remediated are shown in Table D-1. Releases of particulates and radionuclides during excavation are projected to occur in one of two ways: (1) become airborne during heavy equipment movement across the contaminated Area, and (2) become airborne during pickup and dropping of the soil during excavation.

Particulate emission factors and rates were calculated for both release mechanisms and for several sizes of particulate material ($PM_{30}$, PM1s, $PM_{1o}$, PMs, and PM2.5) using the assumptions detailed in Attachment D1. The equations used (EPA 1998) and results also are presented. The emission rates were then used to calculate total particulate and radionuclide emissions for the various particle sizes.

The total emissions from both release methods for particulates (in lbs) were calculated by multiplying the emission rates by the time it takes to remove all of the contaminated material. The amount of material to be moved per hour (61.92 ton/hr) was estimated by taking the amount of material transported per dump truck load (12 $yd^3$) × 4 loads per hour × the weight of the soil per cubic yard

(1.29 ton/yd$^3$). The time to excavate the maximum volume of soil from each site was estimated by dividing the total weight of the material by the amount of material to be moved per hour.

Table D-1. Volumes to be excavated.

| | Dimensions (ft) | Depth of Excavation (ft) | Volume (W) | Volume (Yd) |
|---|---|---|---|---|
| | | TSF-06, Area B | | |
| Asphalt Road | 30 × 500 | 0.33 | 4,950 | 183.3 |
| Shoulders-Soil | 20 × 500 | 0.33 | 3,300 | 122.2 |
| Soil Under Road | 50 × 500 | 9.67 | 241,750 | 8,954.4 |
| Remainder of Site | 50 × 500 | 10 | 250,000 | 9,260.0 |
| TSF-06, Area B Total Contaminated Soil and Asphalt Volume | | | 500,000 | 18,520 |
| | | TSF-26 | | |
| Contaminated Soil | 450 × 175 | 5 | 393,750 | 14,583 |
| TSF-26 Total Contaminated Soil | | | 393,750 | 14,583 |

Table D-2. TSF-06, Area B Emission Calculations.

| | $PM_{30}$ | $PM_{15}$ | PM10 | $PM_5$ | $PM_{2.5}$ |
|---|---|---|---|---|---|
| 1. Total Volume of Contaminated Material to be removed (yd) | 18,520 | 18,520 | 18,520 | 18,520. | 18,520 |
| 2. Weight of Contaminated Material to be removed (tons) | 23,883 | 23,883 | 23,883 | 23,883 | 23,883 |
| 3. Unpaved Road Particulate Emission Rates (lbs/hr)[1] | 0.46 | — | 0.14 | — | 0.02 |
| 4. Pickup and Dropping Particulate Emission Rates (lbs/hr)[1] | 0.06 | 0.04 | 0.03 | 0.02 | 0.01 |
| 5. Amount of Material Moved per hour (Ton/hr) | 61.92 | 61.92 | 61.92 | 61.92 | 61.92 |
| 6. Time to Remove Contaminated Material (hrs) | 386 | 386 | 386 | 386 | 386 |
| 7. Road Particulate Emissions (lbs) 2 | 176 | — | 54 | — | 7.8 |
| 8. Pickup/Drop Particulate Emissions (lbs)[2] | 23 | 15 | 11 | 6.3 | 3.4 |
| 9. Cs-137 (pCi/g) | | | 150 | | |
| 10. Cs-137 (Ci/lb) | | | 6.8E-8 | | |
| 11. Ba-137m (pCi/g)[3] | | | 150 | | |
| 12. Ba-137m (Ci/lb) | | | 6.8E-8 | | |
| 13. Co-60 (pCi/g) | | | 0.185 | | |
| 14. Co-60 (Ci/lb) | | | 8.39E-11 | | |
| 15. Cs-137 Release (Ci) | 1.35E-05 | 1.02E-06 | 4.40E-06 | 4.25E-07 | 7.69E-07 |
| 16. Ba-137m Release (Ci) | 1.35E-05 | 1.02E-06 | 4.40E-06 | 4.25E-07 | 7.69E-07 |
| 17. Co-60 Release (Ci) | 1.67E-08 | 1.26E-09 | 5.43E-09 | 5.25E-10 | 9.48E-10 |

Releases shown are combined total release from both scenarios. The input to CAP-88 was the sum for each nuclide.

$PM_x$ = particulate matter, x microns or less in diameter
1. Calculations of the Unpaved Road and Pickup/Drop Emission rates are described in Attachment D1 along with worksheet calculation summary.
2. Emissions (Lines 7* 8) = Emission Rates (Lines 3 and 4) X Time to Remove (Line 6). Calculation worksheet summary is included in Attachment D1
3. Ba-137m is the daughter product of Cesium-137 (Cs-137). Approximately 85% of Cs-137 decays to Ba-137m. In these calculations it is assumed that 100% of Cs-137 will decay to Ba-137m.

Table D-3. TSF-26 Emission Calculations.

| | $PM_{30}$ | $PM_{15}$ | $PM_{10}$ | $PM_5$ | $PM_{2.5}$ |
|---|---|---|---|---|---|
| 1. Total Volume of Contaminated Material to be removed ($yd^3$) | 14,583 | 14,583 | 14,583 | 14,583 | 14,583 |
| 2. Weight of Contaminated Material to be removed (tons) | 11,288 | 11,288 | 11,288 | 11,288 | 11,288 |
| 3. Unpaved Road Particulate Emission Rates (lbs/hr)[1] | 0.46 | — | 0.14 | — | 0.02 |
| 4. Pickup and Dropping Particulate Emission Rates (lbs/hr)[1] | 0.06 | 0.04 | 0.03 | 0.02 | 0.01 |
| 5. Amount of Material Moved per hour (ton/hr) | 61.92 | 61.92 | 61.92 | 61.92 | 61.92 |
| 6. Time to Remove Contaminated Material (hrs) | 304 | 304 | 304 | 304 | 304 |
| 7. Road Particulate Emissions (lbs)[2] | 138 | — | 42 | — | 6.2 |
| 8. Pickup/Drop Particulate Emissions (lbs)[2] | 18 | 12 | 8.6 | 4.9 | 2.7 |
| 9. Cs-137 (pCi/g) | | | 4,400 | | |
| 10. Cs-137 (Ci/lb) | | | 2.0E-06 | | |
| 11. Ba-137m (pCi/g)[3] | | | 4,400 | | |
| 12. Ba-137m (Ci/lb) | | | 2:0E-8 | | |
| 13. Co-60 (pCi/g) | | | 3.6 | | |
| 14. Co-60 (Ci/lb) | | | 1.6E-09 | | |
| 15. Cs-137 Release (Ci) | 3.8E-04 | 2.4E-05 | 1.0E-05 | 9.8E-06 | 1.8E-05 |
| 16. Ba-137m Release (Ci) | 3.8E-04 | 2.4E-05 | 1.0E-05 | 9.8E-06 | 1.8E-05 |
| 17. Co-60 Release (Ci) | 2.6E-07 | 1.9E-08 | 8.3E-08 | 8.0E-09 | 1.4E-08 |

Releases shown are combined total release from both scenarios. The input to CAP-88 was the sum for each nuclide.

$PM_x$ = particulate matter, × microns or less in diameter
1. Calculations of the Unpaved Road and Pickup/Drop Emission rates are described in Attachment Dl along with worksheet calculation summary.
2. Emissions (Lines 7*8) = Emission Rates (Lines 3 & 4) × Time to Remove (Line 6). Calculation worksheet summary is included in Attachment Dl.
3. Ba-137m is the daughter product of Cesium 137 (Cs-137). Approximately 85% of Cs-137 decays to Ba-137m. In these calculations it is assumed that 100% of Cs-137 will decay to Ba-137m.

Assuming that the radionuclide contamination is homogeneously distributed throughout the soil and will be released with particulates, radionuclide activity released (in Ci) was then calculated by multiplying the total particulate emissions by the nuclide-specific soil concentrations (in Ci/lb). The activities were then summed on a nuclide-specific basis for input to the CAP-88 model.

Exposures were modeled at two distances: 150 m and 16,000 m. These distances were selected to correspond with the nearest public access location approximately 150 m to the east where County Road #133 intersects with Lincoln Boulevard, the road from TAN to CFA to the south, and the nearest community (Mud Lake, Idaho, approximately 16,100 m to the east).

Results for TSF-06, Area B indicate that the total effective dose equivalent rates generated by the model were a maximum rate of 3.4E-04 mrem/yr to an individual at the site boundary (150 m to the east) and 1.10E-04 mrem/yr for all quadrants looted 16,100 m from the source (including Mud Lake, Idaho). These doses are those estimated by the CAP-88PC model to be received by an individual over an entire year at the emission rate calculated. However, emissions of dust and radionuclides from the planned remedial activity would be for a much shorter period of time (approximately 12 weeks). Estimated doses for both locations are well below the NESHAPS limit of 10 mrem/yr.

Results for TSF-26 indicate that the total effective dose equivalent rates generated by the model were a maximum rate of 5.3E-03 mrem/yr to an individual at the site boundary (150 m to the east) and 1.7E-03 mrem/yr for all quadrants located 16,100 m from the source (including Mud Lake, Idaho). These doses are those estimated by the CAP-88PC model to be received by an individual over an entire year at the emission rate calculated. Estimated doses for both locations are well below the NESHAPS limit of 10 mrem/yr.

The CAP-88PC output, including the synopsis, general data, weather data, and dose and risk equivalent summaries, is found in Attachment D2 to this appendix.

**References**

EPA, 1998, *Compilation of Air Pollutant Emission Factors, AP-42,* Fifth Edition, Volume I: Stationary *Point and Area* Sources, January 1995 (Section 13.2.4) and September 1998 (Section 13.2.2).

DOE-HQ, 1997, CAP88 PC *Version 2.0 User's Guide.* US Department of Energy, ER-8/TN, June 1997.

DOE-ID, 1997, *Comprehensive Remedial Investigation Feasibility Study (RI/FS) for Test Area North OU 1-10 at the Idaho National Engineering and Environmental Laboratory,* U.S. Department of Energy Idaho Operations Office, DOE/ID-10557, Revision 0, November 1997.

DOE-ID, 1999, *Final Record of Decision for Test Area North, Operable Unit 1-10,* Idaho National Engineering and Environmental Laboratory, Idaho Falls, Idaho, DOE/ID-10682, Revision 1, October 1999.

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# Attachment D1

# Emission Calculations

# Attachment D1

# Emission Calculations

Problem Statement:

Estimate the fugitive dust particle distribution associated with remediation activities of the TAN site TSF-06, Area B and TSF-26.

Approach:

Methods to estimate fugitive particulate matter (PM) generated from unpaved roads and aggregate handling and storage piles from the most recent revisions (by section) of AP- 42, Chapter 13 (EPA 1998), were used to estimate dust emissions from remedial activities at the TAN TSF-06, Area B site. The PM30, $PM1_5$, $PM_{10}$, $PM_5$, and $PM_{2.5}$ distributions were calculated and used in the CAP-88PC model (DOE-HQ 1997) to estimate radionuclide/dust emissions and dose to receptors at the nearest site boundary and nearest community.

Assumptions used in the calculations:

The remedial action will occur between March and October in the year 2000 (245 days).

The average silt loading, or percent of silt in the soils to be remediated, is characteristic of soils at TAN (8.07%) (an average of silt content sample results for TAN soils as presented in INEL 1995).

Averages used for the number of wheels per vehicle for those to be driven on the contaminated area (excludes dump trucks), and weights of excavation equipment, are listed in Table D1-1.

Wind erosion is minimal and is not included.

The total vehicle miles traveled on the contaminated surface (VMT) are 0.1 mile/hr.

Each dump truck transports 12 cubic yards ($yd^3$) of material.

Average soil moisture content was assumed to be 6.0% (assumed appropriate for INEEL soils in previous estimates).

Monthly average wind speed and direction (quadrant) for the CFA at the 20-ft and 250-ft levels were taken from Clawson (1989). The average wind speeds were determined by using the weighted-average of the months of March through October. The average wind speed for the 20-ft level, WSW quadrant (8.2 mph) was used in the calculation of particulate emissions generated from pickup and dropping during excavation.

| Equipment | Number of Wheels | Weight (lbs) | Number |
|---|---|---|---|
| 416B Backhoe Loader | 4 | 13,700 | 1 |
| 950 Front-End Loader | 4 | 36,500 | 1 |
| D6 Dozer | 4 | 40,000 | 1 |
| 140H Grader | 6 | 30,000 | 1 |
| 838 Soil Compactor | 4 | 44,000 | 1 |
| Dump Truck | 10 | 50,000 | 14 |
| Water Truck | 10 | 50,000 | 1 |
| Average without Dump Trucks | 5.3 | 35,700 (17.85 Ton) | |

Calculations of Particulate Emissions from Unpaved Roads:

To estimate the quantity of size-specific particulate emissions from an unpaved road, per vehicle mile traveled, first an emission factor for each size of particulate matter was calculated using an equation taken from AP-42, Section 13.2.2, Unpaved Roads, 9/98 revision (EPA 1998). The equation and definition of terms are as follows:

$$E_f = k[(s/l2)^a(W/3)^b]/(M/0.2)^c \quad (1)$$

Where:

Ef = size-specific emission factor (lb/VMT) s = surface material silt content (%)

W = mean vehicle weight (tons)

M = surface material moisture content (%)

Where k, a, b, and c are empirical constants provided in Section 13.2.4 (9/98 revision) of AP-42:

| Constant | PM-2.5 | PM-10 | PM-30 |
|---|---|---|---|
| k (lb/VMT) | 0.38 | 2.6 | 10 |
| A | 0.8 | 0.8 | 0.8 |
| B | 0.4 | 0.4 | 0.5 |
| C | 0.3 | 0.3 | 0.4 |

Using the calculated $E_f$ (lbs/VMT), an assumed VMT of 0.1 mph on the contaminated surface, and the site-specific tonnage estimates for the remediation, the emission rates in total lbs and lbs/hr was calculated. The outputs of the calculations are summarized, by site, in Tables D.2 and D.3. Worksheet summaries are also included in this attachment.

Calculations of Particulate Emissions from Pickup and Dropping of Soil during Excavation and Loading:

To estimate the quantity of size specific particulate emissions generated from pickup and dropping during excavation, an emission factor for each size of particulate matter was calculated using an equation from taken from EPA (1998), Section 13.2.4, Aggregate Handling and Storage Piles. The equation and definition of terms are as follows:

$$E_f = k\,(0.0032)[U/5)^{1.3} / (M/2)^{1.4}] \qquad (2)$$

Where:

$E_f$ = emission factor (pounds/ton)

k = particle size multiplier (dimensionless)

U = mean wind speed, (8.2 mph)

M = soil moisture content (6%)

Where k is a dimensionless constant from EPA (1998) Section 13.2.2 (1/95) revision of AP-42:

| PM-2.5 | PM-5 | PM-10 | PM-15 | PM-30 |
|---|---|---|---|---|
| 0.11 | 0.2 | 0.35 | 0.48 | 0.74 |

Using the $E_f$ the emission rates in lbs/ton and lbs/hr was calculated. The outputs of the calculations are summarized, by site, in Tables D.2 and D.3. Worksheet summaries are also included in this attachment.

The emission rates for both excavation activities were then used to estimate total particulate emissions to be then used in the CAP88PC model. Emission factors and emission rates for both activities are presented in Tables D-2 and D-3 of the appendix text.

References:

Clawson, 1989, *Climatography of the Idaho National Engineering Laboratory*, Second Edition, U.S. Department of Commerce, National Oceanic and Atmosphere Administration, Environmental Research Laboratories, Air Resources Laboratory, Field Research Division, December 1989.

DOE-HQ, 1997, *CAP88 PC Version 2.0 User's Guide*, US Department of Energy, ER-8/TN, June 1997.

EPA, 1998, *Compilation of Air Pollutant Emission Factors*, AP-42, Fifth Edition, Volume 1: *Stationary Point and Area Sources*, January 1995 (Section 13.2.4) and September 1998 (Section 13.2.2).

INEL, 1995, *Draft Final Summary Report for the WAG 3 and WAG 10 Radionuclide-Contaminated Soils Treatability Study*, Appendix A, INEL-94/0171, October 1995.

TSF-06, Area B

| Site Dimensions: | | | | | |
|---|---|---|---|---|---|
| | feet | 30 | 500 | 0.33 | Asphalt Road |
| | meters | 9.15 | 152.5 | 0.10065 | |
| | feet | 20 | 500 | 0.33 | Shoulders-Soil |
| | meters | 6.1 | 152.5 | 0.10065 | |
| | feet | 50 | 500 | 9.67 | Soil Under Road |
| | meters | 15.25 | 152.5 | 2.94935 | |
| | feet | 50 | 500 | 10 | Remainder of Site |
| | meters | 15.25 | 152.5 | 3.05 | |

| | |
|---|---|
| Volume (ft3) | 500000 |
| Volume (m3) | 14166.3125 |
| Volume (yd3) | 18518.5185 |
| Weight Tons | 23888.8889 |
| Weight Lbs | 47777777.8 |

short ton conversion

| COC | Maximum pCi/g | pCi/lb | Ci/lb | lbs waste | Ci total | tons waste |
|---|---|---|---|---|---|---|
| Cs-137 | 150 | 68040 | 6.804E-08 | 47777778 | 3.25080002 | 23889 |
| Co-60 | 0.185 | 83.916 | 8.3916E-11 | 47777778 | 0.00400932 | 23889 |
| Ba-137m | 150 | 68040 | 6.804E-08 | 47777778 | 3.25080002 | 23889 |

**Pickup & Dropping**

k, particle size multiplier:

| PM30 | PM15 | PM10 | PM5 | PM2.5 |
|---|---|---|---|---|
| 0.74 | 0.48 | 0.35 | 0.2 | 0.11 |

Aerodynamic particle size multiplier (k) from Section 13.2.4

Emission factor - Ef (lbs/ton) = Ef = k* 0.00130761 Using equation for aggregate handling & storage piles - Section 13.2.4

| PM30 | PM15 | PM10 | PM5 | PM2.5 |
|---|---|---|---|---|
| 0.0009694 | 0.0006288 | 0.0004585 | 0.000262 | 0.0001441 |

Wind speed = 8.2 mph; Moisture = 6 %

Emission total - Et (lbs) - total pounds released based on total tons of waste = Ef*tons

| PM30 | PM15 | PM10 | PM5 | PM2.5 |
|---|---|---|---|---|
| 23.1579966 | 15.0214032 | 10.9531065 | 6.258918 | 3.4424049 |

Emission rate - Er (lbs/hr) - pounds releases bases on time estimated to remove total tons = Et/386 hr 385.8024691

Based on an estimate of moving 61.92 ton/hr which was estimated by taking the material transported per dump truck load (12 yd3) times 4 loads per hourtimes the weight of soil per yd3 ( 1.29 ton/yd3)

| PM30 | PM15 | PM10 | PM5 | PM2.5 |
|---|---|---|---|---|
| 0.060025527 | 0.03893548 | 0.02839045 | 0.016223115 | 0.00892271 |

| | PM30 Ci released | PM15 Ci released | PM10 Ci released | PM5 Ci released | PM2.5 Ci released |
|---|---|---|---|---|---|
| Cs-137 | 1.5757E-06 | 1.0221E-06 | 7.45249E-07 | 4.2586E-07 | 2.3422E-07 |
| Co-60 | 1.9433E-09 | 1.2605E-09 | 9.19141E-10 | 5.2522E-10 | 2.8887E-10 |
| Ba-137m | 1.5757E-06 | 1.0221E-06 | 7.45249E-07 | 4.2586E-07 | 2.3422E-07 |

Unpaved Road - a.k.a excavation of the source

k, particlate size constants (multipliers)

| PM30 | PM10 | PM2.5 |
|---|---|---|
| 10 | 2.6 | 0.38 |

exponential - a

| | | |
|---|---|---|
| 0.8 | 0.8 | 0.8 |

exponential - b

| | | |
|---|---|---|
| 0.5 | 0.4 | 0.4 |

exponential - c

| | | |
|---|---|---|
| 0.4 | 0.3 | 0.3 |

Emission Factor (E) - size-specific Ef in lb/VMT

VMT is Vehicle Mile Travelled per hr - 0.1.

| | | |
|---|---|---|
| 4.555791206 | 1.39250765 | 0.20352035 |

Emission total (lbs) - total lbs released based on total VMT of 0.1 mile traveled per hr on the contaminated surface * 386 hr total to remove = 38.6

| | | |
|---|---|---|
| 175.8535405 | 53.7507952 | 7.85588545 |

Emission rate (lbs/hr)

| | | |
|---|---|---|
| 0.455812377 | 0.13932206 | 0.02036246 |

| | PM30 Ci released | PM15 Ci released | PM10 Ci released | PM5 Ci released | PM2.5 Ci released |
|---|---|---|---|---|---|
| Cs-137 | 1.1965E-05 | 0 | 3.6572E-06 | 0 | 5.3451E-07 |
| Co-60 | 1.4757E-08 | 0 | 4.51055E-09 | 0 | 6.5923E-10 |
| Ba-137m | 1.1965E-05 | 0 | 3.6572E-06 | 0 | 5.3451E-07 |

**Subtotal:**

| | | | | | | Total |
|---|---|---|---|---|---|---|
| Cs-137 | 1.3541E-05 | 1.0221E-06 | 4.40245E-06 | 4.2586E-07 | 7.6874E-07 | 2.01598E-05 |
| Co-60 | 1.67E-08 | 1.2605E-09 | 5.42969E-09 | 5.2522E-10 | 9.4811E-10 | 2.48638E-08 |
| Ba-137m | 1.3541E-05 | 1.0221E-06 | 4.40245E-06 | 4.2586E-07 | 7.6874E-07 | 2.01598E-05 |

## TSF-26 (i.e., PM2A Tank Soils)

| Site Dimensions: | | | | | |
|---|---|---|---|---|---|
| | feet | 450 | 175 | 5 | 450x175' from RI/FS Figure 4-31, page 4-101; 3' from Group 1 Remediation strategy |
| | meters | 137.25 | 53.375 | 1.525 | |
| | Volume (ft3) | 393750 | | | |
| | Volume (m3) | 11171.7211 | | | |
| | Volume (yd3) | 14583.3333 | | | |
| | Weight Tons | 18812.5 | | | |
| | Weight Lbs | 37625000 | | | short ton conversion |

COC

| | pCi/g | pCi/lb | Ci/lb | lbs waste | Ci total | tons waste |
|---|---|---|---|---|---|---|
| Cs-137 | 4400 | 1995840 | 1.99584E-06 | 37625000 | 75.08348 | 18812.5 |
| Co-60 | 3.6 | 1632.96 | 1.63296E-09 | 37625000 | 0.06144012 | 18812.5 |
| | | | | | | |
| Ba-137m | 4400 | 1995840 | 1.99584E-06 | 37625000 | 75.08348 | 18812.5 |

**Pickup & Dropping**

k, particle size multiplier:

| PM30 | PM15 | PM10 | PM5 | PM2.5 | | | | |
|---|---|---|---|---|---|---|---|---|
| 0.74 | 0.48 | 0.35 | 0.2 | 0.11 | | | | Aerodynamic particle size multiplier (k) from Section 13.2.4 |
| Emission factor - Ef (lbs/ton) = | | | | | Ef | = | k* 0.00130761 | Using equation for aggregate handling & storage piles - Section 13.2.4 |
| 0.0009694 | 0.0006288 | 0.0004585 | 0.000262 | 0.0001441 | | | | Wind speed = 8.2 mph; Moisture = 6 % |
| Emission total - Et (lbs) - total pounds released based on total tons of waste | | | | | | = | Ef*tons | |
| 18.2388375 | 11.8283 | 8.62553125 | 4.928875 | 2.71088125 | | | | |
| Emission rate - Er (lbs/hr) - pounds releases bases on time estimated to remove total tons | | | | | | = | Et/304 hr | Based on an estimate of moving 61.92 ton/hr which was estimated by taking the material transported |
| 0.060025248 | 0.0389353 | 0.02839032 | 0.01622304 | 0.00892267 | | | 303.819444 hrs | per dump truck load (12 yd3) time 4 loads per hourtimes the weight of soil per yd3 ( 1.29 ton/yd3) |

| | PM30 Ci released | PM15 Ci released | PM10 Ci released | PM5 Ci released | PM2.5 Ci released |
|---|---|---|---|---|---|
| Cs-137 | 3.6398E-05 | 2.3609E-05 | 1.72152E-05 | 9.8372E-06 | 5.4105E-06 |
| Co-60 | 2.978E-08 | 1.9317E-08 | 1.40851E-08 | 8.0487E-09 | 4.4268E-09 |
| | | | | | |
| Ba-137m | 3.6398E-05 | 2.3609E-05 | 1.72152E-05 | 9.8372E-06 | 5.4105E-06 |

**Unpaved Road** - a.k.a excavation of the source

k, particlate size constants (multipliers)

| PM30 | PM10 | PM2.5 |
|---|---|---|
| 10 | 2.6 | 0.38 |
| exponential - a | | |
| 0.8 | 0.8 | 0.8 |
| exponential - b | | |
| 0.5 | 0.4 | 0.4 |
| exponential - c | | |
| 0.4 | 0.3 | 0.3 |

Emission Factor (E) - size-specific Ef in lb/VMT — VMT is Vehicle Mile Travelled per hr = 0.1.

| | | |
|---|---|---|
| 4.555791206 | 1.39250765 | 0.20352035 |

Emission total (lbs) - total lbs released based on total VMT of 0.1 mile traveled per hr on the contaminated surface * 304 hr total to remove = 30.4 — 30.4

| | | |
|---|---|---|
| 138.4960527 | 42.3322325 | 6.18701859 |

Emission rate (lbs/hr)

| | | |
|---|---|---|
| 0.455649865 | 0.13933352 | 0.02036413 |

| | PM30 Ci released | PM15 Ci released | PM10 Ci released | PM5 Ci released | PM2.5 Ci released |
|---|---|---|---|---|---|
| Cs-137 | 0.00027642 | 0 | 8.44884E-05 | 0 | 1.2348E-05 |
| Co-60 | 2.2616E-07 | 0 | 6.91266E-08 | 0 | 1.0103E-08 |
| Ba-137m | 0.00027642 | 0 | 8.44884E-05 | 0 | 1.2348E-05 |

| **Subtotal:** | | | | | | **Total** |
|---|---|---|---|---|---|---|
| Cs-137 | 0.00031281 | 2.3609E-05 | 0.000101704 | 9.8372E-06 | 1.7759E-05 | 0.00046572 |
| Co-60 | 2.5594E-07 | 1.9317E-08 | 8.3212E-08 | 8.0487E-09 | 1.453E-08 | 3.8105E-07 |
| Ba-137m | 0.00031281 | 2.3609E-05 | 0.000101704 | 9.8372E-06 | 1.7759E-05 | 0.00046572 |

# Attachment D2

# CAP88PC Output

C A P 8 8 - P C

Version 2.00

Clean Air Act Assessment Package - 1988

S Y N O P S I S  R E P O R T

Non-Radon Individual Assessment
Jul 17, 2000 02:18 pm

Facility: TSF Area B
Address: INEEL
City:
State: ID Zip:

Source Category: Area
Source Type: Area
Emission Year: 2000

Comments:

Effective Dose Equivalent
(mrem/year)

5.92E-04

At This Location: 150 Meters North Northeast
Dataset Name: TSFAreaB
Dataset Date: Jul 17, 2000 02:17 pm
Wind File: C:\CAP88PC2\WNDFILES\24156.WND

## MAXIMALLY EXPOSED INDIVIDUAL

Location Of The Individual: 150 Meters North Northeast
Lifetime Fatal Cancer Risk: 1.55E-08

## ORGAN DOSE EQUIVALENT SUMMARY

| Organ | Dose Equivalent (mrem/y) |
|---|---|
| GONADS | 5.67E-04 |
| BREAST | 6.17E-04 |
| R MAR | 5.61E-04 |
| LUNGS | 5.73E-04 |
| THYROID | 6.53E-04 |
| ENDOST | 3.93E-04 |
| RMNDR | 6.35E-04 |
| EFFEC | 5.92E-04 |

Jul 17, 2000 02:18 pm
SYNOPSIS

RADIONUCLIDE EMISSIONS DURING THE YEAR 2000

| Nuclide | Class | Size | Source #1 Ci/y | TOTAL Ci/y |
|---|---|---|---|---|
| CS-137 | D | 1.00 | 2.0E-05 | 2.0E-05 |
| CO-60 | Y | 1.00 | 2.5E-08 | 2.5E-08 |
| BA-137M | D | 1.00 | 2.0E-05 | 2.0E-05 |

SITE INFORMATION

| | |
|---|---|
| Temperature: | 6 degrees C |
| Precipitation: | 22 cm/y |
| Mixing Height: | 1000 m |

SOURCE INFORMATION

Source Number: 1

Source Height (m): 1.
Area (sq m): 14186.

| Plume Rise Pasquill Cat: | A | B | C | D | E | F | G |
|---|---|---|---|---|---|---|---|
| Zero: | 0. | 0. | 0. | 0. | 0. | 0. | 0. |

AGRICULTURAL DATA

| | Vegetable | Milk | Meat |
|---|---|---|---|
| Fraction Home Produced: | 0.700 | 0.399 | 0.442 |
| Fraction From Assessment Area: | 0.300 | 0.601 | 0.558 |
| Fraction Imported: | 0.000 | 0.000 | 0.000 |

Food Arrays were not generated for this run.
Default Values used.

DISTANCES (M) USED FOR MAXIMUM INDIVIDUAL ASSESSMENT

150 16100

C A P 8 8 - P C

Version 2.00

Clean Air Act Assessment Package - 1988

G E N E R A L  D A T A

Non-Radon Individual Assessment
Jul 17, 2000 02:18 pm

Facility: TSF Area B
Address: INEEL
City:
State: ID Zip:

Source Category: Area
Source Type: Area
Emission Year: 2000

Comments:

Dataset Name: TSFAreaB
Dataset Date: Jul 17, 2000 02:17 pm
Wind File: C:\CAP88PC2\WNDFILES\24156.WND

VALUES FOR RADIONUCLIDE-DEPENDENT PARAMETERS

| Nuclide | Clearance Class | Particle Size (microns) | Scavenging Coefficient (per second) | Dry Deposition Velocity (m/s) |
|---|---|---|---|---|
| CS-137 | D | 1.0 | 2.21E-06 | 1.80E-03 |
| CO-60 | Y | 1.0 | 2.21E-06 | 1.80E-03 |
| BA-137M | D | 1.0 | 2.21E-06 | 1.80E-03 |

VALUES FOR RADIONUCLIDE-DEPENDENT PARAMETERS

| | DECAY CONSTANT (PER DAY) | | | TRANSFER COEFFICIENT | |
|---|---|---|---|---|---|
| Nuclide | Radio-active (1) | Surface | Water | Milk (2) | Meat (3) |
| CS-137 | 0.00E+00 | 5.48E-05 | 0.00E+00 | 7.00E-03 | 2.00E-02 |
| CO-60 | 0.00E+00 | 5.48E-05 | 0.00E+00 | 2.00E-03 | 2.00E-02 |
| BA-137M | 3.91E+02 | 5.48E-05 | 0.00E+00 | 3.50E-04 | 1.50E-04 |

FOOTNOTES: (1) Effective radioactive decay constant in plume; set to zero if less than 1.0E-2

(2) Fraction of animal's daily intake of nuclide which appears in each L of milk (days/L)

(3) Fraction of animal's daily intake of nuclide which appears in each kg of meat (days/kg)

VALUES FOR RADIONUCLIDE-DEPENDENT PARAMETERS

| | CONCENTRATION UPTAKE FACTOR | | GI UPTAKE FRACTION | |
|---|---|---|---|---|
| Nuclide | Forage (1) | Edible (2) | Inhalation | Ingestion |
| CS-137 | 8.00E-02 | 1.28E-02 | 9.50E-01 | 9.50E-01 |
| CO-60 | 2.00E-02 | 3.00E-03 | 5.00E-02 | 3.00E-01 |
| BA-137M | 1.50E-01 | 6.42E-03 | 1.00E-01 | 1.00E-01 |

FOOTNOTES: (1) Concentration factor for uptake of nuclide from soil for pasture and forage (in pCi/kg dry weight per pCi/kg dry soil)

(2) Concentration factor for uptake of nuclide from soil by edible parts of crops (in pCi/kg wet weight per pCi/kg dry soil)

VALUES FOR RADIONUCLIDE-INDEPENDENT PARAMETERS

| | |
|---|---|
| HUMAN INHALATION RATE | |
| Cubic centimeters/hr | 9.17E+05 |
| SOIL PARAMETERS | |
| Effective surface density (kg/sq m, dry weight) (Assumes 15 cm plow layer) | 2.15E+02 |
| BUILDUP TIMES | |
| For activity in soil (years) | 1.00E+02 |
| For radionuclides deposited on ground/water (days) | 3.65E+04 |
| DELAY TIMES | |
| Ingestion of pasture grass by animals (hr) | 0.00E+00 |
| Ingestion of stored feed by animals (hr) | 2.16E+03 |
| Ingestion of leafy vegetables by man (hr) | 3.36E+02 |
| Ingestion of produce by man (hr) | 3.36E+02 |
| Transport time from animal feed-milk-man (day) | 2.00E+00 |
| Time from slaughter to consumption (day) | 2.00E+01 |
| WEATHERING | |
| Removal rate constant for physical loss (per hr) | 2.90E-03 |
| CROP EXPOSURE DURATION | |
| Pasture grass (hr) | 7.20E+02 |
| Crops/leafy vegetables (hr) | 1.44E+03 |
| AGRICULTURAL PRODUCTIVITY | |
| Grass-cow-milk-man pathway (kg/sq m) | 2.80E-01 |
| Produce/leafy veg for human consumption (kg/sq m) | 7.16E-01 |
| FALLOUT INTERCEPTION FRACTIONS | |
| Vegetables | 2.00E-01 |
| Pasture | 5.70E-01 |
| GRAZING PARAMETERS | |
| Fraction of year animals graze on pasture | 4.00E-01 |
| Fraction of daily feed that is pasture grass when animal grazes on pasture | 4.30E-01 |

VALUES FOR RADIONUCLIDE-INDEPENDENT PARAMETERS

| | |
|---|---|
| ANIMAL FEED CONSUMPTION FACTORS | |
| Contaminated feed/forage (kg/day, dry weight) | 1.56E+01 |
| DAIRY PRODUCTIVITY | |
| Milk production of cow (L/day) | 1.10E+01 |
| MEAT ANIMAL SLAUGHTER PARAMETERS | |
| Muscle mass of animal at slaughter (kg) | 2.00E+02 |
| Fraction of herd slaughtered (per day) | 3.81E-03 |
| DECONTAMINATION | |
| Fraction of radioactivity retained after washing for leafy vegetables and produce | 5.00E-01 |
| FRACTIONS GROWN IN GARDEN OF INTEREST | |
| Produce ingested | 1.00E+00 |
| Leafy vegetables ingested | 1.00E+00 |
| INGESTION RATIOS: | |
| IMMEDIATE SURROUNDING AREA/TOTAL WITHIN AREA | |
| Vegetables | 7.00E-01 |
| Meat | 4.42E-01 |
| Milk | 3.99E-01 |
| MINIMUM INGESTION FRACTIONS FROM OUTSIDE AREA | |
| (Minimum fractions of food types from outside area listed below are actual fixed values.) | |
| Vegetables | 0.00E+00 |
| Meat | 0.00E+00 |
| Milk | 0.00E+00 |
| HUMAN FOOD UTILIZATION FACTORS | |
| Produce ingestion (kg/y) | 1.76E+02 |
| Milk ingestion (L/y) | 1.12E+02 |
| Meat ingestion (kg/y) | 8.50E+01 |
| Leafy vegetable ingestion (kg/y) | 1.80E+01 |
| SWIMMING PARAMETERS | |
| Fraction of time spent swimming | 0.00E+00 |
| Dilution factor for water (cm) | 1.00E+00 |

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Clean Air Act Assessment Package - 1988

W E A T H E R  D A T A

Non-Radon Individual Assessment
Jul 17, 2000 02:18 pm

Facility: TSF Area B
Address: INEEL
City:
State: ID Zip:

Source Category: Area
Source Type: Area
Emission Year: 2000

Comments:

Dataset Name: TSFAreaB
Dataset Date: Jul 17, 2000 02:17 pm
Wind File: C:\CAP88PC2\WNDFILES\24156.WND

HARMONIC AVERAGE WIND SPEEDS (WIND TOWARDS)

| | Pasquill Stability Class | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Dir | A | B | C | D | E | F | G | Wind Freq |
| N | 1.270 | 1.410 | 2.670 | 5.840 | 3.490 | 1.400 | 0.000 | 0.136 |
| NNW | 1.060 | 1.280 | 2.370 | 4.800 | 3.050 | 1.190 | 0.000 | 0.023 |
| NW | 1.190 | 1.160 | 1.630 | 3.360 | 2.740 | 1.230 | 0.000 | 0.014 |
| WNW | 1.190 | 1.150 | 1.870 | 2.770 | 2.720 | 1.230 | 0.000 | 0.016 |
| W | 1.190 | 1.320 | 2.040 | 2.530 | 2.930 | 1.290 | 0.000 | 0.032 |
| WSW | 1.250 | 1.560 | 2.300 | 2.780 | 2.990 | 1.280 | 0.000 | 0.038 |
| SW | 1.300 | 1.790 | 2.340 | 3.050 | 2.970 | 1.280 | 0.000 | 0.049 |
| SSW | 1.250 | 1.950 | 2.440 | 3.130 | 2.970 | 1.290 | 0.000 | 0.043 |
| S | 1.130 | 1.890 | 2.350 | 2.810 | 3.030 | 1.300 | 0.000 | 0.056 |
| SSE | 1.130 | 2.000 | 2.660 | 2.640 | 3.110 | 1.240 | 0.000 | 0.037 |
| SE | 1.280 | 1.990 | 2.560 | 2.350 | 2.920 | 1.250 | 0.000 | 0.032 |
| ESE | 1.270 | 2.010 | 3.160 | 3.160 | 2.850 | 1.320 | 0.000 | 0.038 |
| E | 1.280 | 2.210 | 3.600 | 4.800 | 3.000 | 1.230 | 0.000 | 0.085 |
| ENE | 1.060 | 2.190 | 3.940 | 5.800 | 3.280 | 1.350 | 0.000 | 0.123 |
| NE | 1.270 | 1.770 | 3.300 | 5.470 | 3.570 | 1.350 | 0.000 | 0.133 |
| NNE | 1.190 | 1.580 | 2.950 | 4.820 | 3.680 | 1.400 | 0.000 | 0.145 |

ARITHMETIC AVERAGE WIND SPEEDS (WIND TOWARDS)

| | Pasquill Stability Class | | | | | | |
|---|---|---|---|---|---|---|---|
| Dir | A | B | C | D | E | F | G |
| N | 1.780 | 2.310 | 4.100 | 7.290 | 3.720 | 1.930 | 0.000 |
| NNW | 1.460 | 2.050 | 3.760 | 6.750 | 3.260 | 1.680 | 0.000 |
| NW | 1.670 | 1.840 | 2.400 | 5.140 | 2.840 | 1.720 | 0.000 |
| WNW | 1.670 | 1.730 | 2.620 | 4.060 | 2.800 | 1.740 | 0.000 |
| W | 1.670 | 2.110 | 2.870 | 3.670 | 3.100 | 1.800 | 0.000 |
| WSW | 1.760 | 2.440 | 3.180 | 3.790 | 3.180 | 1.790 | 0.000 |
| SW | 1.820 | 2.700 | 3.210 | 4.360 | 3.150 | 1.790 | 0.000 |
| SSW | 1.760 | 2.850 | 3.320 | 4.320 | 3.150 | 1.800 | 0.000 |
| S | 1.580 | 2.840 | 3.210 | 4.030 | 3.230 | 1.820 | 0.000 |
| SSE | 1.580 | 2.950 | 3.490 | 3.680 | 3.330 | 1.740 | 0.000 |
| SE | 1.790 | 2.940 | 3.440 | 3.500 | 3.090 | 1.750 | 0.000 |
| ESE | 1.780 | 2.970 | 4.080 | 4.670 | 3.000 | 1.840 | 0.000 |
| E | 1.790 | 3.140 | 4.730 | 6.290 | 3.200 | 1.730 | 0.000 |
| ENE | 1.460 | 3.130 | 5.090 | 7.080 | 3.520 | 1.870 | 0.000 |
| NE | 1.780 | 2.730 | 4.460 | 6.510 | 3.800 | 1.880 | 0.000 |
| NNE | 1.670 | 2.490 | 4.080 | 5.870 | 3.890 | 1.930 | 0.000 |

FREQUENCIES OF STABILITY CLASSES (WIND TOWARDS)

Pasquill Stability Class

| Dir | A | B | C | D | E | F | G |
|---|---|---|---|---|---|---|---|
| N | 0.0012 | 0.0120 | 0.0290 | 0.6289 | 0.1754 | 0.1534 | 0.0000 |
| NNW | 0.0056 | 0.0356 | 0.0434 | 0.4967 | 0.1527 | 0.2659 | 0.0000 |
| NW | 0.0029 | 0.0581 | 0.0780 | 0.2465 | 0.1611 | 0.4533 | 0.0000 |
| WNW | 0.0024 | 0.0774 | 0.0895 | 0.2443 | 0.2025 | 0.3839 | 0.0000 |
| W | 0.0012 | 0.0794 | 0.1236 | 0.2721 | 0.1924 | 0.3313 | 0.0000 |
| WSW | 0.0052 | 0.0729 | 0.1637 | 0.3332 | 0.2070 | 0.2180 | 0.0000 |
| SW | 0.0049 | 0.0818 | 0.1784 | 0.3901 | 0.1536 | 0.1912 | 0.0000 |
| SSW | 0.0046 | 0.0908 | 0.1994 | 0.4010 | 0.1285 | 0.1757 | 0.0000 |
| S | 0.0036 | 0.1222 | 0.1937 | 0.3284 | 0.1500 | 0.2022 | 0.0000 |
| SSE | 0.0055 | 0.1429 | 0.1781 | 0.2786 | 0.1806 | 0.2144 | 0.0000 |
| SE | 0.0164 | 0.1697 | 0.2095 | 0.2397 | 0.1253 | 0.2394 | 0.0000 |
| ESE | 0.0084 | 0.1775 | 0.2723 | 0.2826 | 0.0826 | 0.1767 | 0.0000 |
| E | 0.0044 | 0.0926 | 0.2341 | 0.5143 | 0.0557 | 0.0991 | 0.0000 |
| ENE | 0.0011 | 0.0368 | 0.1268 | 0.7032 | 0.0626 | 0.0696 | 0.0000 |
| NE | 0.0012 | 0.0194 | 0.0626 | 0.6858 | 0.1379 | 0.0930 | 0.0000 |
| NNE | 0.0003 | 0.0158 | 0.0435 | 0.5532 | 0.2290 | 0.1583 | 0.0000 |
| TOTAL | 0.0030 | 0.0594 | 0.1197 | 0.5104 | 0.1461 | 0.1613 | 0.0000 |

ADDITIONAL WEATHER INFORMATION

| | |
|---|---|
| Average Air Temperature: | 5.5 degrees C |
| | 278.66 K |
| Precipitation: | 22.1 cm/y |
| Lid Height: | 1000 meters |
| Surface Roughness Length: | 0.010 meters |
| Height Of Wind Measurements: | 10.0 meters |
| Average Wind Speed: | 4.562 m/s |

Vertical Temperature Gradients:

| | |
|---|---|
| STABILITY E | 0.073 k/m |
| STABILITY F | 0.109 k/m |
| STABILITY G | 0.146 k/m |

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Clean Air Act Assessment Package - 1988

D O S E  A N D  R I S K  E Q U I V A L E N T  S U M M A R I E S

Non-Radon Individual Assessment
Jul 17, 2000 02:18 pm

Facility: TSF Area B
Address: INEEL
City:
State: ID Zip:

Source Category: Area
Source Type: Area
Emission Year: 2000

Comments:

Dataset Name: TSFAreaB
Dataset Date: Jul 17, 2000 02:17 pm
Wind File: C:\CAP88PC2\WNDFILES\24156.WND

ORGAN DOSE EQUIVALENT SUMMARY

| Organ | Selected Individual (mrem/y) |
|---|---|
| GONADS | 5.67E-04 |
| BREAST | 6.17E-04 |
| R MAR | 5.61E-04 |
| LUNGS | 5.73E-04 |
| THYROID | 6.53E-04 |
| ENDOST | 3.93E-04 |
| RMNDR | 6.35E-04 |
| EFFEC | 5.92E-04 |

PATHWAY EFFECTIVE DOSE EQUIVALENT SUMMARY

| Pathway | Selected Individual (mrem/y) |
|---|---|
| INGESTION | 5.68E-04 |
| INHALATION | 1.96E-05 |
| AIR IMMERSION | 1.74E-07 |
| GROUND SURFACE | 4.11E-06 |
| INTERNAL | 5.88E-04 |
| EXTERNAL | 4.28E-06 |
| TOTAL | 5.92E-04 |

NUCLIDE EFFECTIVE DOSE EQUIVALENT SUMMARY

| Nuclide | Selected Individual (mrem/y) |
|---|---|
| CS-137 | 5.87E-04 |
| CO-60 | 4.56E-06 |
| BA-137M | 1.74E-07 |
| TOTAL | 5.92E-04 |

CANCER RISK SUMMARY

| Cancer | Selected Individual Total Lifetime Fatal Cancer Risk |
|---|---|
| LEUKEMIA | 1.77E-09 |
| BONE | 6.94E-11 |
| THYROID | 2.96E-10 |
| BREAST | 2.40E-09 |
| LUNG | 2.83E-09 |
| STOMACH | 1.48E-09 |
| BOWEL | 6.08E-10 |
| LIVER | 2.14E-09 |
| PANCREAS | 1.38E-09 |
| URINARY | 8.09E-10 |
| OTHER | 1.69E-09 |
| TOTAL | 1.55E-08 |

PATHWAY RISK SUMMARY

| Pathway | Selected Individual Total Lifetime Fatal Cancer Risk |
|---|---|
| INGESTION | 1.49E-08 |
| INHALATION | 5.21E-10 |
| AIR IMMERSION | 4.17E-12 |
| GROUND SURFACE | 9.93E-11 |
| INTERNAL | 1.54E-08 |
| EXTERNAL | 1.03E-10 |
| TOTAL | 1.55E-08 |

NUCLIDE RISK SUMMARY

| Nuclide | Selected Individual Total Lifetime Fatal Cancer Risk |
|---|---|
| CS-137 | 1.54E-08 |
| CO-60 | 1.14E-10 |
| BA-137M | 4.18E-12 |
| TOTAL | 1.55E-08 |

INDIVIDUAL EFFECTIVE DOSE EQUIVALENT RATE (mrem/y)
(All Radionuclides and Pathways)

| | Distance (m) | |
|---|---|---|
| Direction | 150 | 16100 |
| N | 5.2E-04 | 1.1E-04 |
| NNW | 3.3E-04 | 1.1E-04 |
| NW | 2.4E-04 | 1.1E-04 |
| WNW | 2.6E-04 | 1.1E-04 |
| W | 3.0E-04 | 1.1E-04 |
| WSW | 3.3E-04 | 1.1E-04 |
| SW | 3.3E-04 | 1.1E-04 |
| SSW | 3.4E-04 | 1.1E-04 |
| S | 3.5E-04 | 1.1E-04 |
| SSE | 3.2E-04 | 1.1E-04 |
| SE | 2.9E-04 | 1.1E-04 |
| ESE | 3.0E-04 | 1.1E-04 |
| E | 3.4E-04 | 1.1E-04 |
| ENE | 4.0E-04 | 1.1E-04 |
| NE | 5.0E-04 | 1.1E-04 |
| NNE | 5.9E-04 | 1.1E-04 |

INDIVIDUAL LIFETIME RISK (deaths)
(All Radionuclides and Pathways)

| | Distance (m) | |
|---|---|---|
| Direction | 150 | 16100 |
| N | 1.4E-08 | 2.9E-09 |
| NNW | 8.5E-09 | 2.9E-09 |
| NW | 6.1E-09 | 2.9E-09 |
| WNW | 6.8E-09 | 2.9E-09 |
| W | 8.0E-09 | 2.9E-09 |
| WSW | 8.5E-09 | 2.9E-09 |
| SW | 8.6E-09 | 2.9E-09 |
| SSW | 8.8E-09 | 2.9E-09 |
| S | 9.0E-09 | 2.9E-09 |
| SSE | 8.4E-09 | 2.9E-09 |
| SE | 7.5E-09 | 2.9E-09 |
| ESE | 7.8E-09 | 2.9E-09 |
| E | 9.0E-09 | 2.9E-09 |
| ENE | 1.1E-08 | 2.9E-09 |
| NE | 1.3E-08 | 2.9E-09 |
| NNE | 1.5E-08 | 2.9E-09 |

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Version 2.00

Clean Air Act Assessment Package - 1988

S Y N O P S I S  R E P O R T

Non-Radon Individual Assessment
Jul 19, 2000 08:51 am

Facility: TSF-26
Address: INEEL
City:
State: ID Zip:

Source Category: Area
Source Type: Area
Emission Year: 2000

Comments:

Effective Dose Equivalent
(mrem/year)

9.13E-03

At This Location: 150 Meters North Northeast
Dataset Name: TSF-26
Dataset Date: Jul 19, 2000 08:38 am
Wind File: C:\CAP88PC2\WNDFILES\24156.WND

MAXIMALLY EXPOSED INDIVIDUAL

Location Of The Individual: 150 Meters North Northeast
Lifetime Fatal Cancer Risk: 2.39E-07

ORGAN DOSE EQUIVALENT SUMMARY

| Organ | Dose Equivalent (mrem/y) |
|---|---|
| GONADS | 8.74E-03 |
| BREAST | 9.51E-03 |
| R MAR | 8.65E-03 |
| LUNGS | 8.83E-03 |
| THYROID | 1.01E-02 |
| ENDOST | 6.06E-03 |
| RMNDR | 9.80E-03 |
| EFFEC | 9.13E-03 |

Jul 19, 2000 08:51 am
SYNOPSIS

RADIONUCLIDE EMISSIONS DURING THE YEAR 200

| Nuclide | Class | Size | Source #1 Ci/y | TOTAL Ci/y |
|---|---|---|---|---|
| CS-137 | D | 1.00 | 3.1E-04 | 3.1E-04 |
| CO-60 | Y | 1.00 | 2.6E-07 | 2.6E-07 |
| BA-137M | D | 1.00 | 3.1E-04 | 3.1E-04 |

SITE INFORMATION

| | | |
|---|---|---|
| Temperature: | 6 | degrees C |
| Precipitation: | 22 | cm/y |
| Mixing Height: | 1000 | m |

## SOURCE INFORMATION

Source Number: 1

Source Height (m): 1.
Area (sq m): 11172.

| Plume Rise Pasquill Cat: | A | B | C | D | E | F | G |
|---|---|---|---|---|---|---|---|
| Zero: | 0. | 0. | 0. | 0. | 0. | 0. | 0. |

## AGRICULTURAL DATA

| | Vegetable | Milk | Meat |
|---|---|---|---|
| Fraction Home Produced: | 0.700 | 0.399 | 0.442 |
| Fraction From Assessment Area: | 0.300 | 0.601 | 0.558 |
| Fraction Imported: | 0.000 | 0.000 | 0.000 |

Food Arrays were not generated for this run.
Default Values used.

DISTANCES (M) USED FOR MAXIMUM INDIVIDUAL ASSESSMENT

150 16100

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Version 2.00

Clean Air Act Assessment Package - 1988

G E N E R A L  D A T A

Non-Radon Individual Assessment
Jul 19, 2000 08:51 am

Facility: TSF-26
Address: INEEL
City:
State: ID Zip:

Source Category: Area
Source Type: Area
Emission Year: 2000

Comments:

Dataset Name: TSF-26
Dataset Date: Jul 19, 2000 08:38 am
Wind File: C:\CAP88PC2\WNDFILES\24156.WND

VALUES FOR RADIONUCLIDE-DEPENDENT PARAMETERS

| Nuclide | Clearance Class | Particle Size (microns) | Scavenging Coefficient (per second) | Dry Deposition Velocity (m/s) |
|---|---|---|---|---|
| CS-137 | D | 1.0 | 2.21E-06 | 1.80E-03 |
| CO-60 | Y | 1.0 | 2.21E-06 | 1.80E-03 |
| BA-137M | D | 1.0 | 2.21E-06 | 1.80E-03 |

VALUES FOR RADIONUCLIDE-DEPENDENT PARAMETERS

| | DECAY CONSTANT (PER DAY) | | | TRANSFER COEFFICIENT | |
|---|---|---|---|---|---|
| Nuclide | Radio-active (1) | Surface | Water | Milk (2) | Meat (3) |
| CS-137 | 0.00E+00 | 5.48E-05 | 0.00E+00 | 7.00E-03 | 2.00E-02 |
| CO-60 | 0.00E+00 | 5.48E-05 | 0.00E+00 | 2.00E-03 | 2.00E-02 |
| BA-137M | 3.91E+02 | 5.48E-05 | 0.00E+00 | 3.50E-04 | 1.50E-04 |

FOOTNOTES: (1) Effective radioactive decay constant in plume; set to zero if less than 1.0E-2

(2) Fraction of animal's daily intake of nuclide which appears in each L of milk (days/L)

(3) Fraction of animal's daily intake of nuclide which appears in each kg of meat (days/kg)

VALUES FOR RADIONUCLIDE-DEPENDENT PARAMETERS

| | CONCENTRATION UPTAKE FACTOR | | GI UPTAKE FRACTION | |
|---|---|---|---|---|
| Nuclide | Forage (1) | Edible (2) | Inhalation | Ingestion |
| CS-137 | 8.00E-02 | 1.28E-02 | 9.50E-01 | 9.50E-01 |
| CO-60 | 2.00E-02 | 3.00E-03 | 5.00E-02 | 3.00E-01 |
| BA-137M | 1.50E-01 | 6.42E-03 | 1.00E-01 | 1.00E-01 |

FOOTNOTES: (1) Concentration factor for uptake of nuclide from soil for pasture and forage (in pCi/kg dry weight per pCi/kg dry soil)

(2) Concentration factor for uptake of nuclide from soil by edible parts of crops (in pCi/kg wet weight per pCi/kg dry soil)

VALUES FOR RADIONUCLIDE-INDEPENDENT PARAMETERS

| | |
|---|---|
| HUMAN INHALATION RATE | |
| Cubic centimeters/hr | 9.17E+05 |
| SOIL PARAMETERS | |
| Effective surface density (kg/sq m, dry weight) (Assumes 15 cm plow layer) | 2.15E+02 |
| BUILDUP TIMES | |
| For activity in soil (years) | 1.00E+02 |
| For radionuclides deposited on ground/water (days) | 3.65E+04 |
| DELAY TIMES | |
| Ingestion of pasture grass by animals (hr) | 0.00E+00 |
| Ingestion of stored feed by animals (hr) | 2.16E+03 |
| Ingestion of leafy vegetables by man (hr) | 3.36E+02 |
| Ingestion of produce by man (hr) | 3.36E+02 |
| Transport time from animal feed-milk-man (day) | 2.00E+00 |
| Time from slaughter to consumption (day) | 2.00E+01 |
| WEATHERING | |
| Removal rate constant for physical loss (per hr) | 2.90E-03 |
| CROP EXPOSURE DURATION | |
| Pasture grass (hr) | 7.20E+02 |
| Crops/leafy vegetables (hr) | 1.44E+03 |
| AGRICULTURAL PRODUCTIVITY | |
| Grass-cow-milk-man pathway (kg/sq m) | 2.80E-01 |
| Produce/leafy veg for human consumption (kg/sq m) | 7.16E-01 |
| FALLOUT INTERCEPTION FRACTIONS | |
| Vegetables | 2.00E-01 |
| Pasture | 5.70E-01 |
| GRAZING PARAMETERS | |
| Fraction of year animals graze on pasture | 4.00E-01 |
| Fraction of daily feed that is pasture grass when animal grazes on pasture | 4.30E-01 |

VALUES FOR RADIONUCLIDE-INDEPENDENT PARAMETERS

| | |
|---|---|
| ANIMAL FEED CONSUMPTION FACTORS | |
| Contaminated feed/forage (kg/day, dry weight) | 1.56E+01 |
| DAIRY PRODUCTIVITY | |
| Milk production of cow (L/day) | 1.10E+01 |
| MEAT ANIMAL SLAUGHTER PARAMETERS | |
| Muscle mass of animal at slaughter (kg) | 2.00E+02 |
| Fraction of herd slaughtered (per day) | 3.81E-03 |
| DECONTAMINATION | |
| Fraction of radioactivity retained after washing for leafy vegetables and produce | 5.00E-01 |
| FRACTIONS GROWN IN GARDEN OF INTEREST | |
| Produce ingested | 1.00E+00 |
| Leafy vegetables ingested | 1.00E+00 |
| INGESTION RATIOS: | |
| IMMEDIATE SURROUNDING AREA/TOTAL WITHIN AREA | |
| Vegetables | 7.00E-01 |
| Meat | 4.42E-01 |
| Milk | 3.99E-01 |
| MINIMUM INGESTION FRACTIONS FROM OUTSIDE AREA (Minimum fractions of food types from outside area listed below are actual fixed values.) | |
| Vegetables | 0.00E+00 |
| Meat | 0.00E+00 |
| Milk | 0.00E+00 |
| HUMAN FOOD UTILIZATION FACTORS | |
| Produce ingestion (kg/y) | 1.76E+02 |
| Milk ingestion (L/y) | 1.12E+02 |
| Meat ingestion (kg/y) | 8.50E+01 |
| Leafy vegetable ingestion (kg/y) | 1.80E+01 |
| SWIMMING PARAMETERS | |
| Fraction of time spent swimming | 0.00E+00 |
| Dilution factor for water (cm) | 1.00E+00 |

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Version 2.00

Clean Air Act Assessment Package - 1988

W E A T H E R  D A T A

Non-Radon Individual Assessment
Jul 19, 2000 08:51 am

Facility: TSF-26
Address: INEEL
City:
State: ID Zip:

Source Category: Area
Source Type: Area
Emission Year: 2000

Comments:

Dataset Name: TSF-26
Dataset Date: Jul 19, 2000 08:38 am
Wind File: C:\CAP88PC2\WNDFILES\24156.WND

HARMONIC AVERAGE WIND SPEEDS (WIND TOWARDS)

Pasquill Stability Class

| Dir | A | B | C | D | E | F | G | Wind Freq |
|---|---|---|---|---|---|---|---|---|
| N | 1.270 | 1.410 | 2.670 | 5.840 | 3.490 | 1.400 | 0.000 | 0.136 |
| NNW | 1.060 | 1.280 | 2.370 | 4.800 | 3.050 | 1.190 | 0.000 | 0.023 |
| NW | 1.190 | 1.160 | 1.630 | 3.360 | 2.740 | 1.230 | 0.000 | 0.014 |
| WNW | 1.190 | 1.150 | 1.870 | 2.770 | 2.720 | 1.230 | 0.000 | 0.016 |
| W | 1.190 | 1.320 | 2.040 | 2.530 | 2.930 | 1.290 | 0.000 | 0.032 |
| WSW | 1.250 | 1.560 | 2.300 | 2.780 | 2.990 | 1.280 | 0.000 | 0.038 |
| SW | 1.300 | 1.790 | 2.340 | 3.050 | 2.970 | 1.280 | 0.000 | 0.049 |
| SSW | 1.250 | 1.950 | 2.440 | 3.130 | 2.970 | 1.290 | 0.000 | 0.043 |
| S | 1.130 | 1.890 | 2.350 | 2.810 | 3.030 | 1.300 | 0.000 | 0.056 |
| SSE | 1.130 | 2.000 | 2.660 | 2.640 | 3.110 | 1.240 | 0.000 | 0.037 |
| SE | 1.280 | 1.990 | 2.560 | 2.350 | 2.920 | 1.250 | 0.000 | 0.032 |
| ESE | 1.270 | 2.010 | 3.160 | 3.160 | 2.850 | 1.320 | 0.000 | 0.038 |
| E | 1.280 | 2.210 | 3.600 | 4.800 | 3.000 | 1.230 | 0.000 | 0.085 |
| ENE | 1.060 | 2.190 | 3.940 | 5.800 | 3.280 | 1.350 | 0.000 | 0.123 |
| NE | 1.270 | 1.770 | 3.300 | 5.470 | 3.570 | 1.350 | 0.000 | 0.133 |
| NNE | 1.190 | 1.580 | 2.950 | 4.820 | 3.680 | 1.400 | 0.000 | 0.145 |

ARITHMETIC AVERAGE WIND SPEEDS (WIND TOWARDS)

Pasquill Stability Class

| Dir | A | B | C | D | E | F | G |
|---|---|---|---|---|---|---|---|
| N | 1.780 | 2.310 | 4.100 | 7.290 | 3.720 | 1.930 | 0.000 |
| NNW | 1.460 | 2.050 | 3.760 | 6.750 | 3.260 | 1.680 | 0.000 |
| NW | 1.670 | 1.840 | 2.400 | 5.140 | 2.840 | 1.720 | 0.000 |
| WNW | 1.670 | 1.730 | 2.620 | 4.060 | 2.800 | 1.740 | 0.000 |
| W | 1.670 | 2.110 | 2.870 | 3.670 | 3.100 | 1.800 | 0.000 |
| WSW | 1.760 | 2.440 | 3.180 | 3.790 | 3.180 | 1.790 | 0.000 |
| SW | 1.820 | 2.700 | 3.210 | 4.360 | 3.150 | 1.790 | 0.000 |
| SSW | 1.760 | 2.850 | 3.320 | 4.320 | 3.150 | 1.800 | 0.000 |
| S | 1.580 | 2.840 | 3.210 | 4.030 | 3.230 | 1.820 | 0.000 |
| SSE | 1.580 | 2.950 | 3.490 | 3.680 | 3.330 | 1.740 | 0.000 |
| SE | 1.790 | 2.940 | 3.440 | 3.500 | 3.090 | 1.750 | 0.000 |
| ESE | 1.780 | 2.970 | 4.080 | 4.670 | 3.000 | 1.840 | 0.000 |
| E | 1.790 | 3.140 | 4.730 | 6.290 | 3.200 | 1.730 | 0.000 |
| ENE | 1.460 | 3.130 | 5.090 | 7.080 | 3.520 | 1.870 | 0.000 |
| NE | 1.780 | 2.730 | 4.460 | 6.510 | 3.800 | 1.880 | 0.000 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **NNE** | 1.670 | 2.490 | 4.080 | 5.870 | 3.890 | 1.930 | 0.000 |

FREQUENCIES OF STABILITY CLASSES (WIND TOWARDS)

Pasquill Stability Class

| Dir | A | B | C | D | E | F | G |
|---|---|---|---|---|---|---|---|
| N | 0.0012 | 0.0120 | 0.0290 | 0.6289 | 0.1754 | 0.1534 | 0.0000 |
| NNW | 0.0056 | 0.0356 | 0.0434 | 0.4967 | 0.1527 | 0.2659 | 0.0000 |
| NW | 0.0029 | 0.0581 | 0.0780 | 0.2465 | 0.1611 | 0.4533 | 0.0000 |
| WNW | 0.0024 | 0.0774 | 0.0895 | 0.2443 | 0.2025 | 0.3839 | 0.0000 |
| W | 0.0012 | 0.0794 | 0.1236 | 0.2721 | 0.1924 | 0.3313 | 0.0000 |
| WSW | 0.0052 | 0.0729 | 0.1637 | 0.3332 | 0.2070 | 0.2180 | 0.0000 |
| SW | 0.0049 | 0.0818 | 0.1784 | 0.3901 | 0.1536 | 0.1912 | 0.0000 |
| SSW | 0.0046 | 0.0908 | 0.1994 | 0.4010 | 0.1285 | 0.1757 | 0.0000 |
| S | 0.0036 | 0.1222 | 0.1937 | 0.3284 | 0.1500 | 0.2022 | 0.0000 |
| SSE | 0.0055 | 0.1429 | 0.1781 | 0.2786 | 0.1806 | 0.2144 | 0.0000 |
| SE | 0.0164 | 0.1697 | 0.2095 | 0.2397 | 0.1253 | 0.2394 | 0.0000 |
| ESE | 0.0084 | 0.1775 | 0.2723 | 0.2826 | 0.0826 | 0.1767 | 0.0000 |
| E | 0.0044 | 0.0926 | 0.2341 | 0.5143 | 0.0557 | 0.0991 | 0.0000 |
| ENE | 0.0011 | 0.0368 | 0.1268 | 0.7032 | 0.0626 | 0.0696 | 0.0000 |
| NE | 0.0012 | 0.0194 | 0.0626 | 0.6858 | 0.1379 | 0.0930 | 0.0000 |
| NNE | 0.0003 | 0.0158 | 0.0435 | 0.5532 | 0.2290 | 0.1583 | 0.0000 |
| TOTAL | 0.0030 | 0.0594 | 0.1197 | 0.5104 | 0.1461 | 0.1613 | 0.0000 |

ADDITIONAL WEATHER INFORMATION

| | |
|---|---|
| Average Air Temperature: | 5.5 degrees C |
| | 278.66 K |
| Precipitation: | 22.1 cm/y |
| Lid Height: | 1000 meters |
| Surface Roughness Length: | 0.010 meters |
| Height Of Wind Measurements: | 10.0 meters |
| Average Wind Speed: | 4.562 m/s |

Vertical Temperature Gradients:

| | |
|---|---|
| STABILITY E | 0.073 k/m |
| STABILITY F | 0.109 k/m |
| STABILITY G | 0.146 k/m |

C A P 8 8 - P C

Version 2.00

Clean Air Act Assessment Package - 1988

D O S E  A N D  R I S K  E Q U I V A L E N T  S U M M A R I E S

Non-Radon Individual Assessment
Jul 19, 2000 08:51 am

Facility: TSF-26
Address: INEEL
City:
State: ID Zip:

Source Category: Area
Source Type: Area
Emission Year: 2000

Comments:

Dataset Name: TSF-26
Dataset Date: Jul 19, 2000 08:38 am
Wind File: C:\CAP88PC2\WNDFILES\24156.WND

ORGAN DOSE EQUIVALENT SUMMARY

| Organ | Selected Individual (mrem/y) |
|---|---|
| GONADS | 8.74E-03 |
| BREAST | 9.51E-03 |
| R MAR | 8.65E-03 |
| LUNGS | 8.83E-03 |
| THYROID | 1.01E-02 |
| ENDOST | 6.06E-03 |
| RMNDR | 9.80E-03 |
| EFFEC | 9.13E-03 |

PATHWAY EFFECTIVE DOSE EQUIVALENT SUMMARY

| Pathway | Selected Individual (mrem/y) |
|---|---|
| INGESTION | 8.78E-03 |
| INHALATION | 3.03E-04 |
| AIR IMMERSION | 2.69E-06 |
| GROUND SURFACE | 4.34E-05 |
| INTERNAL | 9.09E-03 |
| EXTERNAL | 4.60E-05 |
| TOTAL | 9.13E-03 |

NUCLIDE EFFECTIVE DOSE EQUIVALENT SUMMARY

| Nuclide | Selected Individual (mrem/y) |
|---|---|
| CS-137 | 9.08E-03 |
| CO-60 | 4.81E-05 |
| BA-137M | 2.70E-06 |
| TOTAL | 9.13E-03 |

CANCER RISK SUMMARY

| Cancer | Selected Individual Total Lifetime Fatal Cancer Risk |
|---|---|
| LEUKEMIA | 2.73E-08 |
| BONE | 1.07E-09 |
| THYROID | 4.56E-09 |
| BREAST | 3.70E-08 |
| LUNG | 4.36E-08 |
| STOMACH | 2.28E-08 |
| BOWEL | 9.37E-09 |
| LIVER | 3.30E-08 |
| PANCREAS | 2.14E-08 |
| URINARY | 1.25E-08 |
| OTHER | 2.61E-08 |
| TOTAL | 2.39E-07 |

PATHWAY RISK SUMMARY

| Pathway | Selected Individual Total Lifetime Fatal Cancer Risk |
|---|---|
| INGESTION | 2.30E-07 |
| INHALATION | 8.04E-09 |
| AIR IMMERSION | 6.45E-11 |
| GROUND SURFACE | 1.05E-09 |
| INTERNAL | 2.38E-07 |
| EXTERNAL | 1.11E-09 |
| TOTAL | 2.39E-07 |

NUCLIDE RISK SUMMARY

| Nuclide | Selected Individual Total Lifetime Fatal Cancer Risk |
|---|---|
| CS-137 | 2.37E-07 |
| CO-60 | 1.20E-09 |
| BA-137M | 6.47E-11 |
| TOTAL | 2.39E-07 |

INDIVIDUAL EFFECTIVE DOSE EQUIVALENT RATE (mrem/y)
(All Radionuclides and Pathways)

| | Distance (m) | |
|---|---|---|
| Direction | 150 | 16100 |
| N | 8.0E-03 | 1.7E-03 |
| NNW | 4.8E-03 | 1.7E-03 |
| NW | 3.6E-03 | 1.7E-03 |
| WNW | 3.9E-03 | 1.7E-03 |
| W | 4.7E-03 | 1.7E-03 |
| WSW | 5.0E-03 | 1.7E-03 |
| SW | 5.0E-03 | 1.7E-03 |
| SSW | 5.1E-03 | 1.7E-03 |
| S | 5.3E-03 | 1.7E-03 |
| SSE | 4.8E-03 | 1.7E-03 |
| SE | 4.4E-03 | 1.7E-03 |
| ESE | 4.5E-03 | 1.7E-03 |
| E | 5.3E-03 | 1.7E-03 |
| ENE | 6.1E-03 | 1.7E-03 |
| NE | 7.6E-03 | 1.7E-03 |
| NNE | 9.1E-03 | 1.7E-03 |

INDIVIDUAL LIFETIME RISK (deaths)
(All Radionuclides and Pathways)

| | Distance (m) | |
|---|---|---|
| Direction | 150 | 16100 |
| N | 2.1E-07 | 4.5E-08 |
| NNW | 1.3E-07 | 4.5E-08 |
| NW | 9.3E-08 | 4.5E-08 |
| WNW | 1.0E-07 | 4.5E-08 |
| W | 1.2E-07 | 4.5E-08 |
| WSW | 1.3E-07 | 4.5E-08 |
| SW | 1.3E-07 | 4.5E-08 |
| SSW | 1.3E-07 | 4.5E-08 |
| S | 1.4E-07 | 4.5E-08 |
| SSE | 1.3E-07 | 4.5E-08 |
| SE | 1.1E-07 | 4.5E-08 |
| ESE | 1.2E-07 | 4.5E-08 |
| E | 1.4E-07 | 4.5E-08 |
| ENE | 1.6E-07 | 4.5E-08 |
| NE | 2.0E-07 | 4.5E-08 |
| NNE | 2.4E-07 | 4.5E-08 |